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Meckel's Diverticulum Perforation: Report of a Case and Review of the Literature

M. Voultsos, A. Marinis, S. Rizos, N. Paschalidis

Abstract

Meckel's diverticulum is the most common congenital anomaly of the small bowel. The majority of patients with this anomaly will remain asymptomatic; however, several complications can occur, including diverticulitis, haemorrhage, obstruction, intussusception, and perforation. A 39-year-old man was admitted to the emergency department after complaining of abdominal pain for the past few days. Upon worsening of his clinical status and after completing the diagnostic workup, he was taken to the operating theatre where he was found to have faecal peritonitis due to perforated Meckel's diverticulum. Although it might be difficult to diagnose Meckel's diverticulum pathology preoperatively, it should always be sought and identified during a laparotomy for acute abdomen in order to exclude the increased morbidities resulting from its complications.

Key words: *Meckel's diverticulum, perforation, small bowel, congenital anomalies*

Introduction

Wilhelm Fabricius Hildanus, a German surgeon, was the first to record his observations in 1598 on what is now known universally as Meckel's diverticulum when he described an "unusual diverticulum". It was subsequently reported by Levator in 1671 and later by Ruysch in 1730. Alexis Littre also reported the presence of an ileal diverticulum within a hernia in 1700. However, it was not until 1808 that it was described in detail by Hohann Friedrick Meckel, hence the term 'Meckel's diverticulum' [1-4].

The omphalomesenteric duct is obliterated between weeks 7 and 9 of intrauterine life [5]. If it fails to close, congenital anomalies can include omphalomesenteric fistula, omphalomesenteric cyst, umbilical sinus, mesodiverticular bands, or Meckel's diverticulum which accounts for 90% of such abnormalities [6]. Meckel's diverticulum arises from the antimesenteric border of the terminal ileum as a true diverticulum, which contains all layers of the intestinal wall, usually located within the last meter of the ileum in 90% of cases [7].

In most series, Meckel's diverticula are more common in men, with a male-to-female ratio of up to 4: 1. The estimated incidence reported in the general population is approximately 2%, but a higher incidence rate has been noted in newborns with gastrointestinal congenital defects such as gastrointestinal atresia [3,8,9].

Consideration of this condition in the differential diagnosis upon presentation of acute abdomen is essential, secondary to the morbidity that can accompany it when misdiagnosed. We present the case of a patient with an acute abdomen due to perforation of Meckel's diverticulum and faecal peritonitis, as well as an extended view of the current literature.

Case Report

A 39-year-old male patient was admitted to the emergency department after complaining of abdominal pain for the past few days, worsening in the last few hours prior to admission. He had been to another hospital two days earlier but was discharged with a diagnosis of acute gastroenteritis and sent home with instructions to monitor his pain and be rechecked in case the symptoms did not subside. On admission, his blood pressure was 140/90mmHg, pulse rate 98/min and SaO_2 97%. He complained of gradually worsening vomiting episodes, dizziness, anorexia and malaise. He had a temperature of 38.8°C, and reported that a few hours earlier it had reached 39.5°C. Physical examination disclosed increased abdominal tenderness with rebound even on superficial palpation of his abdomen localized primarily in his right lower quadrant. Auscultation detected decreased to absent bowel sounds. CBC and biochemical marker testing revealed a WBC count of 15.950 with 93% PMNs. The findings of his preoperative radiological workup (US scan, and plain abdominal film) are outlined in figures 1 and 2.

The patient was taken to the operating theatre where upon entry into the abdominal cavity we encountered large

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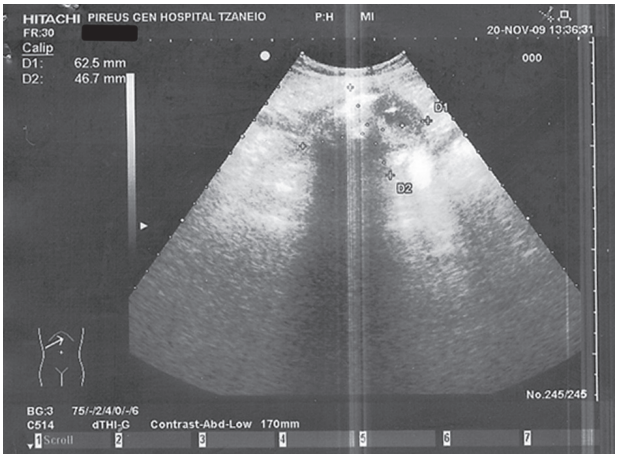

Figure 1. Transverse US of right paraumbilical mass, showing air anteriorly within a rounded fluid collection, surrounding mesenteric inflammation and the Meckel's diverticulum itself containing an enterolith (acoustic shadow)

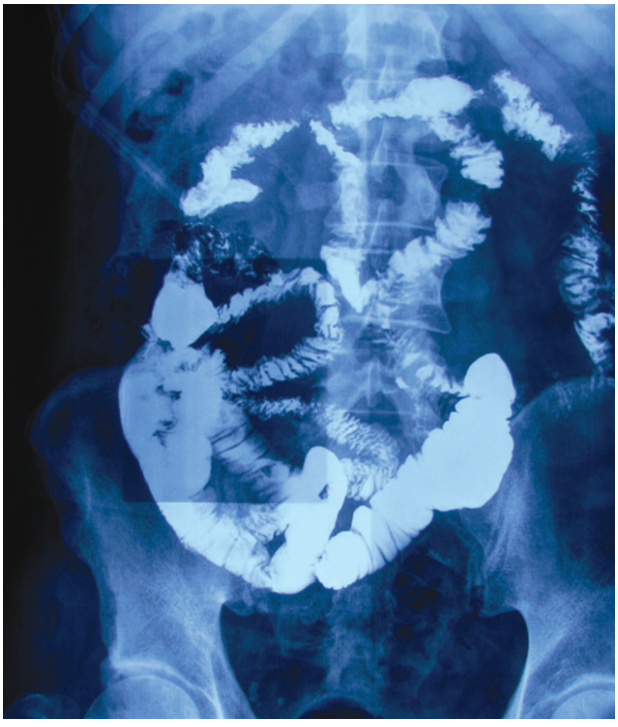

Figure 2. Abdominal radiograph showing leak contrast agent leakage

amounts of pus and feces. The small intestine was excessively distended with multiple adhesions, pseudomembranes and focal ischaemic degenerations. A perforated Meckel's diverticulum oozing enteric content was identified in the right lower quadrant, among a mass of closely adherent intestinal loops. We proceeded to resect approximately 20cm of small intestine including the Meckel's diverticulum using a linear cutter (Figure 3). Small intestinal decompression was followed by end-to-end anastomosis using a loop ileostomy 20cm cephalad to the anastomotic site. The abdominal cavity was subsequently closed after extensive peritoneal lavage and placement of Penrose drainage tubes.

Following extubation, and while still in the surgical resuscitation unit, the patient developed respiratory failure requiring him to be re-intubated and transported to the ICU unit. He remained there for the following 10 days after which he returned to our surgical ward unit, in a hemodynamically stable condition with physiologic diuresis. He was placed on total parenteral nutrition via a central venous catheter.

Histologic examination of the surgical specimen revealed extensive ulcerative haemorrhagic necrosis, micro-abscesses and inflammation at the Meckel's diverticulum rupture site with the presence of ectopic gastric mucosa within the diverticulum, a finding which could possibly explain the diverticular perforation.

The patient was readmitted to our clinic in order to reverse the loop ileostomy. He remains asymptomatic 14 months later.

Discussion

Charles W. Mayo is credited with having stated that "Meckel's diverticulum is frequently suspected, often looked for and seldom found" [10].

Surgical conditions caused by Meckel's diverticulum, particularly inflammation and haemorrhage, occur most frequently in childhood. On the other hand, the diverticulum can remain trouble-free for years only to cause a life-threatening abdominal catastrophe later in adult life. Symptomatic diverticula occur in from 4.2% to 16.9% of individuals with Meckel's diverticula. Painless gastrointestinal bleeding is more common in children, whereas painful inflammation or obstruction is more common among adults. Obstruction results from intussusception, inflammation, omphalomesenteric bands, adhesions, or adenocarcinoma,

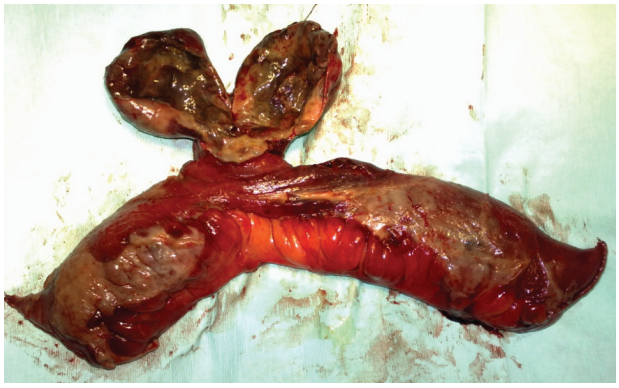

Figure 3. The perforated Meckel's diverticulum

and accounts for 26.2%–53.4% of complications [8,9].

The average mortality from Meckel's diverticulum as reported in several surgical series is around 6%, with a large proportion of deaths occurring in elderly people. Similar to many other less common intra-abdominal conditions, death frequently occurs because of delay in diagnosis and treatment [4].

The preoperative diagnosis of a symptomatic Meckel's diverticulum is difficult since it can mimic many more common ailments as causes of acute abdomen. Appendicitis is the most common preoperative diagnosis in cases of complicated Meckel's diverticulum [4]. Since major morbidities are due to delayed diagnosis and treatment, various techniques in diagnosis have been evaluated and added to our arsenal against this clinical entity. These radiological investigations are summarized in Table 1 [11].

Plain radiographs are not usually helpful in making the diagnosis of a Meckel's diverticulum. They may be normal or show non-specific signs, such as small bowel obstruction or perforation. Rarely, enteroliths may be identified on plain film [11-13]. Contrast studies also seldom outline the primary defect, mostly due to failure of the contrast agent to fill the defect because of inflammation [11,14].

The sonographic appearances of Meckel's diverticulum vary depending on the development of complications. They can mimic those of appendicitis, a duplication cyst commonly found in the region of the terminal ileum, or of intussusception ("double target sign") [11,15].

Although CT is being used more frequently to image the abdomen, it is not clear whether it can improve identification a Meckel's diverticulum since the appearance on conventional CT usually resembles a physiologic bowel loop [11,16] or that of associated complication (e.g. obstruction, perforation etc.). CT can prove more useful in the presence of enteroliths [17]. CT enteroclysis is an alternative to conventional CT if a small bowel lesion is suspected. This has been developed as a useful technique that combines the advantages of a small bowel enema in assessing the mucosa and lumen with those of cross-sectional imaging in assessing extraluminal pathology. Magnetic Resonance enteroclysis is an alternative to CT enteroclysis with the added advantages of reducing the dose of ionizing radiation and the ability to evaluate small bowel function through MR fluoroscopy. Both of these techniques have been used successfully to identify a Meckel's diverticulum [11,18-22].

The incidence of ectopic gastric mucosa has been reported to vary between 23-50% (32, 7) and might play a role in the pathogenetic chain of events leading to haemorrhage and/or perforation as was possibly the case in our patient.

A reported rare cause of obstruction/perforation has been the development of faecoliths within the diverticulum itself. The incidence varies between 8%-10% [33]. Reported causes of perforation by foreign bodies have been button batteries, chicken bones and fish bones [34-37].

There is a general consensus that every symptomatic Meckel's diverticulum should be resected. Regarding surgical technique, some favour resection of the intestinal segment that contains the diverticulum while others opt for diverticulectomy. Intestinal resection is favoured in order to avoid leaving ectopic tissue at the base, whereas diverticulectomy is said to have lower postoperative morbidity [4,7,33,41-45].

Diagnostic laparoscopy can prove to be a very useful adjunct in cases with a high clinical suspicion of Meckel's diverticulum when other available diagnostic approaches fail, as it can be very helpful both in terms of diagnosis and treatment. Contraindications include large diverticula

Table 1. *Sensitivity of radiological investigations in identification of Meckel's Diverticulum*

	Maglinte et al. (1980) (n=13)	Dixon & Nolan (1987) (n=19)	St-Vil et al. (1991) (n=164)	Kusumoto et al. (1992) (n=776)	Groebli et al. (2001) (n=119)	Menezes et al. (2008) (n=71)
Plain film	-	-	-	-	0/47 (0%)	-
Unspecified barium examination	-	-	0	55/118 (47%)	-	-
Enteroclysis	11/13 (85%)	6/8 (75%)	-	-	4/9 (44%)	-
CT	-	-	-	-	1/14 (7%)	-
US	-	-	-	-	-	6 showed intussusception
Technetium 99m	2/5 (40%)	1/6 (17%)	32/37 (86%)	174/210 (83%)	3/4 (75%)	18/27 (67%)
Angiography	1/3 (33%)	2/3 (67%)	-	23/39 (59%)	1/3 (33%)	-
Age of patients included in this study	6-38 years	3-53 years	0-18 years	Not specified	16-87 years	2 days-14 years

(>5cm) or the presence of mesodiverticular bands. Various cases of laparoscopically removed diverticula are reported in the literature [33,46-50].

In contrast, therapy for the incidental finding of an uncomplicated Meckel's diverticulum remains controversial. It is advisable to perform prophylactic resection of the diverticula since the reported morbidity (1%) is lower than the lifelong risk of developing complications (5-6%), or to observe and act accordingly. Certain criteria have been investigated in helping the surgeon decide in favour of a resection, including age (<40 years), sex (male), size (>2cm), diverticulum morphology (adhesions, diameter, etc), and whether or not intraluminal ectopic tissue is palpable. However, a general consensus has yet to be reached as to which of these criteria should or should not be taken into consideration [4,33,37,42,51-55].

Conclusions

Meckel's diverticulum represents a rare embryological remnant which remains largely asymptomatic in adult life. Its associated pathology can be destructive, especially in the event of perforation.

Taking into account the vast possibilities in the differential of acute abdomen, one must always take into account the case of Meckel's diverticulum-associated pathology. Although Meckel's diverticulum pathology might be difficult to diagnose preoperatively, it should always be sought and identified during a laparotomy for acute abdomen in order to exclude the increased morbidity resulting from its complications.

Informed Consent

Written informed consent obtained from the patient for publication of his medical data.

Conflict of Interest

The authors declare that they have not conflict of interest.

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Ρήξη Εκκολπώματος του Meckel: Αναφορά Περίπτωσης και Ανασκόπηση της Βιβλιογραφίας

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Περίληψη

Το εκκόλπωμα του Meckel αποτελεί τη συνηθέστερη συγγενή ανατομική ανωμαλία του λεπτού εντέρου. Η πλειονότητα των ασθενών με αυτή την ανωμαλία παραμένουν ασυμπτωματικοί. Ωστόσο, διάφορες επιπλοκές μπορούν να προκύψουν, που περιλαμβάνουν φλεγμονή, αιμορραγία, απόφραξη, εγκολεασμό και ρήξη. Ένας άνδρας 39 ετών προσήλθε στο τμήμα επειγόντων αιτιώμενος κοιλιακό άλγος που άρχισε προ μερικών ημερών. Λόγω της επιδείνωσης της κλινικής του εικόνας και μετά την ολοκλήρωση του απαραίτητου προεγχειρητικού ελέγχου, οδηγήθηκε στο χειρουργείο. Κατά την ερευνητική λαπαροτομία διαπιστώθηκε εικόνα κοπρανώδους περιτονίτιδας από ρήξη εκκολπώματος του Meckel. Αν και είναι δύσκολο να διαγνώσει κανείς προεγχειρητικά μια πάσχουσα Μεκέλειο απόφυση, πρέπει να αναζητάται και να ανευρίσκεται πάντα κατά τη διάρκεια ερευνητικής λαπαροτομίας για οξεία χειρουργική κοιλία, προκειμένου να αποκλείονται οι επιπλοκές που τη συνοδεύουν κι αυξάνουν τη νοσηρότητα και τη θνητότητα.

Λέξεις κλειδιά: *Εκκόλπωμα Meckel, ρήξη, λεπτό έντερο, συγγενείς ανωμαλίες*

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