REVIEW ARTICLE

Meckel's diverticulum: a literature review

Divertículo de Meckel: revisão de literatura

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ABSTRACT

Meckel's diverticulum (MD) is considered the most common congenital abnormality of the gastrointestinal tract. It results from a failed obliteration of the omphalomesenteric duct (vitelline duct), and generally presents as short diverticulum of wide base, located in the antimesenteric border of the ileum, about 90cm from the ileocecal valve. It is asymptomatic in most cases and diagnosed accidentally by laparotomy/laparoscopy indicated for other causes. It manifests as gastrointestinal bleeding in children and in adults by developing abdominal obstructive or inflammatory processes. Its main complications are bleeding, intussusception, volvulus, enterolith formation, inflammation, perforation, obstruction, and neoplasia. Diagnostic confirmation is defined by imaging studies such as abdominal ultrasound, computed tomography, scintigraphy, and angiography. Clinical conduct in asymptomatic patients is controversial; however, in symptomatic patients, surgical indication is a consensus. The approach requires simple diverticulectomy or segmental bowel resection with primary reconstruction by end-to- end anastomosis.

Key words: Meckel Diverticulum; Vitelline Duct; Gastrointestinal Tract; Laparoscopy; Laparotomy.

RESUMO

O divertículo de Meckel (DM) é considerado a anormalidade congênita mais comum do trato gastrintestinal. Resulta de falha na obliteração do ducto onfalomesentérico (ducto vitelino) e, geralmente, apresenta-se como divertículo curto, de base larga, localizado na borda antimesentérica do íleo a aproximadamente 90 cm da válvula ileocecal. É assintomático na maioria dos casos e diagnosticado acidentalmente em laparotomia/laparoscopia indicadas por outras causas. Manifesta-se em crianças pela hemorragia digestiva e nos adultos pelo desenvolvimento de processos abdominais obstrutivos ou inflamatórios. Suas principais complicações são: hemorragia, intussuscepção, volvo, formação de enterólitos, inflamação, perfuração, obstrução e neoplasia. A confirmação diagnóstica é definida por exames de imagem como a ultrassonografia abdominal, tomografia computadorizada, cintilografia e angiografia. A conduta em pacientes assintomáticos é controversa, entretanto, em pacientes sintomáticos, a indicação cirúrgica é consenso. Sua abordagem requer a diverticulectomia simples ou a enterectomia segmentar com reconstrução pela anastomose primária término-terminal.

Palavras-chave: *Divertículo Ileal; Ducto Vitelino; Trato Gastrintestinal; Laparoscopia; Laparotomia.*

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INTRODUCTION

The Meckel's diverticulum (MD) consists of all layers in the intestinal wall and is a true intestinal diverticulum. It originates from failed obliteration and absorption of

the omphalomesenteric duct (yolk-duct) during the first trimester of fetal life.

It is located on the antimesenteric edge of the ileum at approximately 90 cm from the ileocecal valve. It has ectopic tissue in approximately 50% of cases, mostly with gastric and pancreatic origin. It presents itself, in general, as a short diverticulum with a wide base, with its own blood supply from a terminal branch of the superior mesenteric artery that crosses the ileum until the diverticulum.[1,2]

The first description of a diverticulum in the small intestine was performed by Fabricius Hildanus, in 1598. In 1742, a small diverticulum strangled in an inguinal hernia was reported by Littré and, in 1809, Johann Friedrich Meckel published his observations on the anatomy and embryology of the diverticulum, which bears his name.[1]

The MD represents a relevant cause of low gastrointestinal bleeding in the pediatric population. Although it also affects both sexes, it predominates in males.[1, 2]

Most individuals with MD remain asymptomatic throughout life. The emergence of symptoms suggests complications such as gastrointestinal bleeding, more common in children; and obstructive phenomena, inflammatory or neoplastic, more common in adults.[3-5] Its major complication is acute diverticulitis, which must be detected in the differential diagnosis of acute appendicitis.[5] The probability of the disease to become symptomatic at some point in life is estimated in 4 to 6% if the cases.[2]

Excluding the cases of incidental finding during surgeries, the diagnosis of MD depends on the occurrence of complications and is primarily based on imaging tests.[6-9] The main complementary exams are: abdominal ultrasound, abdominal CT scan, scintillography, and abdominal angiography, which becomes relevant before diverticulitis, intestinal, invagination/intussusception, and obstruction and digestive bleeding.[1,10]Scintillography is considered the gold standard in MDs with heterotopic gastric mucosa.

The surgical treatment, always indicated in cases with symptoms and/or complications, consists of removal of the diverticulum via diverticulectomy or segmental ileal resection with simple termination-terminal anastomosis.[6, 8, 10-15] However, the real benefit of surgery in asymptomatic patients with MD incidental diagnosis of discussed because the rates of complications are low and the inherent risks in significant surgical procedure.[5, 11, 12, 14, 16, 17]

EPIDEMIOLOGY

Gastrointestinal malformations correspond to approximately 6% of all congenital malformations.[2]The MD is the most common congenital gastrointestinal anomaly with prevalence ranging from 1 to 4% in the general population. It is twice more common in men than in women and, usually, is located at 60 cm from the ileocecal valve.[1, 2, 10]

The MD is the most frequent cause of low gastrointestinal bleeding in children. It seems to have increased incidence in newborns with other anomalies - cleft palate, bicornuate uterus, annular pancreas, esophageal atresia, and anorectal atresia or malformations of the central nervous and cardiovascular systems.[2, 5, 18]

CLINICAL MANIFESTATIONS

The MD is predominantly observed in the asymptomatic form and is, usually, diagnosed during laparotomy and laparoscopy indicated for other reasons. High or low digestive bleeding, altered bowel habit, and/or abdominal pain suggest some complication associated with MD.[3, 4, 5, 19]

In children, bleeding is the most frequent complication (45-50%), followed by obstruction and infection.[5] Episodes of bleeding occur especially under two years of age, possibly associated with ulceration of the gastric (60-65%) or pancreatic (5%) heterotopic mucosa. Gastric acid and pancreatic alkaline secretions would cause ulceration in the ileal adjacent mucosa, which may explain the bleeding episodes.[2,18] The association of Helicobacter pylori with the bleeding related to MD[20] is still a controversial subject.

Diverticular obstruction is the most common finding in adults.[19] It may be due to the formation of enteroliths;[21-23] internal hernias; diverticular pedicle axial twist; volvulus;[24] MD inversion simulating a pedunculated polyp with obstruction of the intestinal lumen; inflammatory bands; and intestinal intussusception and meconium obstruction in children.[2-4] The clinical presentation can include abdominal pain, vomiting, and constipation. In intestinal intussusception, the characteristic abdominal palpation, and feces "in raspberry jam" are important diagnostic clues. The obstruction, when not addressed surgically, can evolve to necrosis with peritonitis.[19]

The acute diverticulitis, sudden diverticulum inflammation, is observed in 13-31% of cases occurring with complication, with higher incidence in the fourth and

fifth decades of life.[2, 5] It is difficult to diagnose and its main differential diagnosis is acute appendicitis.[10]One must think of complicated MD when a seemingly normal appendix is found in a patient with clinic suspicion of acute appendicitis. MD diverticulitis can be triggered by enteroliths, foreign bodies, or parasites,[2] which causes the obstruction of the diverticulum and determines ileal mucosal inflammation.[5,25]

The MD is internally lined with the ileal mucosa and may contain heterotopic tissue in 30 to 40% of cases. Gastric and pancreatic tissues, or both, are among the heterotopic tissues included. However, there are reports of sporadic findings of the colonic mucosa, and endometrial and hepatobiliary tissue. The incidence of complication in the diverticula with an ectopic mucosa is high. The MDs with gastric mucosa evolve, as a rule, with mild to moderate gastritis in the ectopic tissue, potentially leading to inflammation, bleeding, or perforation. The ectopic pancreatic tissue, in turn, could lead to complication with inflammation or obstruction by the formation of nodulations at the bottom of the diverticulum.[3-5,19]

The occurrence of malignant transformation in the diverticular mucosa is extremely rare. When present, the prognosis is, usually, reserved and histopathology can indicate carcinoid and adenocarcinoma tumors.[26]

DIAGNOSIS

Charles Mayo[2] immortalized the difficulty in the MD diagnosis in a sentence reverberated by many of his colleagues: "Meckel's diverticulum is frequently suspected, often looked for, but seldom found".

The MD has difficult diagnosis and remains a challenge in the medical practice.[5] Most of the complementary exams shows alterations arising from complications such as diverticulitis, intestinal lumen obstruction, hemorrhage, or perforation. Some exams, allied to the clinical manifestations assist in the correct diagnosis such as: abdominal ultrasound, abdominal CT scan, scintillography, and abdominal angiography.[6-9]

Simple abdomen radiography

The simple abdomen radiography is nonspecific in general. Signs of peritonitis can be observed in the case of inflammation. Pneumoperitoneum is easily identified with incidence with horizontal beams if diverticular perforation occurs. In the obstruction by inverted diverticulum into the intestinal lumen, signs of obstruction of the small intestine or intestinal invagination are observed.[7]

Transit of the small intestine

Sacculation of the ileoterminal wall is the characteristic finding in the study of the small intestine transit with irradiated pattern in the joint of the ileal and diverticular mucosae. In some cases, gastric roughness can be identified within the diverticulum.[6]

Ultrasonography

The ultrasound is a good method to diagnose MD complications, especially inflammatory processes and intestinal intussusception. It is useful in rectal bleeding with negative scintillography, which are suggestive conditions of atypical or inflammatory abdomen; however, there are no data to indicate ultrasound as a method that is superior to scintillography with technetium 99, which is considered the gold standard by many authors.[10]

In the cases of intussusception, a double intussusception image can be visualized: the ileum diverticulum and colon ileum through the ileocecal valve. A blind tubular structure with a liquid content is noted that can be quite similar to ultrasound findings in acute appendicitis when there is diverticulitis without obstruction. In the diverticular obstruction, it is possible to observe distended tubular structure with liquid content connected to the umbilical scar.[6, 7, 9]

Computed tomography

The CT scan is usually not useful in the diagnosis, unless there is an inflammatory or obstructive process associated because it is practically impossible to differentiate the intestinal loop from the MD unless it is connected to the umbilical scar.[6-9, 13]

Scintillography T^{99}

Scintillography with technetium 99 (T^{99}) is the most widely used method for the diagnosis of MD. It relies on the labelling property of the gastric mucosa by techne-

tium 99. The exam has around 90% accuracy in pediatric patients.[4] However, it is not very useful in adults due to the reduced frequency of diverticular gastric heterotopia mucosa in this group. It has high specificity (95-100%) but its sensitivity revolves around 85%.[27]

Arteriography

The arteriography may be employed to detect any bleeding site or blood abnormality. Because it is invasive, its nomination should be restricted only to selected cases or when previous exams are normal.[6, 9, 27] It is quite useful when the patient has active bleeding or intermittent bleeding and normal scintillography; and, when positive, an anomalous artery is visualized nourishing the diverticulum and contrast extravasation in cases of active bleeding.[13] Colonoscopy and upper gastrointestinal endoscopy may be useful to rule out other causes of intestinal bleeding.[6]

Videolaparoscopy

Exploratory laparoscopy is considered an effective method in the inspection of the cavity and has the advantage of performing both diagnosis and its correction.[27]

TREATMENT

The definitive MD treatment is surgical. The access can be by laparoscopy or laparotomy with equally satisfactory results.[2,15] Simple diverticulectomy can be performed when there is no involvement of adjacent loops,[6] although the preferred surgical technique is ileal resection with segmental termination-terminal anastomosis, especially in cases with bleeding, diverticulitis, and suspicion of associated neoplasia.[13]

The decision of MD removal, incidentally diagnosed, is controversial. There are several authors who recommend its removal, claiming to be impossible to define macroscopically the absence of heterotopia mucosa in the diverticulum, or that it will not present any kind of complication in the future.[14, 16, 26] Other authors argue that, due to the low probability of MD to become symptomatic, it would require approximately 800 diverticulectomies to avoid one single complication. When the decision for surgery is taken, one must consider the morbidity and mortality associated with the surgical procedure.[1, 5,12]

The rate of MD complication is low, 0.03% per year, and the risk of association with any complications decreases with age, being insignificant in the elderly.[28] Complications by age group present indexes of 4.2% in childhood, 3% in adults, and virtually zero in the elderly evidencing that complications are more common in children and young adults.[29] These findings are relevant for the decision of how to approach asymptomatic MDs.

Some authors suggest[30] that there is sufficient data in the literature that justify the watchful waiting conduct for patients with asymptomatic MD, especially in the elderly, a group in which the rate of complication is known to be smaller, and in which the risks of the surgical procedure are potentially higher. Conversely, in asymptomatic young individuals there would be more benefit than risk in the surgical removal of the MD because these patients have significant risk to evolve into some kind of complication and would generally tolerate the surgical procedure well. Thirunavukarasu et al.,[16] however, recommend surgical removal of all diagnosed MDs based on whether the estimated risk of cancer being 70 times higher in the diverticular mucosa compared to the remainder of the ileum. This proposal is questioned[17] because these data do not justify the indiscriminate prophylactic removal of all MDs. Considering the 2% overall MD prevalence, there would be approximately 0.7 neoplasia cases/100,000 MD carriers/year; that is, 1,600 to 2,000 diverticula would need to be removed to prevent one case of cancer. Although the conduct against incidental MD diagnosis is rather controversial, the evidences are insufficient to indicate massive surgical approach.[17]

CONCLUSION

Since its description in 1809, the most common congenital malformation of the gastrointestinal tract persists as a diagnostic challenge. The clinical presentation of MD is, usually, conditioned to complications and is commonly confused with other diseases. These data underline the importance of suspicion diagnosis in patients with vague abdominal symptoms. In children, digestive bleeding; and in adults, abdominal inflammatory or obstructive clinical conditions should include MD as a diagnosis possibility. Abdominal scintillography is the most accurate complementary method. Ultrasonography and CT scan aid in the diagnosis and corroborate the exclusion of other diseases. The definitive treatment is surgical (diverticulectomy or ileal resection with termination-

terminal anastomosis) with absolute indication in symptomatic patients. In asymptomatic patients, surgical treatment is controversial given the potential for complications versus the risk of the surgical procedure. It is essential that each case be evaluated individually, taking into account variables such as gender, age (complications are more frequent in children and young men), anesthetic risk, characteristics of the diverticulum, and the experience of the surgeon and the service in which the patient is being assisted.

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