

Obstructive internal hernia caused by mesodiverticular bands in children

Two case reports and a review of the literature

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Abstract

Introduction: The mesodiverticular band (MDB) is an embryologic remnant of the vitelline circulation, which carries the arterial supply to the Meckel diverticulum. In the event of an error of involution, a patent or nonpatent arterial band persists and extends from the mesentery to the apex of the antimesenteric diverticulum. This creates a snare-like opening through which bowel loops may herniate and become obstructed. This report describes 2 rare cases of small bowel occlusion owing to an internal hernia caused by a MDB.

Cases: Case 1 was a 5-year-old boy who presented to our Emergency Department with colicky abdominal pain diffused to all abdominal quadrants. He also had 5 episodes of emesis, the last with bilious vomiting. Case 2, a 12-year-old boy, presented to our Emergency Department complaining of colicky abdominal pain. He had 2 episodes of nonbilious emesis. On physical examination, both children showed distension and tenderness of the abdomen and abdominal x-ray and ultrasound confirmed an occlusive picture without an apparent etiology. In case 1, an urgent laparotomy was performed and the MDB was ligated and cut, whereas in case 2 diagnosis and excision were performed in laparotomy. In both patients, there was a positive clinical evolution.

Conclusion: Although MDB causing internal hernia is very rare, it should be considered in patients with a clinical picture of small bowel obstruction. In these cases, early surgery is important to prevent strangulation and gangrene of the bowel and to avoid dramatic events. Moreover, laparoscopy seems a safe and effective technique in these patients, especially in children with mild abdominal distention without surgical or trauma history, highlighting that further studies on the value of laparoscopy for the treatment of small bowel obstruction in pediatric patients are urgently needed.

Abbreviations: MD = Meckel's diverticulum, MDB = mesodiverticular band, SILS = single incision laparoscopic surgery.

Keywords: internal hernia, laparoscopy, Meckel diverticulum, mesodiverticular band, small bowel obstruction

1. Introduction

Meckel diverticulum (MD) is the most common congenital anomaly of the gastrointestinal tract.^[1] MD originates from an incomplete obliteration of the omphalomesenteric or vitelline duct, which occurs around the fifth week of gestation.^[2] It usually appears as a pouch, 3 to 6 cm in length, arising from the antimesenteric border of the ileum at variable lengths from the ileocecal junction.^[3] MD has a complication rate of approximately 4%.^[4] Bowel obstruction, gastrointestinal bleeding, acute inflammation, and umbilical abnormalities are the most common presentations of MD in children.^[5–8]

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The mesodiverticular band (MDB) is an embryologic remnant of the vitelline circulation that carries the arterial supply to the MD. In the event of an error of involution, a patent or nonpatent arterial band persists and extends from the mesentery to the apex of the antimesenteric diverticulum. This creates a snare-like opening through which bowel loops may herniate and become obstructed.^[9] This kind of internal hernia is a very rare and often overlooked cause of small bowel obstruction.

Here, we report 2 rare cases of internal hernia in children caused by a MDB, and we reviewed the pediatric literature about this rare condition in children.

2. Cases

2.1. Presenting concerns

Case 1 was a 5-year-old boy who presented to our Emergency Department with colicky abdominal pain. The pain started 1 day before admission and was diffused to all abdominal quadrants. He also had 5 episodes of emesis, the last with bilious vomiting. No past surgical or trauma history was declared.

Case 2, a 12-year-old boy, presented to our Emergency Department complaining of colicky abdominal pain. The pain started 1 day before admission and was located in the mesogastric position. He also had 2 episodes of nonbilious emesis. He had no past surgical or trauma history.

In both patients, family and psychosocial history were negative.

2.2. Clinical findings

On physical examination, case 1 showed distension and tenderness of the abdomen. On physical examination, case 2 presented a mild distension of the abdomen and mild tenderness in the mesogastric abdomen. In both cases, no mass was palpable and no peritoneal signs were noted.

2.3. Diagnostic focus and assessment

In case 1, an abdominal x-ray was performed showing an occlusive picture without an apparent etiology (Fig. 1). Abdominal ultrasound was negative for intussusception, but revealed a moderate amount of fluid in the pelvis.

In case 2, an abdominal x-ray was performed showing an occlusive picture without an apparent etiology. Abdominal ultrasound was also conducted to exclude intussusception or other causes of intestinal occlusion, but it revealed only dilated small bowel loops with a small amount of fluid in the pelvis.

2.4. Therapeutic focus and assessment

In case 1, an urgent surgical exploration was performed. Laparotomy showed loops of the ileum herniating through an orifice formed by a MDB (Fig. 2). The herniated ileal loops were not compromised. The MDB was ligated and cut, freeing the incarcerated small bowel. The MD (Fig. 3) was then excised, and an end-to-end ileal anastomosis was performed.

In case 2, owing to the persistence of colicky pain episodes with a new episode of bilious vomiting and the absence of a surgical history, an urgent laparoscopic exploration was performed to obtain the correct diagnosis. A 10-mm trocar was inserted through an umbilical incision. On exploration, the proximally

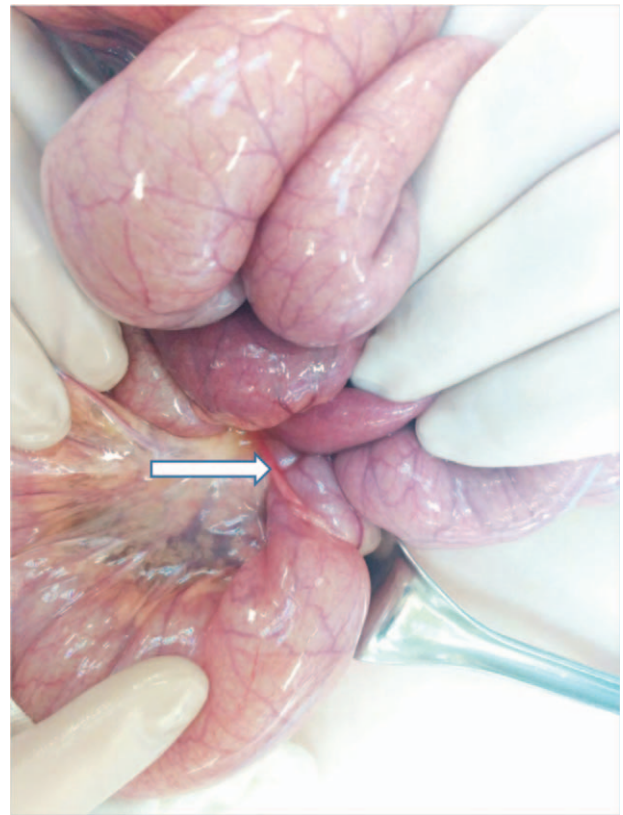


Figure 2. Case 1: mesodiverticular band (arrow).



Figure 1. Case 1: abdominal x-ray showing an occlusive picture.

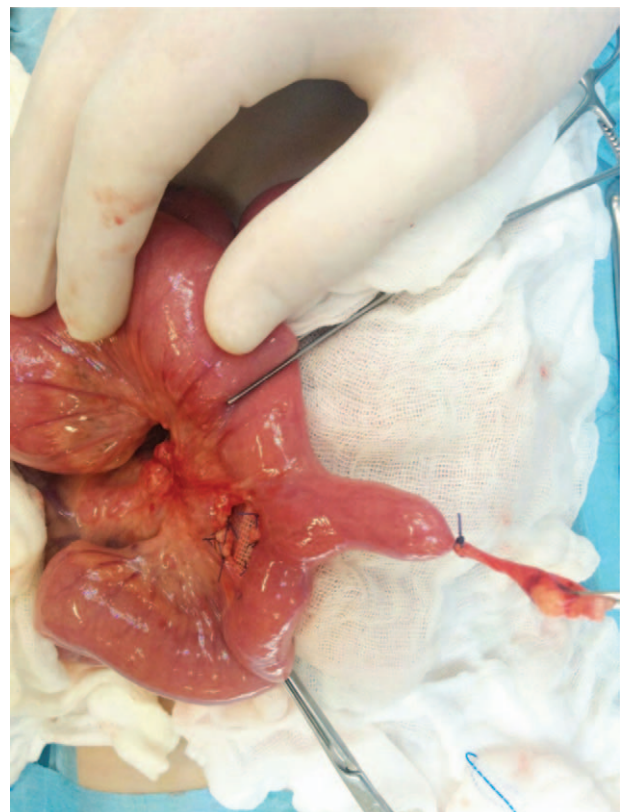


Figure 3. Case 1: Meckel diverticulum with resected mesodiverticular band.

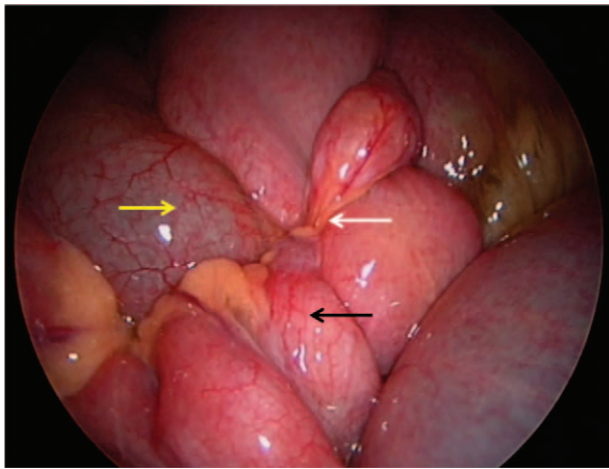


Figure 4. Case 2: laparoscopic view. The white arrow shows the mesodiverticular band. The black asterisk shows the distally collapsed jejunum and the white asterisk shows the proximally dilated jejunum.

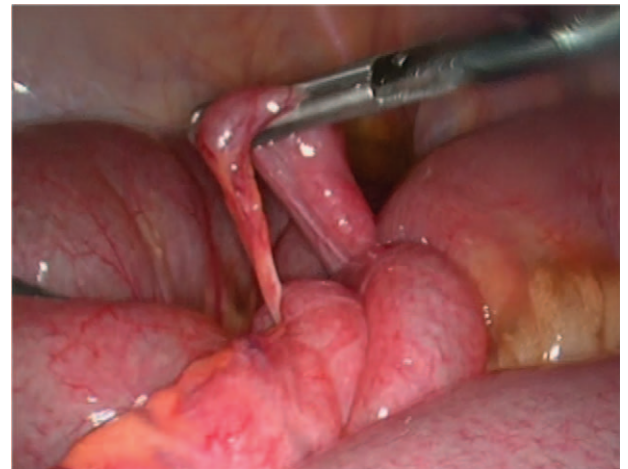


Figure 5. Laparoscopic image showing the snare-like opening created by the mesodiverticular band through which bowel loops were herniated and obstructed.

dilated jejunum was encountered (Fig. 4). Some loops of the jejunum that had herniated through an orifice formed by a MDB were found (Fig. 5). The vascularity of herniated ileal loops was not compromised. After the positioning of 2 operative 5-mm trocars in triangulation, the MDB was coagulated and cut, freeing the incarcerated small bowel. The MD was then exteriorized from the umbilical incision and excised by a 3-cm ileal resection and an end-to-end ileal anastomosis.

2.5. Follow-up and outcomes

The postoperative course was uneventful in both cases, and the boys were discharged on postoperative day 6 without any complications.

2.6. Timeline

Acute signs, symptoms, and clinical findings upon admission to the Emergency Room raised the suspicion of small bowel occlusion. Abdominal x-ray and abdominal ultrasound were immediately performed and showed an occlusive picture without an apparent etiology. To prevent strangulation and gangrene of the bowel, laparotomy in case 1 and minimally invasive surgery in case 2 were performed and showed that the occlusion was because of an internal hernia caused by a MDB. The

MDB was ligated and cut in both cases and the MD was then excised.

3. Discussion

Internal hernia is a rare cause of small bowel obstruction and is defined as a condition where a viscus protrudes through an opening within the abdominal cavity.^[1] Symptoms of patients affected by internal hernia include colicky abdominal pain, vomiting, distention, or constipation.^[5-8]

The MDB is an error of involution of the vitelline circulation, which carries the arterial supply to the MD.^[9] This embryologic remnant may cause different kinds of complications, including hemorrhage and hemoperitoneum owing to traumatic rupture of the patent MDB^[10] as well as intermittent small bowel obstruction caused by torsion around the MDB or acute small bowel obstruction caused by an internal hernia,^[11] as shown in our cases. The literature reports this last complication as a cause of sudden infant death syndrome for incarceration and the infarct of the herniated loops of small bowel beneath the band.^[12] MDB may also be misdiagnosed as acute appendicitis.^[13]

In addition to our 2 cases, the review of the literature showed 8 other cases of symptomatic MDB in pediatric patients (Table 1).^[5,12-17] The age of onset ranged from 10 days to 12 years. All cases reported an intestinal occlusion as the clinical

Table 1

Review of published pediatric reports with mesodiverticular band MDB, including our presented cases.

Patient n.	Authors	Age	Sex	Surgical approach	Bowel obstruction ethiogenesis
1	Seagram et al, 1968 ^[5]	8 months	Not reported	Laparotomy	Direct compression
2	Pfalzgraf et al, 1988 ^[12]	2 years	M	–	Internal hernia
3	Pfalzgraf et al, 1988 ^[12]	2 years	M	–	Internal hernia
4	Singh et al, 1994 ^[14]	6 years	M	Laparotomy	Internal hernia
5	Prasad et al, 2006 ^[15]	12 years	F	Laparoscopy	Internal hernia
6	Shaaban et al, 2009 ^[13]	8 years	M	Laparotomy	Internal hernia
7	Sun et al, 2012 ^[16]	10 years	M	Laparotomy	Internal hernia
8	Kunitsu et al, 2015 ^[17]	10 days	F	Laparotomy	Direct compression
9	Present case 1	5 years	M	Laparotomy	Internal hernia
10	Present case 2	12 years	M	Laparoscopy	Internal hernia

MDB = mesodiverticular band.

picture at onset. Including our cases, internal hernia was the cause of the obstruction in 8 cases, whereas in 2 patients, the occlusion was because of a direct compression of the small bowel by the MDB. Kunitsu et al reported that a relatively long MDB can lead to pathogenesis over a wide age range, from childhood to adulthood, with regard to the internal hernia of an intestinal loop.^[17] In contrast, a short MDB can exert direct compression on the digestive tract before or shortly after birth.

All patients were approached with emergent laparotomy except our second case and another one who was treated with an urgent laparoscopy, which confirmed the diagnosis and resolved the clinical condition. Laparoscopy is widely used in pediatric age as an alternative procedure to open surgery for many surgical problems. In the last 2 decades, the use of laparoscopy in the diagnostic confirmation and subsequent laparoscopic excision of MD in children has gained popularity. Laparoscopic intracorporeal or laparoscopic-assisted extracorporeal resection of MD is the possible approach.^[18] One of the concerns in total laparoscopic intracorporeal resection of MD is the failure to perform segmental resection of MD because there may be a risk of leaving ectopic gastric mucosa in the adjacent ileum.^[18] For this reason, many authors prefer a laparoscopic-assisted technique with an extracorporeal segmental resection of the MD and an open end-to-end intestinal anastomosis of the adjacent ileum.^[19] Recently, single incision laparoscopic surgery (SILS) has emerged as a new technique in minimally invasive surgery, but limited numbers of reports on SILS in MD management in children are available.^[20,21] As is the usual practice in our Department, the MD in our second case was laparoscopically individuated and excised using a laparoscopic-assisted technique.

For selected children with bowel obstruction, laparoscopy may be an alternative to traditional laparotomy and is associated with reduced morbidity and length of hospital stay. Nevertheless, >30% of conversions to laparotomy may be required.^[22] Our first case was submitted to laparotomy because the abdomen showed distension. However, in our second case, laparoscopy was performed because of the unknown origin of the obstruction in the absence of surgical or trauma history and mild distension of the abdomen, which permitted a sufficient working space during laparoscopy.

In conclusion, although MDBs causing internal hernias are very rare, they should be considered in patients with a clinical picture of small bowel obstruction. In these cases, early surgery is important to prevent strangulation and gangrene of the bowel and to avoid dramatic events. Moreover, laparoscopy is a safe and effective technique in these patients, especially in children with mild abdominal distention without surgical or trauma history, highlighting that further studies on the value of laparoscopy for the treatment of small bowel obstruction in pediatric patients are urgently needed.

4. Patients' parents' perspective

We are very grateful to the surgeons for their diagnostic and therapeutic approach, which was associated with a favorable clinical evolution.

5. Informed consent

The patients' parents provided their written informed consent for the publication of this study.

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