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Perforated Meckel's diverticulum in a neonate

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ABSTRACT

Background: Meckel's diverticulum (MD) is a true diverticulum in the small intestine due to an incomplete obliteration of the vitelline duct. It is commonly located within two feet from the ileocecal valve and occurs in approximately two percent of the population before the age of two years. Meckel's diverticulum is often clinically silent but when symptomatic (4%), it could present with gastrointestinal bleeding, bowel obstruction, perforation or diverticulitis.

Case: A 1900g male infant was born at 31 weeks and six days. He was placed on CPAP for poor respiratory effort, and was transported to our intensive care unit immediately after delivery. By day of life three, he had failed to pass meconium and developed signs of intestinal perforation prompting surgical exploration. A perforated Meckel's diverticulum was discovered and he underwent a small bowel resection with primary anastomosis. Histopathology study of resected bowel showed a small intestine with focal mural necrosis and perforation, and marked serositis with abundant acute on chronic inflammation. We present a case of a neonatal symptomatic MD in a preterm infant with failure to pass meconium without obstruction on imaging, and an extensive literature review on this topic in the last 40 years.

Conclusion: The literature review and our case show that it can be safe to perform primary anastomosis after resection for perforated MD in the neonatal population, even in those of low birth weight.

1. Introduction

Meckel's diverticulum (MD) results from the formation of a true diverticulum in the small intestine as a result of an incomplete obliteration of the vitelline duct [1]. Classically, it is often defined by the rule of two's: 1) occurs in approximately 2% of the population with a male-to-female ratio of 2:1, 2) Located within two feet from the ileocecal valve, 3) occurs before the age of two years, and 4) two inches in length; although, the size of a MD varies in practice [2,3]. Meckel's diverticulum is often clinically silent and discovered incidentally on imaging. But when symptomatic, it could present with symptoms such as gastrointestinal bleeding, bowel obstruction or diverticulitis [4]. Symptomatic Meckel's diverticulum often contains heterotrophic mucosa such as gastric (most common), pancreatic or colonic mucosa [5]. We present a case of a neonatal symptomatic MD in a preterm infant with failure to pass meconium without obstruction on imaging, and an extensive literature review on this topic in the last forty years.

2. Case report

A male infant was born at 31w6d gestation via cesarean section due to breech presentation to a 30yo G1P2 mother. The infant was twin A of IVF assisted di-di twins and had a birth weight of 1907 g. Pregnancy was complicated by pyelonephritis and hydronephrosis requiring ureteral shunt placement. Infant was born with spontaneous cry, but poor respiratory effort. APGARs were 8, 9 at 1 and 5 min respectively. He was started on CPAP and transported to the NICU. Blood cultures were obtained and he was placed on antibiotics. He was weaned of CPAP and antibiotics were stopped within 48 h. By day three, the neonate had failed to pass meconium and he developed a distended abdomen. Abdominal x-rays were obtained (Fig. 1 and Fig. 2) and there was evidence of free intraperitoneal air suggesting an intestinal perforation. Patient was started on broad-spectrum antibiotics and was taken for exploratory laparotomy. Upon entering the peritoneal cavity, a significant pneumoperitoneum was detected, as well as fluid and succus. The bowel was eviscerated and a perforated Meckel's diverticulum was identified (Fig. 3). There was no evidence of necrotizing enterocolitis and the rest of the intestine was well perfused. The patient was hemodynamically stable. The Meckel's diverticulum was resected and a primary anastomosis was performed. Post-operatively he did well. He was extubated on post-operative day two and started feeds on post-operative day five. Histopathology study of resected bowel showed a

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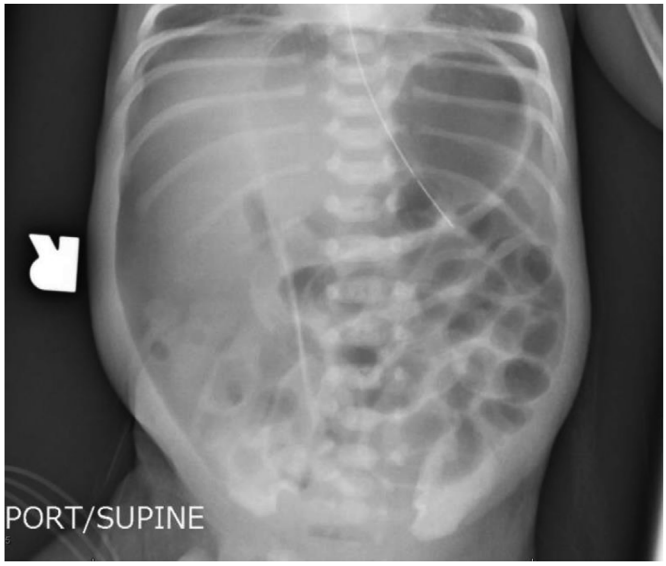

Fig. 1. Supine abdominal x-ray showed gaseous distention of bowel loops throughout the abdomen. There was no evidence of bowel obstruction. Outlining of the falciform and umbilical ligaments, and lucency around the periphery of the abdomen was observed. No pathologic calcification was seen.

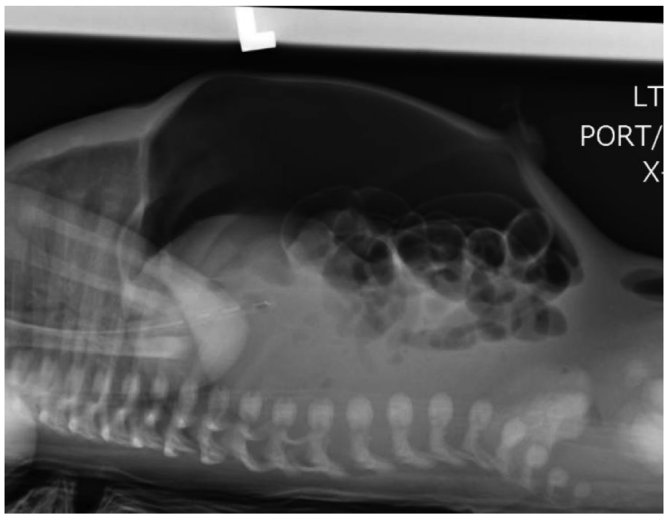

Fig. 2. Cross table x-ray view of the abdomen showed a marked distention of the abdomen with a significant degree of free intraperitoneal air throughout. Bowel loops were compressed into the posterior lower abdomen on this film. X-ray findings were compatible with free intraperitoneal air.

small intestine with focal mural necrosis and perforation, and marked serositis with abundant acute on chronic inflammation. Meckel diverticulum resection margins appeared viable. At time of discharge on day of life 29 the patient weighed 2395 g and was tolerating all feeds by mouth. At two month of follow up, he was found to be thriving, eating well, and gaining weight.

3. Discussion

Meckel's Diverticulum is the most common anomaly of the GI tract, present in 2–3% of individuals with symptoms being infrequent at roughly 4% of patients [6]. Symptoms most often include intussusception, obstruction, volvulus, bleeding and perforation.

Bertozzi et al. describe obstruction being the presenting feature of MD in 58.3% of patients and pneumoperitoneum being found as the presenting feature in 33.3% of symptomatic patients [7]. Other studies

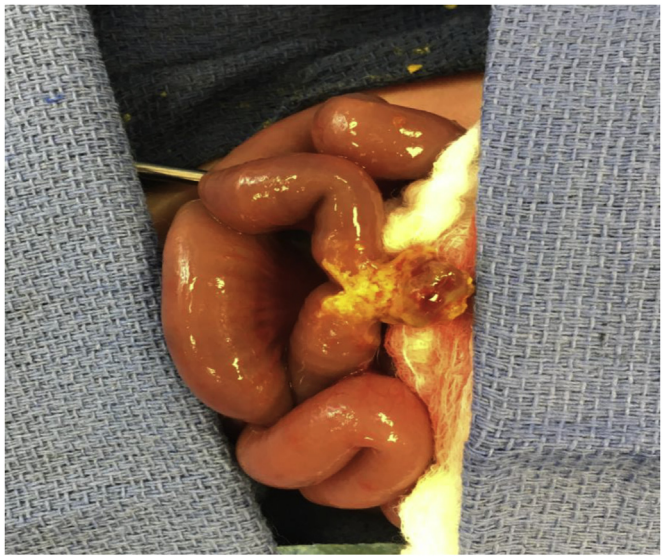

Fig. 3. Intraoperative image of the perforated Meckel's Diverticulum.

have shown intestinal obstruction as the presenting sign for MD at 33.8%, inflammation at 30.9% and hemorrhage at 25% (Mackey). Lee et al. describes GI bleeding being the most common presentation in children with MD at 76% [8]. It has been noted that less than 10% of symptomatic MD are diagnosed pre-operatively [9]. Perforation of MD can be secondary to multiple causes including ulcer perforation from gastric mucosa with the MD, separation of vitelline remnants from the abdominal wall, or perforation from diverticulitis. In the current case, no ectopic mucosa was found on pathology, however marked serositis and abundant acute and chronic inflammation was noted.

We identified 22 published cases of symptomatic perforated or obstructed Merkel's diverticulum in neonates. The majority of cases, 19 (86.7%), were male. As shown in Table 1, most cases were in neonates greater than two kilograms and were treated with a small bowel resection and primary anastomosis. Of the six cases listed above with neonates weighing less than two kilograms, two had primary anastomosis, two were left in discontinuity and two had no description of GI continuity. A previous review of neonates less than 1 kg shows reports of primary anastomosis after resection of MD [10,11]. The literature review and our case show that it can be safe to perform primary anastomosis after resection for perforated MD in the neonatal population, even in those of low birth weight. Primary anastomosis versus diversion with ostomy is a debated topic in the case of necrotizing enterocolitis (NEC). The pathophysiology of NEC is different than that of spontaneously perforated MD and therefore we feel that in the absence of profound hemodynamic instability pediatric surgeons should perform primary anastomoses in these patients. This avoids the morbidity of a second operation and anesthetic.

In our patient, initial abdominal imaging revealed gaseous distention of small bowel but more notably, free intraperitoneal air. Given the way our patient presented with failure to pass meconium and free intraperitoneal air on imaging, our differential included necrotizing enterocolitis, spontaneous intestinal perforation, and gastric perforation. Perforated Meckel's diverticulum was given far less consideration. Given the patient's low weight, some surgeons may have argued for a peritoneal drain. We felt that the patient was large enough and stable enough to undergo an exploratory laparotomy. It is unclear how the patient's course would have gone if a drain had been placed first.

In summary, we presented a case of perforated Meckel's diverticulum in a 1900 g neonate. This is a rare entity but should be considered as a cause of free intraperitoneal air in the neonatal population. Primary anastomosis has been shown to be safe and should be considered as first line treatment.