Meckel's diverticulum: a rare cause of intestinal perforation in a preterm newborn

Stanley Crankson[a], Abdulhafidh Kadhi[a], Khalil Al Tawil[b] and Ibrahim A. Ahmed[b]

Meckel's diverticulum (MD) is the most common congenital anomaly of the gastrointestinal tract. It is usually encountered as an incidental finding at operation or autopsy. Symptomatic cases usually present during infancy with intestinal obstruction, intestinal hemorrhage, diverticulitis, or perforation. We report on a preterm newborn who developed abdominal distension at 17 h of age and pneumoperitoneum at 30 h. At laparotomy, a narrow-based MD with a small perforation at the tip was encountered. Segmental resection of the ileum, including the MD, and end-to-end anastomosis was performed. A review on perforated MD from the English medical literature is also presented. Perforated MD, although rare, should be included in the differential diagnosis of neonatal gastrointestinal perforations and acute abdomen. ***Ann Pediatr Surg*** **9:147–149 © 2013 Annals of Pediatric Surgery.**

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Departments of [a]Surgery and [b]Pediatrics, King Abdulaziz Medical City, Riyadh, Kingdom of Saudi Arabia

Correspondence to Stanley Crankson, Department of Surgery, King Abdulaziz Medical City, PO Box 22490, Riyadh 11426, Kingdom of Saudi Arabia
Tel: +966 11 8011111; fax: +966 11 2520051;
e-mail: cranksons@ yahoo.com

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Introduction

Meckel's diverticulum (MD) is the most common congenital anomaly of the gastrointestinal tract, with an incidence of about 2%. The majority of cases are asymptomatic; clinical cases usually present during the first 2 years of age [1].

Although neonatal presentation of MD is uncommon, cases of intestinal obstruction, hemorrhage, diverticulitis, and perforation have been reported [2–4]. Included were 22 cases of perforated MD in the English medical literature [4–25].

Case report

A 1640 g boy was delivered at 29 weeks' gestation by emergency cesarean section for abruptio placentae and breech presentation from a 31-year-old G6 P4 mother. Antenatal history was unremarkable and Apgar scores were 8 and 9 at 1 and 5 min, respectively. Clinical examination revealed no abnormality. After inserting an orogastric tube, the neonate was kept nil orally together with total parenteral nutrition. An umbilical catheter was not inserted.

The neonate developed abdominal distention at 17 h of age, but the abdomen was soft and not tender. However, plain abdominal radiographs at 30 h revealed pneumoperitoneum. At laparotomy, a narrow-based MD with a small perforation at the tip was encountered (Fig. 1). There was no evidence of peritoneal soiling or peritonitis. Segmental resection of the ileum, including the MD, and end-to-end anastomosis was performed. Histological examination revealed normal intestinal mucosa, no heterotopic tissue, and no significant inflammation. Postoperative recovery was uneventful.

Discussion

MD is a remnant of the omphalomesenteric or vitelline duct, which usually obliterates by the fifth week of gestation. It is located on the antimesenteric border of the ileum at variable distances from the ileocecal junction. Although MD is commonly asymptomatic and presents as an incidental finding at operation or autopsy, it has varied manifestations. About two-thirds of symptomatic patients present before 2 years of age; 8–22% of patients present with complications [1].

Neonatal presentation of MD is uncommon and clinical presentations include intestinal obstruction, gastrointestinal hemorrhage, diverticulitis, and perforation [2–4]. Perforation of the gastrointestinal tract in neonates is commonly due to necrotizing enterocolitis or some mechanical obstruction such as atresia, stenosis, meconium ileus, or Hirschsprung's disease; it can also occur spontaneously in the premature [15]. The rarity of neonatal perforated MD is emphasized in a retrospective study of 402 cases of MD over a 50-year period: only one neonate with a perforated MD and peritonitis was included [1]. Neonatal perforated MD has been reported in 22 cases in the English medical literature and we add a new case [4–25].

The male-to-female ratio for perforated neonatal MD is 3.4 : 1 (Table 1). The mean birth weight is 2196 g (range 650–4500 g); about 56% were term infants. Eight neonates were premature, three with extremely low birth weight. Of the neonates, 43% presented within the first day of life; the mean age at presentation was 2.4 days (range 0–14 days). The clinical features were suggestive of peritonitis (13%); necrotizing enterocolitis was suspected in 4.5%. Other differential diagnoses included intestinal obstruction (8.5%), strangulated inguinal hernia (4.5%), and abdominal mass/abscess (4.5%). A preoperative diagnosis of a gastrointestinal perforation was made in 65% of cases.

Plain abdominal radiographs revealed pneumoperitoneum, indicating a gastrointestinal perforation [6,7,10,11,14,16–18,20–25]. Other investigations included

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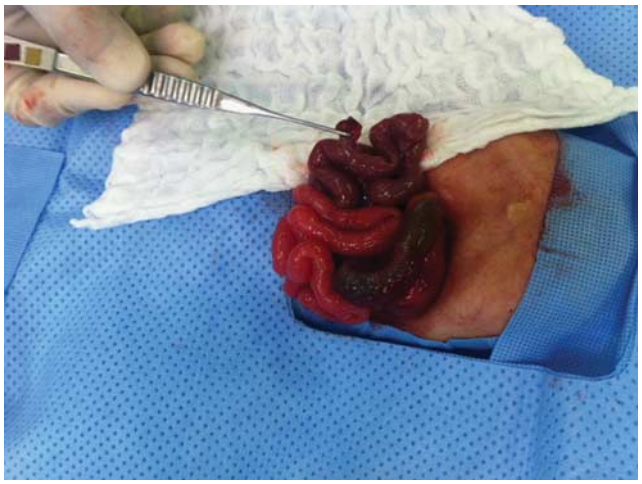
ultrasonography (US) and computed tomography (CT), which were found to be unnecessary when plain radiographs revealed pneumoperitoneum. In the study by Oyachi *et al.* [19], abdominal CT showed an intra-abdominal mass/abscess in a neonate who was found to have a perforated MD at laparotomy. In another study, abdominal US showed ascites, which was secondary to a perforated MD [15].

Although the etiology of MD is not known, the theories include ectopic gastric ulcer perforation from ectopic gastric mucosa, perforated diverticulitis, etc. Spontaneous blow-out of MD is also possible, as is iatrogenic as a complication of umbilical catheterization [4–25]. In two extremely low-birth-weight infants, antenatal and postnatal steroid therapy, hypoxia, poor intrauterine blood flow, and use of intravenous ibuprofen for treatment of a symptomatic patent ductus arteriosus may have contributed to the perforation [21,25].

Fig. 1



At laparotomy, a Meckel's diverticulum with a tiny perforation is shown using forceps. The surrounding bowel was healthy without inflammation.

Intrauterine perforation of MD has been reported [5,10,11,26]. Prenatal US may detect MD and meconium peritonitis [27–29]. MD is seen as an anechoic, ovoid or tubular, fluid-containing structure, persistently localized to the right lower abdomen. The tubular structure remains unchanged in size and lacks bowel calcification; however, it may increase in echogenicity and become isoechoic to the fetal bowel loop as pregnancy progresses [27,28]. The differential diagnoses include duplication or choledochal, mesenteric, or ovarian cysts. Prenatal assessment is useful for planning delivery and neonatal management. Postnatally, plain abdominal radiography, US, and CT scanning or laparotomy may be necessary to confirm the diagnosis.

Early surgical intervention for perforated MD is associated with a good prognosis; however because it is uncommon and the presentation varies, a high index of suspicion is required. Laparotomy, resection of a segment of the ileum, including MD and anastomosis, or wedge resection of MD is the usual procedure. A peritoneal drain was inserted in a very sick neonate, which may be necessary in extremely low-birth-weight infants when the differentiation of spontaneous intestinal perforation from a perforated MD is difficult [24].

There were three neonatal deaths: one neonate with an intrauterine rupture of MD from peritonitis died 9 h after birth and another died from cardiorespiratory failure as a result of associated congenital anomalies [5,11]; the third neonate died from sepsis 6 days after operation [24].

Table 1 A review of reported cases of neonatal perforated Meckel's diverticulum

References	Sex	Birth weight (g)	Gestational age (weeks)	Symptom onset	Preoperative diagnosis	Histology	Ectopic mucosa
Abramson [4]	F	3742	–	5 days	Peritonitis	Inflammation	None
Rosza and Gross [5]	F	–	–	Died at 9 h	Peritonitis	Inflammation	None
Roger [6]	M	2300	–	Birth	Perforated viscus	No inflammation	None
Lin *et al.* [7]	M	2450	36	4 days	Perforated viscus	Focal muscular defect	None
McManus *et al.* [8]	M	2268	–	8 h	Peritonitis	Focal muscular defect	None
Wright and Bhagwandeen [9]	M	3515	Full term	Birth	Strangulated inguinal hernia	No inflammation	Gastric
Coppes *et al.* [10]	M	1780	32	3 days	Perforated viscus	No inflammation	Pancreatic
Ford and Woolley [11]	?	1900	37	1 day	Perforated viscus	Inflammation and necrosis	Pancreatic
Yeh *et al.* [12]	M	–	–	5 days	Bowel obstruction	Inflammation and necrosis	None
Gandy *et al.* [13]	M	4500	Full term	4 days	Bowel obstruction	Inflammation	Pancreatic
Kumar *et al.* [14]	M	2300	Full term	3 days	Perforated viscus	No inflammation	None
Zahraa *et al.* [15]	M	2070	Full term	3 days	Necrotizing enterocolitis	Inflammation	None
Okazaki *et al.* [16]	M	2628	39	1 day	Perforated viscus	Focal muscular defect	None
Chang *et al.* [17]	M	2040	33	13 h	Perforated viscus	Focal muscular defect	None
Sy *et al.* [18]	F	3200	40	30 h	Perforated viscus	Inflammation	None
Oyachi *et al.* [19]	M	3060	Full term	14 days	Abdominal mass/abscess	Inflammation	None
Costa *et al.* [20]	M	1250	29	12 h	Perforated viscus	No inflammation	None
Aguayo *et al.* [21]	M	798	28	3 days	Perforated viscus	No inflammation	None
Alkan *et al.* [22]	F	2800	38	17 h	Perforated viscus	No inflammation	None
Anay *et al.* [23]	M	740	24	2 days	Perforated viscus	–	–
Qasim and Shaukat [24]	M	2500	Full term	2 days	Perforated viscus	No inflammation	None
Khan [25]	F	650	29	6 days	Perforated viscus	No inflammation	None
Present case	M	1630	29	17 h	Perforated viscus	Inflammation	None

In conclusion, perforation of MD during the neonatal period is uncommon. The clinical features are varied and despite the use of radiological investigation techniques, diagnosis is usually made at laparotomy. In general, the prognosis of perforated MD is good, especially when diagnosed early in a neonate with no anomalies. Perforated MD should be considered in the differential diagnosis of gastrointestinal perforation and acute abdomen in neonates.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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