Meckel’s diverticulum in adults.

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Abstract

BACKGROUND: Meckel’s diverticulum is the most common congenital anomaly of the gastrointestinal tract. It is a true diverticulum because it comprises all the layers of the intestinal wall. It is usually asymptomatic and is detected incidentally in diagnostic tests with imaging. It has a 2 to 40% risk of complications, the most common of which are bleeding, intestinal blockage, and diverticulitis.

OBJECTIVE: Show the different forms of clinical manifestation of Meckel’s diverticulum from our experience based on cases evaluated with ultrasound and computed tomography, with emphasis on the usefulness of multiplanar reconstructions.

MATERIAL AND METHODS: We present a series of cases, from Hospital Central Militar, with acute abdominal pain syndrome in addition to intestinal blockage syndrome.

RESULTS: In the 7 patients studied, identified with Meckel’s diverticulum from our experience based on cases evaluated with ultrasound and computed tomography, with intestinal intussusception of Meckel’s diverticulum in 1 (14%). In our universe, in patients over 40 years of age, the risk of Meckel’s diverticulum giving rise to complications was 57%.

CONCLUSIONS: Given the low incidence in the general population and the fact that this condition may be masked by symptoms of other more common conditions, despite a high degree of suspicion and advances in diagnostic methods, the aphorism expressed by Doctor Mayo in 1933 still applies today: “Meckel’s diverticulum is often suspected, almost always looked for, and rarely found”. This condition leads us to recognize the need to always keep an open mind, focus on differential diagnosis, and not overlook entities like that under consideration with their associated complications.

KEYWORDS: Meckel’s diverticulum; computed tomography; intestinal blockage
INTRODUCCIÓN

Meckel's diverticulum is the most common congenital anomaly of the gastrointestinal tract; up to 2% of the population is affected.1 It is the remnant of the primitive omphalomesenteric duct that in the embryo connects the bowel with the yolk sac.1 Meckel's diverticulum involves a complication risk ranging from 4 to 6% and is more common in children than in adults (26 to 53%). Males are more affected with a 3:1-2 ratio. The possibility for an asymptomatic diverticulum to become symptomatic and lead to complications is 4% under 20 years of age, decreasing to 2% at 40 years of age and in elderly patients there are no complications.2

The special features that distinguish Meckel's diverticulum have made some authors put forth a rule that can point to the diagnosis. It is the “Rule of 2”: its incidence is 2%, it is located 2 feet (60 cm) from the ileocecal valve, it is 2 inches long (5 cm), it has 2 cm in diameter, and turns symptomatic before 2 years of age, commonly contains 2 types of heterotopic tissue (gastric and pancreatic) and is 2 times more common in males than in females.3 Approximately in 50% of cases it contains heterotopic mucosa, commonly gastric (60%), with the possibility of finding pancreatic tissue, jejunal mucosa, duodenal and other tissue.

Anatomical remnant4

The omphalomesenteric duct is an embryonic structure that connects the primitive middle intestine with the yolk sac up to the seventh intrauterine week; subsequently, it becomes a thin fibrous band that gradually involutes by the tenth week. The incomplete resolution of the omphalomesenteric duct results in a range of anomalies such as: a) umbilicoileal fistula; b) sinus of the omphalomesenteric duct (umbilical); c) omphalomesenteric duct cyst; fibrous cord and e) Meckel's diverticulum, accounting for 98% of all the anomalies of the omphalomesenteric duct.5

The first surgeon who classified the different types of intestinal diverticula was Johann Friedrich Meckel, who in 1809 described an incomplete obliteration of the omphalomesenteric duct, so this diverticulum is named after him. Meckel's diverticulum arises when the ileal end remains patent and the umbilical end is atrophied. It comprises the three layers of the intestinal wall and therefore it is a true diverticulum. There is no agreement as to the shape and size, although some authors state that it may have an approximate length of 5 cm (with a variation ranging from 1-10 cm) and a 2 cm diameter; there are literature reports of giant Meckel's diverticuli (≥ 5 cm) which are uncommon6,7 and are associated with more severe complications such as obstruction. It is usually located in the pelvic region and the lower right quadrant, but it may be periumbilical. Its blood supply comes from the omphalomesenteric artery (a remnant of the primitive vitelline artery, ileal branch of the superior mesenteric artery),8,9 the superior mesenteric artery, and less commonly from the ileocolic artery. It is located at the antimesenteric ileal margin, at 4-10 cm from the ileocecal valve, it is 5 to 10 cm long. Bleeding from the heterotopic gastric tissue that has bleeding ulcers is the most common presentation in children under 2 years. In adults the most common presentation is intestinal obstruction and diverticulitis.4

Objective

Show the different clinical presentation forms of Meckel's diverticulum based on our experience in cases evaluated with ultrasonography and computed tomography, with emphasis on the usefulness of multiplanar reconstructions.
MATERIAL AND METHODS

Our objective was to conduct an observational, retrospective and descriptive study to learn about the most common presentation form and complications of Meckel’s diverticulum. The medical files of adult patients diagnosed with Meckel’s diverticulum based on imaging studies (in the Department of Ionizing Radiation, computed tomography subsection of the hospital) and findings after surgery (in the General Surgery Department of the hospital), confirmed also with histopathology reports obtained from the Pathological Anatomy Department of the hospital) were reviewed. Patients had imaging studies, CAT scans, in a 7 year period, from January 2007 to August, 2014.

Inclusion criteria: Patients 16 years old or older who had diagnosis of Meckel’s diverticulum, either with clinical suspicion, CAT scan evaluation, and incidental intraoperative finding confirmed with histopathology. The variables used were age, gender and predominant symptom. Also, complications from Meckel’s diverticulum were identified.

RESULTS

Seven clinical files of patients with clinical suspicion, CAT scan evaluation, and incidental intraoperative finding with histopathological confirmation of Meckel’s diverticulum were reviewed. Cases were reported from January 1, 2007 to August 1, 2014. Table 1. There was clear predominance of males with 5 patients (72%) and only 2 (28%) females. The age range was from 16 to 25 years in 43% (3 male patients); 26 to 40 years 14% (1 male patient) and between 41 and 61 years 43% (3 patients, 1 male and 2 females).

Out of the 7 patients with Meckel’s diverticulum, 5 (71%) presented to the Emergency room because of a clinical picture of abdominal pain syndrome, 3 (43%) of them, also had intestinal obstruction syndrome, in one acute appendicitis was suspected and in the other (14%) intra-abdominal disease was suspected: collection, intra-abdominal abscess or both.

All the patients were evaluated with CAT scan. In 2 (28%) a clinical suspicion of Meckel’s diverticulum was noted, but without surgical correlation. Case number 6 (Figures 1a-c): in 5 of them (71%) Meckel’s diverticulum was recognized during surgery, with retrospective identification of Meckel’s diverticulum and its complication in computed tomography, with subsequent histopathological confirmation.

From the 3 patients with intestinal obstruction syndrome, in case number 7 (Figures 2a-e) intestinal intussusception was identified in Meckel’s diverticulum, which consequently led to the intestinal obstruction syndrome; in this case, in the histopathology report, heterotopic gastric antral mucosa foci were found. In case number 3, with clinical suspicion of acute abdominal pain syndrome secondary to acute appendicitis and intestinal obstruction syndrome, the appendix was found to be normal and diverticulitis from Meckel’s diverticulum was the causal agent of both syndromes; in the third patient, case number 4 (Figures 3a-3d), a CAT scan revealed perforated Meckel’s diverticulum.

In patient number 5 (Figuras 4a-d), with acute abdominal pain syndrome, the appendix proved to be normal and Meckel’s diverticulum was identified with peritonitis. Thus, in 4 (57%) of cases Meckel’s diverticulum was identified in CAT scan and in 1 (14%) intestinal intussusception of Meckel’s diverticulum. The probability of a symptomatic diverticulum to become symptomatic and have complications is 4% in patients under 20 years, decreasing to 2% at 40 and in elderly patients there are no complications.2 In
our universe of patients the age range was 16 to 25 years, 43%; 3 male patients, 2 of them with no surgical confirmation of the disease and after medical management of the abdominal pain were discharged from the hospital; the remaining case (case number 3), a 25-year-old had diverticulitis from Meckel’s diverticulum (33%). In the remaining age ranges, 26 to 30 years 14% (1 male patient) and 41 to 61 years 43% (3 patients, 1 male, 2 female) all had complications. Contrary to what is found in the specialized literature in patients over 40 years of age, the risk of Meckel’s diverticulum to have a complication was 57% in our universe of patients.

Table 1. Meckel’s diverticulum

<table>
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<th>Number of patient</th>
<th>Gender</th>
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<th>CAT scan</th>
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<th>Surgical confirmation</th>
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<td>22</td>
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<tr>
<td>2</td>
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<td>54</td>
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<tr>
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</table>

M: male; F: female IOS: intestinal obstruction syndrome; AAPS: acute abdominal pain syndrome.

Figure 1. A-C) Case number 6, 16-year –old male with abdominal pain syndrome, CAT scan of abdomen and pelvis showed free intra-abdominal fluid and right pelvic tubular structure that led to suspect Meckel’s diverticulum.
DISCUSSION

Although most of the Meckel’s diverticulum cases are asymptomatic, it can give way to multiple complications. Meckel’s diverticulum is clinically present with a triad of complex symptoms such as intestinal obstruction syndrome, gastrointestinal bleeding and clinical signs of inflammation. However, different manifestations, that are similar to several intra-abdominal diseases, need to be considered during the clinical assessment.

Most of the patients with Meckel’s diverticulum are clinically silent, asymptomatic and with a prevalence between 1 to 3% in the population. The clinical presentation, laboratory tests and physical examination are unspecific. In less than 10% of cases the diagnosis is established before surgery.

The complication rates vary according to the series and have a range between 2 and 40%. However, Park and Wolff showed in a study of 1,476 patients with intra-operative diagnosis of Meckel’s diverticulum that 16% had some of the complications that are mentioned below; they also concluded that most of them were found in males under 50 years of age.
Figure 3. A-B) Case number 4, 48-year-old female with intestinal obstruction syndrome. CAT scan of the abdomen and pelvis showed mechanical obstruction with small bowel loops at the pelvic cavity, intra-abdominal free fluid and identification of a tubular structure with air fluid level in the pelvic cavity closely associated with the transition point leading to suspect Meckel’s diverticulitis. She was subjected to exploratory laparotomy with intestinal resection showing in the antimesenteric aspect a Meckel’s diverticulum that was 8 cm long and 1.5-3 cm in diameter with severe purulent fibrinous acute diverticulitis, perforated.

Figure 4. A-B) Case number 5, 61-year-old female with abdominal pain syndrome. CAT scan of abdomen and pelvis showed a distended area in the appendix with no abnormalities to report, with free fluid in the abdominal cavity and tubular structure with air distention and changes in local and regional fat that led to suspect Meckel’s diverticulitis. C) Case number 5, coronal multiplanar reconstruction showing the normal appendix with air distention, free fluid in the pelvic cavity and tubular structure with air distention and changes in local and regional fat that led to suspect Meckel’s diverticulitis. D) Case number 5, exploratory laparotomy that shows Meckel’s diverticulitis with peritonitis.

Around 19% of patients with Meckel’s diverticulum have complications such as stones, internal hernia when a loop of normal bowel is trapped between the mesentery and the mesiodiverticular portion, inguinal or femoral hernia (Littre’s hernia), obstruction caused by adhesions, secondary obstruction to the formation of a loop that acts as a “lead point” of an obstruction site, Bezoar induced obstrucción, parasite harbor site with complications such as intestinal obstruction, intestinal intussusception, perforation, gastrointestinal bleeding, as well as inflammatory component called ileitis of Meckel’s diverticulum, intradiverticular neoplasms with a 0.5 to 3.2% incidence, ulcers and acute inflammation with or without perforation and diverticulitis.
According to the literature, the most common complication in adults is intestinal obstruction (34-53%). The intestinal obstruction may be caused by the following mechanisms: a) diverticulitis induced by a foreign body or enterolith, b) intestinal rotation with subsequent obstruction, c) persistence of an onphalomesenteric fibrous band that induces volvulus, d) intestinal intussusception or hernia incarceration. In theory, the rapid passage of the small bowel content through the area where the mouth of the diverticulum is found creates a partial vacuum in the diverticulum. With the inflammatory process, the walls become thickened and a pseudopolip is formed, that would increase peristalsis of the diverticular walls, and would gradually push the intestinal mucosa and then the serosa to the inside of the intestinal lumen. In adults, any lesion on the intestinal wall that disturbs peristalsis is capable of starting an intestinal intussusception. Peristalsis allows a proximal segment of the intestine to go into the relaxed distal segment. When this happens, the mesentery is trapped and leads to a cycle of vascular compression, edema and eventually ischemic necrosis of the intestinal wall.

Another of the most common manifestations is Meckel's diverticulitis (13-31%) that may lead to perforation and peritonitis similar to acute appendicitis, with which it is often confused. Meckel's diverticulitis may arise from the effect of acid produced by the ectopic gastric mucosa on the adjacent intestinal mucosa; it may also be due to obstruction of the diverticulum by enteroliths that are formed inside, similarly as what occurs in acute appendicitis. Concerning ethiopathogenesis of enteroliths, it has been postulated that Meckel's diverticulum without gastric mucosa tends to have a silent course for a longer time allowing deposits of calcific salts and other minerals, also fostered by an environment that contributes to have stasis of diverticular content and formation of enteroliths. This would explain why enterolith detection is more common in adults than in children.

Although the formation of enteroliths in Meckel's diverticulum has been considered a rare complication, it is described in the literature from anecdotal publications to be present in 10% of cases. Enteroliths tend to be triangular and flat and tend to have a radiolucent center. Ultrasound and CAT scan may detect enteroliths and are more sensitive than simple radiography. In our series we found no enteroliths.

Another possible complication of Meckel’s diverticulum is hemorrhage. This occurs more frequently in children due to the greater prevalence of ectopic gastric mucosa. A scan with Technetium99 in hemorrhage cases is the ideal technique to recognize it, but is less useful in adults.

Imaging studies

Ultrasonography and computed tomography

Since inflammation in Meckel’s diverticulum may be confused with other abdominal and pelvic inflammatory processes, it is wise to know what the findings in ultrasonography and multidetector CAT scan, useful to establish a preoperative diagnosis. The growingly more frequent use of imaging techniques (ultrasonography and CAT scan) to evaluate an acute abdominal pain syndrome in the Emergency services requires the indispensable knowledge of ultrasound or CAT scan findings of Meckel’s diverticulum. Identification of these findings makes feasible a preoperative diagnosis of Meckel’s diverticulum.

Ultrasoundography and computed tomography have been considered to be of little use for identification of uncomplicated Meckel’s diverticulum because of the difficulty to differentiate it from
Diverticulitis cases, according to the grade of inflammation on the wall, may show a blind tubular structure, in cul de sac with concentric layers that generally contain fluid, air or material with particles, with a thin wall (if there is little wall inflammation) related to the distal ileum, proximal to the abdominal wall anterior to the umbilicus. If, on the contrary, there is inflammation of the wall, the diverticulum may appear as a mass with attenuation pattern in soft tissue adjacent to an intestinal loop, with thickened walls that enhance after IV contrast. According to the grade of inflammation of the wall, the mesenteric fat may also be affected as a sign of localized peritonitis. In cases of intestinal intussusception a target image may be visualized. If the diverticulum is obstructed, a distended structure with fluid content can be seen connected to the umbilicus.

Oral contrast delivered in CAT scan, or using the enterography technique in computed tomography, facilitates the identification of diverticular structure dependence, of Meckel’s diverticulum from an ileus loop, especially in cases in which there is no obstruction of its lumen. Some authors discourage the use of oral contrast because it may hinder the detection of enteroliths, which we consider incorrect because even with contrast their identification is feasible. With the use of CAT scan equipment multiplanar reconstruction ability helps to identify dependence of an ileal loop, as shown in Figures 2-4 and thus have a preoperative diagnosis of this disease.

In elderly population Meckel’s diverticulum is considered to be responsible of many complications. Very often it is not identified in this group of patients because symptoms are very unspecific, it may not be known that this anomaly may be found in this group of patients, and also because the sensitivity of diagnostic tests will depend on the protocol used.

The radiologist must recognize this disease entity, common in pediatric patients and consider it likely when evaluating adult patients with acute or intermittent abdominal pain, with no apparent cause, nausea and vomiting, rectal bleeding, peritonitis or intestinal obstruction.

When the appendix has normal features the whole abdominal cavity must be explored to rule out other inflammatory processes, Meckel’s diverticulitis among them.

While it is reported that Meckel’s diverticulitis is the second complication after intestinal obstruction in adult population, in our viewpoint (in agreement with Jeng-Jung Chen et al), the inflammatory disease of Meckel’s diverticulum is common in adult males and indistinguishable from acute appendicitis, and in our universe of patients it accounted for 57% of cases, where Meckel’s diverticulitis was identified with computed tomography. The intestinal obstruction syndrome is more common in females than in males, in our universe of patients 1 patient was found (14%) corresponding to an intestinal intussusception of Meckel’s diverticulum.

It is currently considered that in most cases, the finding of Meckel’s diverticulum does not always require resection, unless there is one or more of the following conditions: a) narrow diverticular neck; b) unexplainable abdominal pain;
c) low bleeding in recent past; d) palpable mass within the diverticulum; e) fibrous band that connects with the diverticulum; f) diverticulum with its own vitelline vessel and without mesentery that predisposes to incarceration.

CONCLUSIONS

Meckel’s diverticulitis must be considered in the differential diagnosis of acute abdominal syndrome, in children as well as in adult patients.

If the inflammatory process is identified (by CAT scan) in the inferior abdomen or pelvis, particularly the midline, and if there is evidence of distal obstruction, it is advised to do a careful evaluation searching for Meckel’s diverticulum. If the appendix looks normal, the likelihood of this diagnosis increases.

Opacification of the small intestine with oral contrast facilitates identification of Meckel’s diverticulum. As in acute appendicitis, an inflamed diverticulum shows posterior wall enhancement after IV contrast unless changes occur due to gangrenous necrosis that modifies the enhancement pattern thus allowing to define the anomaly pointing to the identification of Meckel’s diverticulum and the diagnosis of its complication.

The use of oral contrast or intravenous contrast helps to recognize and establish the diagnosis of Meckel’s diverticulitis; whenever possible it should be used in patients who will be subjected to a CAT scan because of acute abdominal pain syndrome. Since prevalence in the general population is low and can be masked by signs and symptoms of other more common diseases in spite of a good suspicion index and in spite of advances in diagnostic methods, the aphorism expressed by doctor Mayo in 1933 is still valid today: “Meckel’s diverticulum is often suspected, always looked for and rarely found”.33

This medical condition makes us acknowledge the need to have an open mind, focusing on a differential diagnosis, keeping this disease in mind with its associated complications.

REFERENCES


