

## Case Series

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# Meckel's diverticulum and its plethoric presentation in paediatric surgery: a case series

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## ABSTRACT

Meckel's diverticulum (MD) is a congenital abnormality of the gastrointestinal tract resulting from incomplete obliteration of the vitellointestinal duct by 5th to 7th week of gestation. Incidence is 2% in the general population with a 2:1 male to female ratio. The various presentations of MD include gastrointestinal bleeding, intestinal obstruction, diverticulitis and intestinal perforation. Majority of the MD is asymptomatic however the potential risk of developing complication it's about 4-6%. Preoperative diagnosis of MD is challenging. We present 6 cases of MD managed at our centre over the course of 1 year. Two cases presented as intestinal obstruction secondary to mesodiverticular band from MD, one case with bleeding, two cases with intussusception and one case of meckel's diverticulitis.

**Keywords:** Meckel's diverticulum, Vitellointestinal duct, Complications

## INTRODUCTION

Meckel's diverticulum is a true diverticulum because it contains all 3 layers of intestines.<sup>2</sup> It is located at the anti-mesenteric border of the terminal ileum. It receives blood supply from two vitelline arteries. "The rule of two" is widely used to peculiarize Meckel's diverticulum: 2% of the population, male : female ratio 2:1, located within 2 feet from ileocecal valve (ICV), frequently measures 2 cm in diameter and 2 inches in length, may contain 2 types of ectopic tissue and frequently found before 2 years of age.<sup>1</sup> Presence of pluripotent cells within the vitelline ducts give rise to heterotopic tissue in 30-50%.<sup>5</sup> Most common ectopic tissue is gastric mucosa (60-80%) and pancreatic tissue (1-6%).<sup>1</sup> Other types of ectopic tissues include colonic tissue, endometrial tissue, duodenal tissue and biliary tissue but these are less common. Most cases of MD are asymptomatic, per contra 1% of MD can have serious complications.<sup>1</sup> The complications are gastrointestinal bleeding (40%),

intestinal obstruction (30%), diverticulitis (20%) and intestinal perforation (10%).<sup>5</sup> Each complication has its own pathophysiology. MD can mimic disorders such as appendicitis, peptic ulcer disease and Crohn's disease.<sup>2,3</sup> We report 6 cases of MD with its various presentations in children.

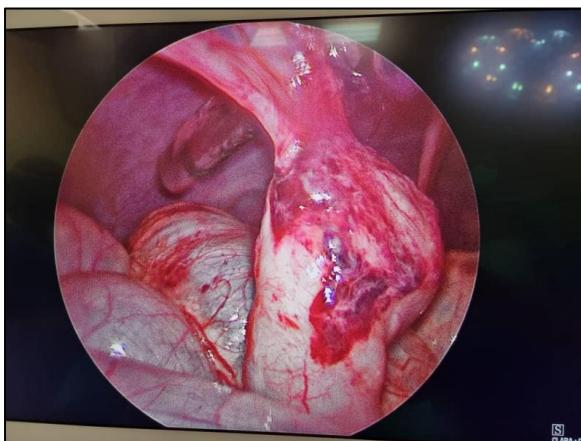
## CASE SERIES

### Case 1

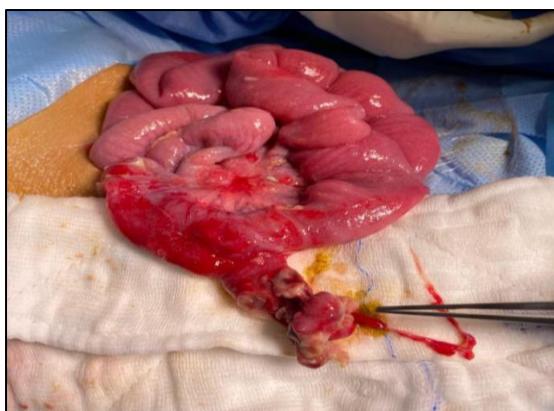
#### *Bleeding Meckel's diverticulum*

This is a 2 year 6 months old boy who was admitted with bouts of vomiting and 1 day history of periumbilical pain. In the ward child developed 2 episodes of per rectal bleeding. There was significant drop in hemoglobin up to 3 g/dl. Abdominal sonography showed mesenteric lymphadenitis. Child developed further episodes of per rectal bleeding and we proceeded with colonoscopy,

esophagogastroduodenoscopy (OGDS) and laparoscopic assessment. Colonoscopy and OGDS revealed no source of bleeding. Laparoscopy revealed a broad bases MD (Figure 1). A laparoscopic assisted extracorporeal wedge resection of the MD was performed. Child recovered well. Histopathological examination (HPE) reported a true diverticulum with gastric body type mucosal glands and intestinal tissue with focal ulceration.



**Figure 1: Laparoscopic image of the Meckel's diverticulum showing areas of haemorrhage and its tip adhered to a band to the abdominal wall.**



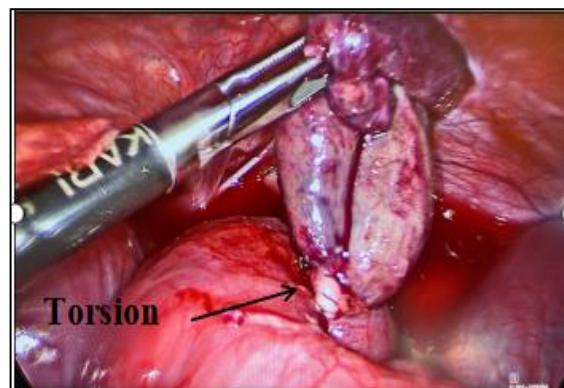
**Figure 2: Perforated MD with mesodiverticular band (post release of the band) with distal ileum inflammation.**

#### Case 2

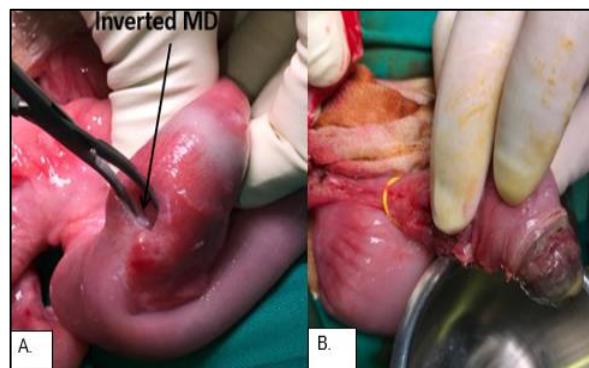
*Perforated MD with intestinal obstruction secondary to mesodiverticular band*

This 1 year 4 months old boy was admitted to the referring hospital with 3 days of fever, vomiting, abdominal distension, reduced bowel output and 1 episode of fitting prior to admission. Clinical examination revealed no neurological deficits. Computed Tomography of the brain was normal. The child was empirically treated for meningitis with ceftriaxone. However, the following day the child had worsening abdominal distension with episodes of bilious vomiting. Abdominal

radiography showed dilated bowel with sonography showing a collapsed dilated segment of bowel. Laparotomy revealed a perforated MD 38 cm from ICV with a mesodiverticular band from the tip to the small bowel mesentery (Figure 2). Small bowel was entrapped by the mesodiverticular band. Release of band and wedge resection of MD was performed. Post-operative recovery was complicated by Surgical Site Infection (SSI) which responded to antibiotics and dressing. HPE reported a true diverticulum of small bowel with dense inflammatory infiltrate and presence of both pancreatic and gastric mucosa.



**Figure 3: Laparoscopic image of the Meckel's diverticulum in this child showing axial torsion of MD (post release of the band).**



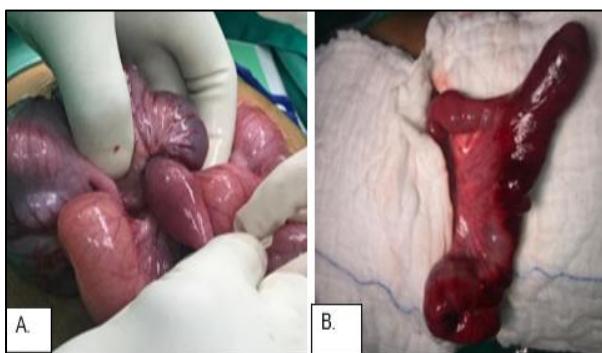
**Figure 4: (A) Post reduction of intussusception with an inverted MD and intraluminal mass. (B) Post resection of small bowel revealed presence of intraluminal MD.**

#### Case 3

*Axial torsion of MD and intestinal obstruction secondary to mesodiverticular band*

This patient was a 6 year old girl who initially presented to a private hospital with complaints of abdominal pain and non-bilious vomiting for 1 day. There was tenderness over the right iliac fossa. Child underwent an open appendicectomy. Appendix was mildly inflamed with an appendicolith. Post operatively, pain persisted and she

developed abdominal distention. Abdominal sonography and Computed tomography (CT) showed presence of dilated and collapsed bowel with no obvious collection. She was referred to us as the initial centre lacked intensive care, surgical and parenteral nutrition services for paediatric patients. Laparoscopic assessment revealed a twisted MD 20 cm from ICV and presence of mesodiverticular band from tip of MD down to the mesentery trapping a segment of terminal ileum (Figure 3). Band was released and a laparoscopic assisted extracorporeal wedge resection of MD done. Post-operative recovery was uneventful. HPE reported a true diverticulum of small bowel with focal ischemic necrosis, however no heterotopic rest was detected.



**Figure 5: (A) Ileocolic intussusception with MD which acted as a lead point for intussusception. (B) Broad base MD seen post reduction of ileo-colic intussusception.**



**Figure 6: Laparoscopic image showed axial rotation of MD with tip adhered by a band to the abdominal wall.**

#### Case 4

##### *Inverted MD causing intussusception*

This 8 months old boy was admitted with vomiting, diarrhea, per rectal bleeding and irritability for 4 days duration. Sonography revealed an ileocolic intussusception with apex at the hepatic flexure. There was a persistent pseudokidney sign despite initial movement of the apex from the hepatic flexure to the caecum during the attempted hydrostatic reduction.

Intraoperative findings was a reduced intussusception with an intraluminal mass within the small bowel lumen (Figure 4). We suspect the persistent “pseudokidney sign” during hydrostatic reduction was not a residual intussusception but the inverted intraluminal MD. Segmental resection of the ileum with clip and drop was done. Relaparotomy and bowel anastomosis was done 48 hours later after adequate resuscitation. Post-operatively the child recovered well. HPE showed a true diverticulum with heterotopic tissue consistent with MD. There was presence of heterotopic ducts and acinars structures.

#### Case 5

##### *Broad base MD being the lead for intussusception*

This 3 years old boy was admitted with abdominal pain and vomiting. Per abdomen revealed a right hypochondrium mass. Sonography showed long segment ileo-colic intussusception. Intraoperatively the lead point was a broad base MD (Figure 5). Segmental resection of the ileum with clip and drop was performed. Relaparotomy and bowel anastomosis was done 24 hours later after adequate resuscitation. HPE showed a true MD with absence of heterotopic tissue.

#### Case 6

##### *Axial rotation of MD causing meckel's diverticulitis.*

This 7 years old boy was admitted with central abdominal pain and vomiting. Sonography revealed an echogenic linear band below the umbilicus with twisting of the mesentery at right iliac fossa. Laparoscopy assessment showed twisted MD (Figure 6). Segmental resection of ileum done. HPE report showed a true MD with area of ischemia and inflammation. There was absence of heterotopic tissue.

#### DISCUSSION

Meckel's diverticulum was first reported by Guilhelmus Fabricius Hildanus in 1598 and in 1808, Johann Friedrich Meckel described its embryological origin which was a remnant of vitellointestinal duct.<sup>1</sup> Though not the first to report on this pathology, MD was credited to Johann Meckel. Failure of duct obliteration gives rise to various malformations like meckel's diverticulum, VI duct fistula, enterocyst, umbilical sinus and congenital band between umbilicus and the bowel. Among these, MD is the most common anomaly.<sup>4</sup> Diagnosing MD is always challenging for surgeons. MD is clinically not evident until complications occur. Occasionally, MD is incidentally discovered during laparoscopy or laparotomy.

Gastrointestinal bleeding is the most common presentation of the MD. This bleeding is due to gastric acid or pancreatic juice secreted by ectopic tissue. These juices damage the diverticulum itself and neighbouring

intestine leading to inflammation, ulceration and bleeding.<sup>1,3</sup> Technetium-99 m pertechnetate radionuclide study, also known as Meckel's scan, is the test of choice for identifying bleeding MD. Meckel's scan has a sensitivity of 60-90% and specificity of 90-98%.<sup>1,2,4</sup> Yield of scan can be optimized by giving intravenous glucagon, histamine -receptor blockers and pentagastrin.<sup>6</sup> It acts by retention of isotopes within the ectopic gastric mucosa. Negative meckel's scan doesn't negate MD.<sup>4</sup> In the circumstance of negative meckel's scan and persistent symptoms, the next diagnostic tool would be laparoscopic assessment. Our centre lacks nuclear medicine facilities. Hence, in cases of persistent or recurrent lower gastrointestinal bleeding in our centre, we proceed with diagnostic laparoscopic assessment after OGDS and colonoscopy negates the source of bleeding. We do not actively intervene in single, small volume episodes of per rectal bleed because 75 to 85% of the lower gastrointestinal bleeding will resolve spontaneously with supportive care.<sup>7</sup>

Intestinal obstruction is the second most complication of MD and occurs by a number of mechanisms.<sup>1</sup> These include a segmental volvulus of terminal ileum due to a fibrous band from MD to anterior abdominal wall. MD can also be a lead point in an intussusception. Other mechanisms include entrapped bowel loops by a mesodiverticular band or MD being the content of inguinal or femoral hernia (littre's hernia).<sup>5</sup> In our case series, 4 children presented with different mechanisms of intestinal obstruction. The second and third case presented with intestinal obstruction secondary to entrapment of bowel loops by mesodiverticular band. Whereas the fourth and fifth case presented with intussusception and failed hydrostatic reduction. In an intussusception, a lead point is identified in approximately 25% of cases and can be secondary to a variety of conditions including lymphoid hyperplasia, intestinal polyps, vascular malformation, lymphoma, vasculitis, duplication cysts, and MD.<sup>8</sup> MD is the second most common lead point for intussusception after lymphoid hyperplasia.<sup>8,9</sup> MD should be a one of the differential diagnoses in a child presenting with intestinal obstruction or failed reduction of intussusception. Sonography and CT Abdomen have infrequently identified MD. However, in children with these presentations, these imaging options may be useful in identifying target sign in intussusception, collapsed and dilated bowel segment in obstructed small bowel, intra-abdominal collection in perforation, thickened bowel wall indicating inflammation. We advocate the initial use of sonography in this group of children to detect these. As demonstrated in our series, we did not use CT as a diagnostic modality which greatly reduces the known radiation burden in children. The single case in our series that had a CT Abdomen was performed in a private healthcare centre before referral.

Diverticulitis occurs in 20% of MD and is more common in adults than children.<sup>1</sup> It is more likely to occur with

narrow-based lesions. Clinical manifestation and pathophysiology will be similar to acute appendicitis in which bacterial overgrowth occurs due to obstruction of the lumen by fecalith, foreign body or parasites.<sup>3</sup> Acute diverticulitis also occurs as a result of damage by gastric/pancreatic juice produced by ectopic tissue mucosa. Untreated acute diverticulitis may progress to perforation. MD has also been discovered when surgery was performed for an initial diagnosis of acute appendicitis (Mohiuddin and Brackett).<sup>2,10</sup> This scenario was similar to Case 3 in our series, with the pitfall being the failure to critically correlate the operative findings of the initial surgery with the clinical findings. The appendix was assessed to be mildly inflamed despite the clinical findings of abdominal tenderness. The degree of inflammation may be subjective to the operating surgeon, however we propose in cases where the intraoperative findings do not fit the clinical findings, careful reassessment of the surrounding organs and the peritoneal cavity would be ideal.

Management of symptomatic MD will be surgical resection.<sup>3</sup> Surgical options include wedge resection for narrow- base diverticulum or segmental ileal resection for broad base diverticulum. Resection of MD can be done via laparotomy, laparoscopic assisted intracorporeal or extracorporeal resection and anastomosis.<sup>4</sup>

There are no clear guidelines for resection of an incidental Meckel. There are opposing views to prophylactic diverticulectomy. Proponents of this argue, preoperative diagnosis of MD is difficult, heterotopic tissue exists in the incidentally found MD and it is difficult to predict who will become symptomatic. Considering all these factors Chen et al suggested excision in an incidental finding of MD.<sup>4</sup> Opponents of an incidental diverticulectomy, Soltero and Bill mentioned in 1976, a 4.2% lifetime complication risk of MD versus 9% morbidity after incidental resection, did not favor incidental diverticulectomy.<sup>11</sup> Stone et al did not recommend removal of incidental asymptomatic MD in women.<sup>12</sup> Onen et al recommended its removal in symptomatic and asymptomatic cases in children younger than 8 years.<sup>13</sup> The mortality rate and morbidity rate after removal of a complicated MD is 2% and 12%. As compared to incidental removal of MD which accounts for 1% mortality and 2% morbidity.<sup>2,3</sup> As described above, there are varying opinions on incidental diverticulectomy. We advocate removal of incidental MD in view of its varying presentation, associated morbidity with complications, difficulty to identify preoperatively and the procedure being relatively low risk.

The concurrent "walk through" of the small bowel during appendectomy is advocated by some authors. Ueberrueck et al analyzed the presence of MD in cases diagnosed as appendicitis.<sup>14</sup> In a 26 year period, approximately 10,000 appendectomies were performed, in that about 80% of cases was explored to look for MD. It was incidentally discovered in 3% of the cases. The experience in this

series led to the author's suggestion to explore the bowel in all appendicectomies. It was evident in case 3 in our series that failure to walk through the bowel resulted in a missed pathological MD. Thus, we recommend to walk through the bowel during appendicectomy especially in cases where the operative features of appendicitis are ambiguous.

## CONCLUSION

Meckel's diverticulum is a common congenital gastrointestinal abnormality which can lead to severe complications including bleeding, intestinal obstruction, diverticulitis, perforation and intussusception. Preoperative diagnosis is always challenging despite advanced radio imaging techniques. It is advisable and safe to remove incidentally found MDs. Laparoscopy should be the primary option since it allows diagnosis and resection.

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