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ORIGINAL ARTICLE

Meckel's diverticulum: clinical and surgical aspects of patients seen at a pediatric referral hospital

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Abdomen, Acute, Digestive System Surgical Procedures, Meckel Diverticulum, Gastrointestinal Hemorrhage.

Abstract

Objective: To evaluate the epidemiological profile of symptomatic Meckels diverticulum in patients admitted to a specialized childrens hospital from January 2009 to December 2018. **Methods:** This retrospective study analyzed the medical records of patients admitted to a childrens hospital in Curitiba (Paraná-Brazil) from 01/01/2009 to 31/12/2018. **Results:** We found an incidence of 5.3 cases of symptomatic Meckels diverticulum per year. Of the 43 medical records, there was a predominance of male patients (69.7%) and 21 (48.8%) were less than 1-year-old. As for the clinical presentation,15 patients presented acute abdominal inflammation (34.8%), 9 acute abdominal hemorrhage (21%), and 6 acute abdominal obstruction (14%). 13 patients (30.2%) presented unspecific condition and were not classified. Regarding treatment, 41 patients (95.2%) underwent segmental enterectomy with enteroanastomosis. Ectopic mucosa was found in 19 anatomopathological examinations, 16 of which were gastric in origin, 1 pancreatic, and 2 had both mucosae. Post-operative complications included wound dehiscence (4.6%), paralytic ileus (4.6%), and peritonitis (2.3%). Of the 41 patients, 38 were discharged (88.4%), and 5 (11.6%) died. **Conclusion:** Meckels diverticulum had a propensity to manifest in children who were breastfeeding, most often with inflammation and hemorrhage. Of the 9 patients who manifested hemorrhage, 7 (78%) showed ectopic mucosa, which indicates a likely relationship between the presence of ectopic mucosa and hemorrhage. The percentage of patients who died is higher in our sample than in the literature; those who died were predominantly male and 4 (80%) were younger than 1.

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INTRODUCTION

Meckel's diverticulum (MD), described by the German anatomist Johann Friedrich Meckel in 1809[1], is regarded as the most common congenital anomaly of the gastrointestinal tract. MD originates from a failure of the omphalomesenteric duct to obliterate between the 6th and 9th week of gestation.[2] Estimates indicate that MD occurs in approximately 2% of the population, with preference for males at a 2:1 to 4:1 ratio.[3] The anomaly is usually identified at two years of age, and some patients present with ectopic tissue (such as gastric mucosa and pancreatic tissue).[3]

Most individuals with MD are asymptomatic. Many cases are identified incidentally during emergency and elective abdominal surgery. A reported 4-54% of individuals with MD develop symptoms[4,5]. The clinical signs of MD are nonspecific and include different forms of acute abdomen (abdominal inflammation, perforation, intestinal obstruction, gastrointestinal bleeding). Complementary diagnostic tests include complete ultrasound of the abdomen, abdominal computed tomography, and technetium 99m-pertechnetate scintigraphy.

The treatment for symptomatic MD is surgical resection. Approaches include simple diverticulectomy and bowel resection, laparoscopically or via a laparotomy. The most frequent postoperative complications are wound infection and paralytic ileus.

This study describes the epidemiological profile, clinical presentation, performed surgery, and main postoperative complications of patients with symptomatic MD seen at a pediatric tertiary referral hospital.

METHOD

This quantitative retrospective study included the medical records of patients with symptomatic MD admitted to a pediatric hospital from January 2009 to December 2018. Medical records without data supporting a clear diagnosis of MD were excluded.

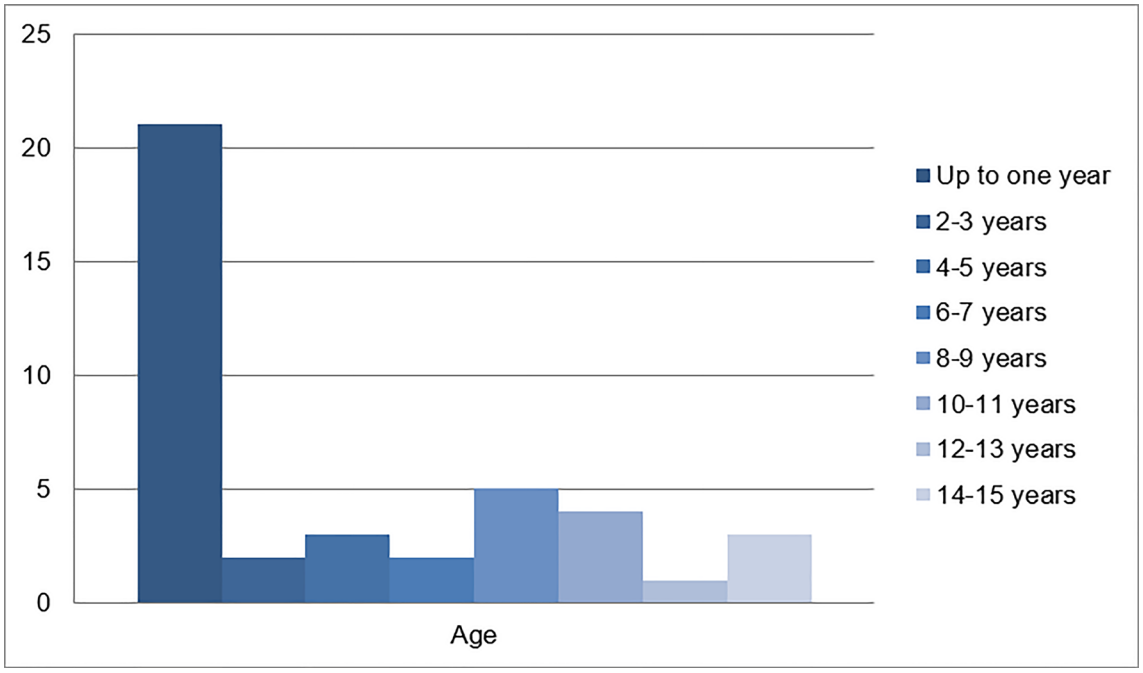
Data were recorded in Microsoft Excel 2016 spreadsheets and processed on software package SPSS 22.0. Statistical analysis included the chi-squared test, Fisher's Exact Test, and analysis of variance. P values of less than 0.05 were considered significant. This study was approved by the institution's Research Ethics Committee (certificate no.: 05852819.5.00000.0097).

RESULTS

This study included the medical records of 43 patients submitted to surgery for MD during the period from 2009 to 2018. Thirty were males and 13 were females. The mean age was 4.6 years (±4.9), as shown in Graph 1.

The most common clinical presentation of MD was abdominal inflammation in 15 patients (34.8%), followed by gastrointestinal (GI) bleeding in nine (21%) and intestinal obstruction in six patients (14%).

A total of 40 pathology test results were found. Nineteen patients (47.5%) had ectopic tissues. Sixteen patients had ectopic gastric mucosa and one had ectopic pancreatic tissue. Two patients had both ectopic gastric mucosa and pancreatic tissue.



Graphic 1. Patient ages. Source: the authors (2020).

Regarding the choice of surgery, there was a preference for bowel resection with enteroanastomosis (95.2%) over simple diverticulectomy (4.8%).

Appendicectomy was performed in 24 patients (55.8%), six of whom were females.

Average diet time was 2.9 days (± 7.8) and length of hospitalization ranged from one to 90 days, with a mean of 13.5 days (±19.4). The length of hospitalization varied according to clinical presentation: inflammation/perforation (14 days); GI bleeding (10 days); or intestinal obstruction (14.1 days). Seven patients used a nasogastric tube and one of them developed a paralytic ileus.

Thirteen patients were prescribed antimicrobial prophylaxis with cefazolin and four of them had abdominal inflammation. The combination ceftriaxone and metronidazole was prescribed to one patient suspected with abdominal sepsis and one patient suspected with septic shock (one had abdominal inflammation and the other had gastrointestinal bleeding).

Thirteen patients were prescribed antimicrobial therapy with gentamicin associated with metronidazole; most had GI bleeding.

The main postoperative complications included suture dehiscence (4.6%), paralytic ileus (4.6%), and peritonitis (2.3%). Thirty-eight patients (88.4%) were discharged and five (11.6%) died. Fisher's exact test showed a statistical correlation between postoperative complication and death (p = 0.003).

DISCUSSION

In our study, the incidence of patients with symptomatic MD was 5.3 cases a year. Thirty of 43 patients (69%) were males and they were aged 4.6 years on average (±4.9). This is consistent with the literature, in which males are preferentially affected by a 2:1 to 4:1 ratio. Although the mean age at symptom onset was 4.6 years (±4.9), more than half of the population were under the age of four years.[3]

The nonspecific symptoms and the lack of standardization in the classification of clinical presentations are a limiting factor in the comparisons between epidemiological studies about MD. Therefore, we used the definitions of acute abdomen (abdominal inflammation, bowel obstruction, and GI bleeding) from the Education Division of the American College of Surgeons as a reference to categorize the symptoms observed in our population (Figure 1). Patients with symptoms of abdominal pain, fever, nausea, and vomiting were categorized as having abdominal inflammation. Abdominal pain, nausea, bilious vomiting, abdominal distension, and constipation were described as intestinal obstruction. Presence of painless rectal bleeding, however, is the main factor in the description of GI bleeding, although nonspecific symptoms may be associated.

Despite the categorization, 13 patients (30.2%) with nonspecific symptoms (abdominal pain or nausea) and incomplete medical records could not be described as suffering from acute abdomen. The impossibility of fully analyzing these medical records is a limitation of the study.

The most common symptom of MD was abdominal inflammation, with 15 patients (34.8%), followed by GI bleeding with nine (21%), and bowel obstruction with six (14%). The systematic review by Hansen et al.[6] showed that eight of 12 articles described intestinal obstruction as the most prevalent event, while the other four described GI bleeding as the predominant finding.

As discussed, clinical manifestations vary in symptomatic MD.[7] The most frequently reported signs are GI bleeding, intestinal obstruction, and diverticulitis.[4,5,8] MD is the most important cause of significant gastrointestinal bleeding in boys before school age.[7,8] The causes of intestinal obstruction include volvulus, intussusception, incarceration of a diverticulum in an inguinal hernia, adhesions, and diverticular stenosis.[6,7,8] Diverticulitis usually affects older children and is often diagnosed as appendicitis due to shared similarities in clinical signs and symptoms.[2,8]

Patients with symptomatic MD have a 10-fold chance of having ectopic tissue, which possibly explains cases of bleeding and inflammation (secretions of gastric/pancreatic juice by the ectopic tissue injuring the diverticulum and the surrounding bowel).[9] Nevertheless, only 50% to 60% of patients with ectopic tissue present symptoms. In our study, seven of nine patients with GI bleeding (78%) had ectopic tissue; the other two (22%) did not undergo pathology examination.

Ectopic tissue is present in 4.6% to 71% of patients with symptomatic MD, with a predominance of gastric mucosa in relation to pancreatic tissue,[6] while the combined presence of multiple ectopic tissues is relatively rare and occurrence has not been established in the literature.

Eight of the 19 cases of ectopic tissue reported in our study occurred in children under one year of age. Six had ectopic gastric mucosa, one had pancreatic ectopic tissue, and one had ectopic gastric mucosa and pancreatic tissue. Burjonrappa et al.[10] analyzed the cases of 22 children and did not find ectopic tissue in patients aged less than a year submitted to diverticulectomy (p<0.006). The authors did not find an association between ectopic tissue and increased incidence of complicated MD.

Diagnosing cases of MD is difficult.[11] Although imaging technologies such as ultrasonography, radiography, computed tomography, angiography, endoscopic capsule, colonoscopy, and magnetic resonance imaging help in investigation, they have limited investigative value due to their low levels of sensitivity and specificity.[3,6,8,9,11]

Technetium (Tc) 99m pertechnetate scintigraphy is a useful diagnostic tool, since it allows the identification of ectopic tissue. This technology was used on three of the patients included in our study. Sensitivity ranges from 60% to 90% and specificity from 90% to 98%.[11]

Some drugs may improve the accuracy of scintigraphy if administered before the examination. H2 receptor antagonists given prior to scintigraphy decrease acid secretion by the gastric mucosa, but do not reduce radionuclide uptake by ectopic tissue. Pentagastrin, in turn, stimulates acid secretion

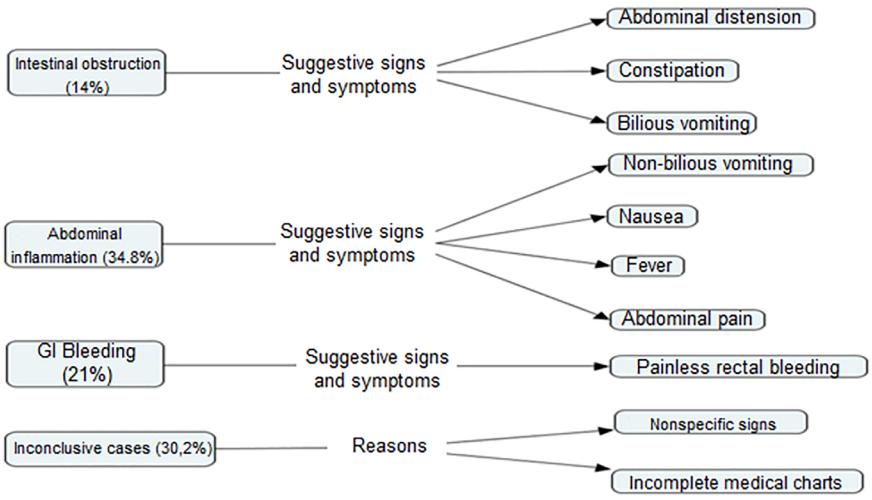


Figure 1. Acute abdomen categorization. Source: the authors (2020).

by parietal cells and increases the speed, duration and intensity of technetium uptake.[12] Glucagon's antiperistaltic activity may delay the clearance of the radioisotope.[13]

It is important to emphasize, however, that scintigraphy should not be used for MD investigation in the presence of significant bleeding (> 0.1 mL/min). Active bleeding can dilute or rapidly clear the radionuclide, preventing its detection on scintigraphy.[13]

Since scintigraphy is a noninvasive test with a low radioactive load, repeating it to optimize results has been considered. Vali et al. argue that scintigraphy can be repeated in the presence of high clinical suspicion despite a negative first scan.[14]

Surgical treatment of symptomatic MD is indicated in the presence of bleeding, diverticulitis, intussusception or obstruction of the diverticulum. Seventy of 102 children (60%) included in a study underwent diverticulectomy and 32 (31%) were offered ileum resection.[4] In another similar study with 50 children, 42 (84%) underwent small bowel resection and eight (16%) were prescribed diverticulectomy.[11] There is no consensus over which procedure is more appropriate, bowel resection or diverticulectomy.

In the present study there was a clear preference for performing bowel resection with enteroanastomosis (95.2%) over simple diverticulectomy (4.8%).

Robinson et al.[4] showed that children treated with diverticulectomy had shorter operative times (105.8 min versus 142.5 min for bowel resection) and a hospital stay after surgery of 2.5 days less than children submitted to an ileum resection. Supporters of diverticulectomy also claim that the procedure can be used to remove ectopic tissue, allowing the adjacent tissue to recover with minimal risk of rebleeding.[15] However, contraindications such the presence of a thick, broad-based or very short diverticulum must be considered, since there is a risk of ileal incorporation and stenosis, with bowel resection standing as the procedure of choice in these cases.[4] Advocates of the procedure claim that bowel resection prevents continued or recurrent GI bleeding, since the entire segment with ulcerated ileum is removed along with ectopic mucosa.

Regardless of approach, management is well established and the indicated treatment for symptomatic MD is surgical resection. However, prophylactic removal in incidental findings and cases of non-symptomatic MD remains controversial. Critics argue that the risk of postoperative complication outweighs the likelihood of developing symptomatic MD, while supporters of the procedure claim that the risk of developing symptomatic MD does not necessarily decrease with age.[4] However, it is currently impossible to predict when and how incidental findings might complicate during an individual's lifetime, which makes it difficult to manage these cases.

Regarding surgery, eight laparoscopies (18.6%) and 35 laparotomies (81.4%) were performed, similarly to previous literature reports.[16] Ruscher et al.[17] reported that more than 75% of MD resections were performed via (open) laparotomy. The operation for symptomatic MD remains an open procedure, since it allows direct palpation of the small bowel and ensures proper resection. It is performed through a right lower quadrant incision similar to that of an appendicectomy. For this reason, most surgeons perform an appendicectomy while performing a diverticulectomy.

Although there is no consensus among surgeons about the need to perform a prophylactic/incidental appendicectomy, laparoscopic approaches to diverticulectomy are becoming more common and may not include an appendicectomy. Since the bowel wall is breached during MD resection, the addition of an appendicectomy is not expected to increase the risk of infection of the procedure. In addition, the ports are placed in similar locations as in a laparoscopic appendicectomy. Another benefit of laparoscopy is the lower likelihood of leaving scar tissue, making future operations less challenging.[18]

Akbulut et al.[10] recommend that prophylactic appendicectomy should not be performed in patients on chemotherapy or radiotherapy, with Crohn's disease, or in unstable surgical conditions. The authors also contraindicate surgery for female patients with vascular grafts.

However, Akbulut et al.[10] and Song et al.[19] agree that female patients benefit more from prophylactic appendicectomy. This may be explained by the greater complexity of the etiological investigation of abdominal/pelvic pain in this group of patients, which may delay diagnostic confirmation. For example, Song et al.[19] found that 75% of the women with appendicitis had not been diagnosed prior to surgery. Diagnosis was only confirmed during surgical exploration.

Other elements that justify an incidental appendicectomy are the negligible increase in the length of surgery and time on anesthesia, and the minimal postoperative complication rates.

The postoperative complications found in this study – namely suture dehiscence (4.6%), paralytic ileus (4.6%) and peritonitis (2.3%) – were more prevalent in males. A large epidemiological study by Hall et al.[5] showed that the incidence of complications related to MD is 6.4% and that affected patients are aged 1.8 years on average.[9] Gezer et al.[11] reported that 24% of the patients included in their study had paralytic ileus, with operative complications such as requiring additional ileal surgery present in 39% of the patients with complicated MD.

Ultimately, it is worth noting that the patients progressed well in most cases. Twenty-eight did not have postoperative complications and 38 were discharged from hospital. In a systematic review by Hansen et al,[6] postoperative morbidity was 5.3%, with wound infections as the main cause of death. In our study, of the five patients who died (11.6%), four were under one year of age, indicating a trend toward unfavorable outcomes for patients in this age group (p = 0.063). No statistically significant associations were found for clinical manifestations (p = 0.511). Two patients had early symptoms of GI bleeding, two of abdominal inflammation, and one had a medical record with insufficient information.

CONCLUSION

In the period between January 2009 and December 2018, the incidence of MD in the study population was 5.3 cases per year. Males and infants were preferentially affected among the 43 individuals included in the study.

The clinical manifestations of MD can be nonspecific. However, GI bleeding and abdominal inflammation were the predominant manifestations in children. In cases of acute abdomen secondary to MD, a possible association was observed with ectopic gastric mucosa.

The pediatric surgeons at the hospital of the study had a preference for treating symptomatic MD with bowel resection over simple diverticulectomy. Most patients were discharged after treatment. However, the percentage of patients who died is higher than that observed in the literature, with a predominance of males and higher morbidity and mortality among infants.

A third of the study population was not fully analyzed due to missing or incomplete data in their medical records, an issue that constitutes a limitation of this study.

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