

# Symptomatic Meckel's diverticulum in children: a 12-year survey

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## Abstract

**Introduction:** Meckel's diverticulum (MD) is usually asymptomatic but may be associated with severe complications that require awareness. This study aimed to assess the clinical and pathological features of symptomatic MD in children as well as the accuracy of [<sup>99m</sup>Tc]sodium pertechnetate scintigraphy.

**Methods:** We retrospectively reviewed all symptomatic MD in pediatric patients treated between 2007 and 2018 at a tertiary center. Records included demographics, clinical presentation, scintigraphy with [<sup>99m</sup>Tc]sodium pertechnetate, surgical outcome, and histopathology.

**Results:** There were 47 patients (93.6% males) with a median age of 4.31 [1.76-8.10] years. The most common clinical presentation was digestive bleeding (n = 25, 53.2%), followed by intestinal obstruction (n = 12, 25.5%) and diverticulitis (n = 10, 21.3%). The patients with digestive bleeding were younger than those with intestinal obstruction or diverticulitis (2.76 vs. 6.02 years). All patients with digestive bleeding underwent scintigraphy that revealed ectopic gastric mucosa in 23. From the 23 positive scintigraphy, there were 22 available histological exams, from which 21 revealed ectopic gastric mucosa; the 2 negative scintigraphy studies also revealed ectopic gastric mucosa. Therefore, scintigraphy revealed a sensitivity of 91.3% (21/23) in patients presenting digestive bleeding. In the conclusive histological exams (n = 41), ectopic mucosa was detected in 82.9% of cases: 96% in digestive bleeding, 71% in intestinal obstruction, and 60% in diverticulitis. With a median follow-up of 7.2 years, there were no mortality or major complications.

**Conclusion:** Symptomatic MD predominated in males, the digestive bleeding occurring at younger ages. Scintigraphy demonstrated high sensitivity in the detection of ectopic gastric mucosa in patients with digestive bleeding. Overall symptomatic MD usually has ectopic mucosa. Although the surgical outcome is excellent, complications of MD should be kept in mind.

## Keywords

Meckel's diverticulum, digestive bleeding, intestinal occlusion, intussusception, diverticulitis, pertechnetate scintigraphy.

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## How to cite

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## Introduction

Meckel's diverticulum (MD) is the most common congenital anomaly of the gastrointestinal tract and results from the incomplete regression of the omphalomesenteric duct (vitelline duct) [1, 2]. Although usually asymptomatic, it may be associated with diverse clinical manifestations in the pediatric age group related to severe complications. Therefore, MD still presents a clinical and diagnostic challenge.

The present study assessed the clinical and diagnostic features of symptomatic MD in children treated at a tertiary centre over 12 years to evaluate clinical presentation versus age and presence of ectopic mucosa, as well as to evaluate the accuracy of [<sup>99m</sup>Tc]sodium pertechnetate scintigraphy in patients presenting digestive bleeding.

## Methods

We reviewed all symptomatic MD in pediatric patients treated between January 1<sup>st</sup>, 2007, and December 31<sup>st</sup>, 2018, at a Portuguese tertiary centre. Demographics, clinical presentation, imaging with [<sup>99m</sup>Tc]sodium pertechnetate scintigraphy, surgical outcome, and histopathology were recorded. Scintigraphy was performed in patients presenting acute digestive bleeding with significant blood loss. Surgery was performed in front of failed non-operative reduction of intussusception as well as in patients with presumptive acute appendicitis.

Age is presented as median [interquartile range], and categorical data as absolute and/or relative (%) frequency. Statistical analysis was performed using SPSS® (IBM® SPSS® Statistics for Windows®, Version 25.0; IBM Corp, Armonk, NY). Statistical significance was set at 5%.

## Results

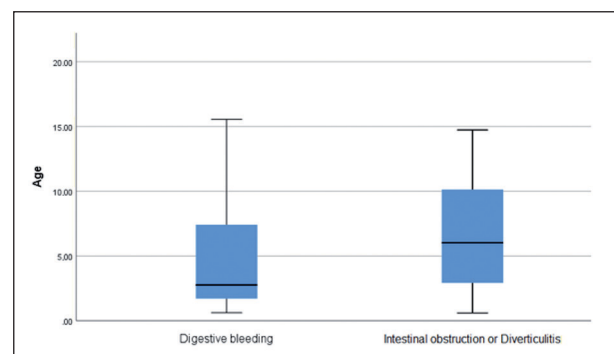
Forty-seven children presenting symptomatic MD were operated on. **Tab. 1** shows the demographics and clinical characteristics of these patients. Pre-school age and males were predominant. The most common presentation was digestive bleeding. Intestinal intussusception with an MD as a lead-point was the most common cause of intestinal obstruction. The least frequent manifestation was diverticulitis.

**Table 1.** Demographics and clinical features.

		n (%)
Gender	Male	44 (93.6)
	Female	3 (6.4)
Age, years <sup>a</sup>	0-4	25 (53.2)
	5-9	11 (23.4)
	10-14	9 (19.1)
	≥ 15	2 (4.3)
Clinical manifestations	Digestive bleeding	25 (53.2)
	Intestinal obstruction	12 (25.5)
	Diverticulitis	10 (21.3)

<sup>a</sup> Median [range]: 4.31 [1.76-8.10].

Patients with digestive bleeding tended to be younger (2.76 [1.67-7.75] years) than those with intestinal obstruction or diverticulitis (6.02 [2.86-10.27] years), but the difference did not reach statistical significance (Mann Whitney U test,  $p = 0.156$ ) (**Fig. 1**).



**Figure 1.** Age and clinical manifestations.

All patients presenting digestive bleeding (n = 25) underwent [<sup>99m</sup>Tc]sodium pertechnetate scintigraphy, which revealed ectopic gastric mucosa in 23. In the group of conclusive histological exams, ectopic mucosa (gastric and/or pancreatic) was detected in the greater majority (34/41, 82.9%) of the patients (**Tab. 2**). According to the presentation, almost all the cases of digestive bleeding presented ectopic mucosa; in cases of diverticulitis and intestinal obstruction, it was present in a substantial proportion of the patients.

**Table 2.** Type of ectopic mucosa versus clinical manifestation in conclusive histological exams (n = 41).

Type of mucosa	Clinical presentation		
	Digestive bleeding (n = 24)	Intestinal obstruction (n = 7)	Diverticulitis (n = 10)
Gastric	19	2	6
Pancreatic	-	2	-
Both	4	1	-
Total	23 (96%)	5 (71%)	6 (60%)

From the 23 positive scintigraphy, there were 22 available histological exams, from which 21 revealed ectopic gastric mucosa; the 2 negative scintigraphy studies also revealed ectopic gastric mucosa. Therefore, scintigraphy revealed a sensitivity of 91.3% (21/23) in patients presenting digestive bleeding.

At a median follow-up of 7.2 years, there were no mortality or major complications.

## Discussion

MD, the most common congenital malformation of the gastrointestinal tract in children, is caused by a failure of closure of the vitelline duct [2]. It is estimated that this embryological remnant can occur in 2% of the general population but usually remains asymptomatic [3, 4]. However, about 2-6% become symptomatic, with digestive bleeding, intestinal obstruction, and inflammation of the MD [1, 4-6].

Our series has a predominance of symptomatic MD in males, corroborating previously published studies [1, 4, 7, 8].

Symptomatic MD can be associated with different clinical manifestations in children, and therefore it is important to maintain a high degree of suspicion of MD in pediatric patients with abdominal pain, digestive bleeding, or intestinal

obstruction. According to a recent systematic review [7], 46.7% of children with symptomatic MD present with obstruction, 25.3% present with gastrointestinal hemorrhage, and 19.5% present with inflammation. Other studies also reported that intestinal obstruction was the most common complication in the pediatric age group [5]. In our study, however, the most common presentation of symptomatic MD was digestive bleeding, followed by intestinal obstruction and diverticulitis. Nevertheless, these results are in agreement with other studies that show that intestinal obstruction and bleeding are more frequent than inflammation in pediatric MD [4].

Interestingly, in our study, children with digestive bleeding tended to be younger than those with intestinal obstruction or diverticulitis, contrary to what was reported by other studies, in which patients with bowel obstruction seem to be younger than those with bleeding [9, 10].

Concerning bowel obstruction, intussusception was the leading cause in our series, and therefore it should be emphasized that the presence of an MD should always be kept in mind, particularly in not reducible, recurrent, or atypical intussusceptions.

In cases of gastrointestinal bleeding, the diagnosis of MD is usually performed preoperatively with [<sup>99m</sup>Tc]sodium pertechnetate scintigraphy [5]. It represents a non-invasive method for the diagnosis of MD with ectopic gastric mucosa [11]. In our series, scintigraphy demonstrated high sensitivity in the detection of the ectopic gastric mucosa in agreement with other studies [12, 13].

In the present series, overall symptomatic MDs usually have ectopic mucosa, a feature that may have a pathogenic relationship. Histologically, MD can contain heterotopic gastric mucosa, which is seen in 50-60% of cases and may cause abdominal pain, ulceration, and bleeding [4, 14]. Ectopic gastric tissue has been the most common form of ectopic tissue found in the MD, as seen in our study, followed by ectopic pancreatic tissue [4, 7]. Pancreatic or other tissues like duodenal and colonic mucosa have been identified in 5-6% of MD in general, and in most of the cases presented with intestinal obstruction [4, 15]. When analyzing the relative frequency of ectopic mucosa by clinical presentation, we found a high incidence not only in cases of digestive bleeding but also in cases of diverticulitis or intestinal obstruction. This has been corroborated by other studies, reporting ectopic mucosa in approximately 60-70% of symptomatic MD [4, 6, 14, 16-18].

Management of symptomatic MD involves early diagnosis and surgical resection, either laparoscopically or by open surgery, with or without a wedge or segment of the adjacent intestine. Morbidity after resection of MD is low; in fact, it was absent in the present series. Despite the favorable outcome after surgery, the complications of MD may be severe and life-threatening and should, therefore, be kept in mind.

This study has some limitations, such as its retrospective nature. Moreover, the sample size is relatively small, which may justify the non-rejection of the null hypothesis concerning the comparison between the ages for the different types of presentation.

### Declaration of interest

The Authors have no conflict of interest to disclose.

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