

case report

Ultrasonographic diagnosis of obstructive ileus in a patient with Meckel's diverticulum

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Introduction. Despite the use of modern imaging techniques, the reliable preoperative assessment of Meckel's diverticulum and related complications with this rare congenital anomaly of the gastrointestinal tract in adults is uncommon.

Case presentation. This report presents the case of a 25 year old man who presented with a sudden onset of pain in the right lower abdomen and vomiting. On clinical examination the affected area was tender to palpation which revealed an elastic cylindrical formation situated deeply in the abdomen. Blumberg's sign was positive while the laboratory findings were still within normal limits. An ultrasonography of the abdomen revealed an ileocaecal fluid collection containing thicker residue, which was suspicious for Meckel's diverticulum or a duplication cyst and ileus of the small bowel proximally from the formation described. Native radiogram of the abdomen in supine position has confirmed the presence of obstructive ileus at the level of the distal part of the small bowel. Surgery revealed an ileus and compression of the distal part of the small bowel due to the presence of an edematous Meckel's diverticulum.

Conclusion. In view of the frequent use of ultrasonography in the evaluation of acute abdomen, the diagnostic procedures could be rationalized and the time to surgery reduced if possible complications due to Meckel's diverticulum would be considered in the differential diagnosis.

Key words: Meckel's diverticulum - complications; interstitial obstruction - ultrasonography

Introduction

Meckel's diverticulum (MD) is a congenital anomaly of the gastrointestinal tract. It occurs due to incomplete obliteration of the omphalomesenteric duct (vitelline duct)

which would normally close during the 5th to 7th embryonic week. MD represents 90% of all anomalies of the omphalomesenteric duct.^{1, 2} During the embryonic development, the omphalomesenteric duct forms a communication between the yolk sac and the midgut.

With its incidence of 0.3-4% as evident from autopsy reports, the presence of MD is the most frequent anomaly of the gastrointestinal tract.³ Progressive obliteration can be incomplete, leading to various anomalies, such as: a fibrous cord between the umbilicus

Received: 4 May 1999

Accepted: 20 July 1999

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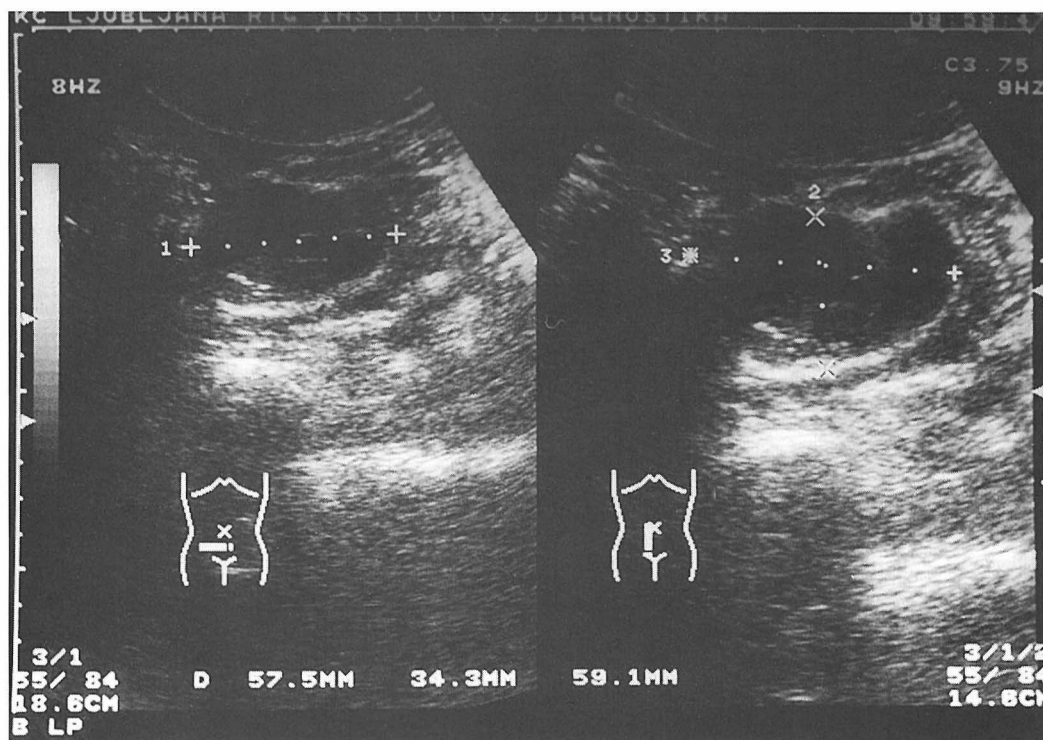


Figure 1. Meckel's diverticulum: The ileocaecal cystic formation with a layer of echogenic tissue at the bottom - edematous heterotopic gastric mucosa.

and the ileum which can contain cystic remnants of the lumen. MD occurs when the intestinal end of the omphalomesenteric duct fails to close. When no bliteration of omphalomesenteric duct occurs the anomaly is ileumbilical fistula.

Only 20-30% of all MD are symptomatic.^{4,5} MD is a true diverticulum containing all the layers of the ileal wall, including heterotopic islets of the gastric mucosa, pancreas, and rarely also other parts of the gastrointestinal tract mucosa.⁶ Complications include bleeding, inflammation, perforation, obstruction or strangulation due to polyps, volvulus, inversion or intussusception of the diverticulum.⁷ While in children MD is suspected quite frequently, in adults where complications are less common, the possibility of MD is rarely considered before surgery.⁸ The symptoms prevailing in adults include inflammation and

obstructive ileus of the small bowel due to volvulus and strangulation by the fibrous cord connecting MD to the anterior abdominal wall. Obstructive ileus can be easily detected by an ultrasonography of the abdomen (abdominal US) in the case of suspected acute abdomen.

Case presentation

A 25 year old man presented with a sudden onset of pains in his right lower abdomen and vomiting. On clinical examination the affected area was tender to palpation. An elastic cylindrical formation was palpated deeply in the abdomen. Blumberg's sign was positive while the laboratory findings were still within normal limits.

Abdominal US revealed an ileocaecal fluid

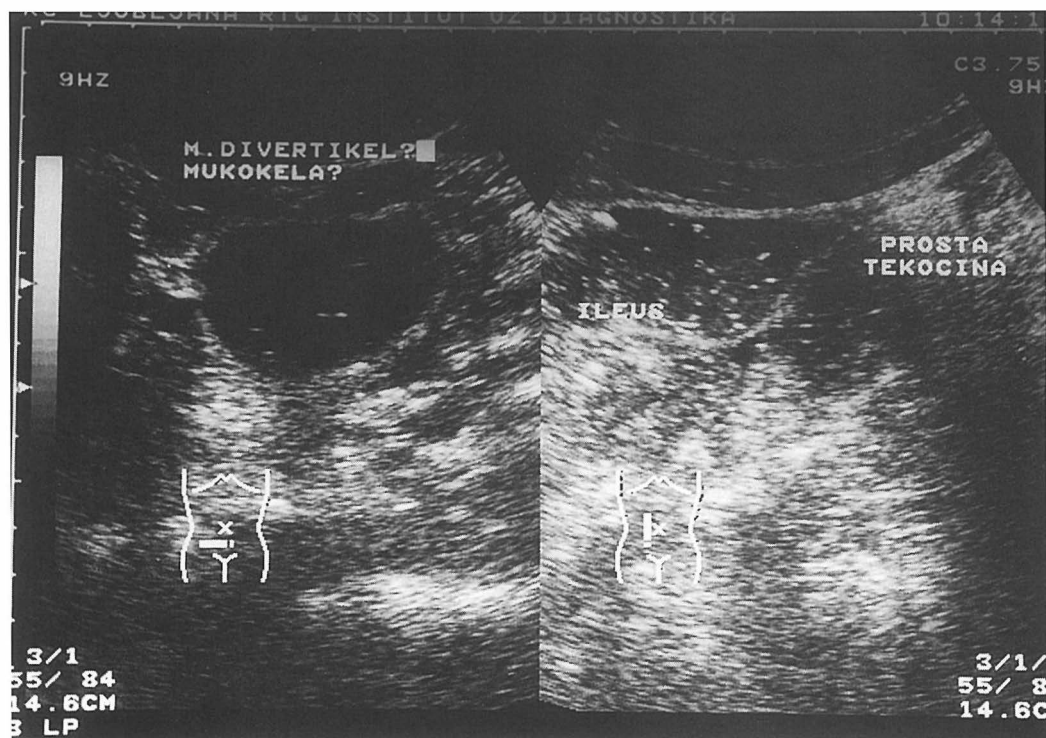


Figure 2. Meckel's diverticulum on the left side. Ileus of the small bowel proximally from MD on the right side.

collection, 6 x 3.5 x 6 cm of size, with a thicker and more echogenic residue in the bottom (Figure 1), which was suspicious for MD, or a duplicate cyst and ileus of the small bowel situated proximally from the described formation (Figure 2). Doppler sonography showed evidence of hyperemia in the area of the cystic wall. The findings of other abdominal organs were within normal limits. There was no evidence of acute appendicitis.

Native radiogram (X-ray) of the abdomen in the supine position confirmed the presence of obstructive ileus at the level of the distal part of the small bowel.

On surgery, intussusception of the distal part of the small bowel due to the presence of edematous MD and the associated obstructive ileus of the proximally situated small bowel were found. A resection of edematous MD and appendectomy were performed.

The postoperative course was uneventful.

Pathohistological analysis of the resected diverticulum showed an edematous wall with moderate a mononuclear infiltration which was most probably due to ischemia. In the top of the diverticulum, transition of the small bowel mucosa into the heterotopic gastric mucosa with individual chronic erosive changes was found.

Discussion

Morphologically, MD is a blind diverticulum found most frequently in the anti-mesenteric side of the ileum, within a 90 cm distance from the ileocaecal valvula in more than 90% of cases, while the minority of cases can be situated even within 180 cm distance from the ileocaecal valvula.⁸ The average size of MD is 3 cm in width (range 1.5 - 12.5 cm) and 4.5 cm in length (range 2 - 10 cm).^{2, 8} They

occur more frequently in males than in females, the ratio being 1.7 vs. 1 respectively, and the frequency of complications in males is higher as well, which further increases the ratio to 2.8 vs. 1.8. Generally clinically silent diverticula have a broader basis and rarely contain heterotopic tissue of the gastric or pancreatic mucosa.⁸ MD is a true diverticulum since its wall contains all the layers of the ileal wall. 6 - 40% of MD contain ectopic tissue: gastric mucosa in 62% and pancreatic tissue in 6%, while mucosa of other parts of the gastrointestinal tract, *i.e.* the colon, duodenum, jejunum and other tissues, is found less frequently.^{6, 8} In symptomatic cases, the percentage of heterotrophic tissue can increase to 79.4%. MD is supplied by remnant of the primitive vitelline artery arising from an ileal branch of the superior mesenteric artery or, less commonly, from the ileocolic artery.⁹

MD related complications occur more frequently before the age of 2 years, and decrease with age. The main symptom in children is gastrointestinal bleeding, while adults will mostly present with symptoms resulting from inflammation or obstruction. In adult women symptoms occur much later, the mean age being 70 years, and less frequently than in men, whose mean age is 40 years.⁸

MD becomes clinically detectable only in patients with complications; with incidence according to the reports from literature in 20-30%.^{4, 5} The possibility of MD should be considered in the differential diagnosis of pain and tenderness to palpation in the right lower quadrant, vomiting, borderline leukocytosis and silent bleeding from the gastrointestinal tract. Clinically the symptoms may mimic appendicitis, ileal diverticulitis, mesenteric lymphadenitis and other rarer conditions.

The most frequent complication is obstructive ileus, which represents 34-53% of all complications.^{2, 8, 9} Obstructive ileus can be caused by the fibrous cord that connects MD with the anterior abdominal wall and can

cause intestinal obstruction and volvulus with strangulation of the bowel. Obstruction is further caused by intussusception of an inflamed or inverted MD, an internal herniation and adhesions.

A frequent complication is gastrointestinal bleeding, which occurs in 12-25% as a result of the presence of ectopic tissue in MD.^{2, 8, 9} This causes ulcerations in the surrounding intestinal mucosa of the ileum. A case of spontaneous intraperitoneal bleeding from a necrotic MD, without evidence of intraluminal bleeding has been reported as well.^{2, 10, 11} Bleeding is most common in children where it is the most frequent sign of MD.

Acute diverticulitis occurs in 13-31%, either with or without perforation.^{2, 6, 8} The signs as well as associated complications can resemble those seen in appendicitis, and may include perforation and peritonitis. Acute diverticulitis is generally resulting from a peptic effect of the gastric mucosa on the surrounding intestinal mucosa. Other causes are comparable to those seen in acute appendicitis, or those associated with enteroliths closing the diverticular lumen.

Incarcerations with incarceration are less frequent; according to the data from literature they are found in 2-5%, most often inguinally or femorally, on the right, and generally do not cause obstruction.^{2, 6, 8}

Malignant tumors represent only 3% of all complications.^{2, 6} The most frequent malignant types include sarcomas, carcinoids and adenocarcinoma, originating from the gastric mucosa. Among the benign ones, leiomyomas, angiomas, neurinomas and lymphomas are seen most frequently.

Preoperative diagnosis of MD is rare, particularly owing to its small size, content of feces and small orifice. In the largest known study of 600 cases by Yamaguchi *et al.*, preoperative diagnosis was established in as little as 6% of cases.

In advanced cases, a plain radiogram of the abdomen in supine position reveals prevail-

ingly non-specific signs of obstruction in the distal part of the small bowel, where complication is present. Very rarely we can see laminar type of enteroliths (11%) and more common ring shaped Meckel's enteroliths (89%) with calcinated margins and radiolucent center.¹² Meckel's enteroliths are mostly (57%) situated in the right lower quadrant of the abdomen.¹² Rare cases of diverticulitis show gas-fluid levels.²

Among the X-ray diagnostic procedures employing a contrast medium for verification of MD in adults, enteroclysis is found to be the most sensitive since it can most clearly image the meeting point of MD with the small bowel wall.¹³ Radiological signs indicative of MD presence are as follows: a collection of contrast in the diverticulum in a typical site, a filling defect due to the presence of concrement, fold pattern in the small bowel wall at the MD orifice, the mucosal "triangular plateau" which marks the site where the diverticulum orifice meets with the intestinal wall when the latter is dilated, and a "triradiate" fold pattern when the loops are collapsed.^{2,8}

Frequent presence of the ectopic gastric tissue in MD (6-40%) enables its detection by means of ^{99m}Tc-pertechnetate based scintiscan, and in the case of bleeding, the use of ^{99m}Tc-sulfur colloid labeled erythrocytes, will also image possible hemorrhage. In adults, the sensitivity of 62.5% and specificity of only 9% has been established due to numerous false-positive findings attributable to inflammatory processes in other organs, arteriovenous malformations, and false-negative results which were mainly due to circulatory disorders and massive bleedings.^{2,6,14}

In the diagnosis of MD, CT scan is hardly of any use, as it is generally impossible to distinguish between the intestinal loops and MD.

Angiography is often indicated in active bleeding from the gastrointestinal tract. The selective angiography of the superior mesen-

teric artery using digital subtraction technique is required. The arterial, capillary and venous phases as well as the mucosal blush are evaluated. The image includes the bowel and the pelvis. In order to prove the presence of extravasation, the bleeding flow should be at least 0.5 ml/min. Sometimes, a superselective imaging of the vitelline artery is made possible by means of magnification technique.²

In the diagnosis of abdominal symptoms, US is frequently the first method used, its sensitivity to detect any pathological changes in the ileocaecal area largely depending on the expertise of the investigator. There is little information available on the US features of MD, since the incidence of this pathological condition is low, and the specificity and sensitivity of US in the diagnosis of MD related pathological changes is probably small. No exact data could be found in the existing literature. Nevertheless, US proved to be first diagnostic modality for the detection of symptomatic MD related complications because it is simple and fast. In the case of MD lumen obliteration, an US image of MD appears as a hypoechogenic, cystic, possibly tubular and solid formation. Its axis is perpendicular to the intestinal wall. In the presence of inflammation the wall is thickened, and a Doppler sonography reveals hyperemia with free exudate in the surroundings. US is hardly able to distinguish between an MD and appendicitis, while it can reliably image early signs of ileus: more than 3-4 cm wide liquid-filled loops of the small bowel with either intense or already failing peristalsis. The threatening discontinuation of circulation in the wall in the site of intussusception is assessed by Doppler sonography.

We believe that the role of US in the diagnosis of MD is prevailing in the exclusion of other acute abdominal conditions and MD related complications, reduced need of additional radiological examinations, and a shorter way to diagnosis. The sensitivity of detec-

tion increases the targeted screening for MD and its related complications in patients with corresponding symptoms. Often, any further radiological investigations fail to contribute significantly to the final diagnosis.

Due to their similar features, it is necessary to exclude more frequent duplication cyst, which is situated parallel with the ileum axis, as well as diverticula of the small bowel, which are more numerous in the jejunal area (66%).¹⁴ Unlike MD, both are situated in the side of the mesentery.

The treatment for symptomatic MD is surgery. MD is removed together with a part of the ileum. Opinions on the procedure based on incidentally detected asymptomatic MD are controversial. When the surgical procedure is simple, it is indicated in these cases as well. However, in the diverticula with a broad base, which are unlikely to cause any complications, surgery is not simple and is therefore frequently contraindicated; such cases may rarely become symptomatic later on.⁸

Conclusion

Diagnosis of symptomatic MD is difficult. Frequent use of US in suspected cases of acute abdomen, as well as consideration of the possibility of MD related complications in the differential diagnosis may contribute to fast and accurate evaluation of the cause of condition. The sensitivity and specificity of US are probably low, the role of this investigation being prevailing in the exclusion of other accompanying diseases and complications, in the reduced need for additional exposure of the patient to X-rays, and finally, in shortened way to diagnosis.

Scarce data in the available literature call for further investigations which would determine more accurately the role of US in the diagnosis of MD and this condition related complications.

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