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PERFORATION OF MECKEL'S DIVERTICULUM – CASE REPORT

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SUMMARY – Perforated callous ulcer of Meckel's diverticulum on the base of heterotopic gastric mucosa, in a 20-year-old man is presented as a relatively rare and unusual case interesting for its localization and histopathologic substrate. Preoperative diagnosis of Meckel's diverticulum is extremely rare, as there is no efficient and reliable diagnostic procedure in spite of the great diagnostic progress in general. In case of clinical suspicion, multiple diagnostic procedures should be performed to increase the likelihood of preoperative diagnosis. Meckel's diverticulum is usually detected when inflammatory complications mimicking the clinical picture of acute appendicitis have already set in. There are no specific symptoms of the pathologic changes in Meckel's diverticulum, thus the diagnosis is most frequently reached intraoperatively, as in the case presented. The patient underwent laparotomy for the clinical picture of diffuse peritonitis. During the operative procedure, a gangrenous, inflamed perforated Meckel's diverticulum was found, at 80-cm distance from ileocecal valve. The diverticulum was of a thumb size, with a perforation orifice at the base, located on the mesenterial aspect of the intestine. Due to its position, the perforation orifice was located in the triangle formed by the base of diverticulum, ileum and respective mesenterium. Such a localization of Meckel's diverticulum and perforation orifice required resection of the diverticulum, segments of the intestine with mesenterium, and terminoterminal anastomosis. Based on the heterotopic gastric mucosa, the histopathologic finding indicated a callous perforated ulcer of Meckel's diverticulum. As the Meckel's diverticulum consisted of all layers of the ileum wall, there was no doubt that it was a true Meckel's diverticulum. The postoperative course proceeded uneventfully and the patient was discharged from the hospital on postoperative day 14, in good general condition and with normal abdominal finding.

Key words: *Meckel's diverticulum – surgery; Meckel's diverticulum – pathology; Meckel's diverticulum – complications; Laparoscopy*

Introduction

Meckel's diverticulum is the most common malformation of the gastrointestinal tract. It is an omphalomesenteric duct rudiment, usually found on the ileum segment, 30-100 cm orally from the ileocecal valve, at the site of superior mesenteric artery termination, being implanted onto the antimesenterial segment of the intestine, and less frequently at the mesenterium. The length of Meckel's diverticulum varies from 4 to 8 cm; only exceptionally, it may be very short or very long, up to 15-25 cm. Various forms have been described; however, the shape of a glove finger is most common; it is rarely very narrow or very wide. In male, the prevalence of Meckel's diverticulum is two- to threefold that in female. It remains asymptomatic in most cases; however, complications develop in 15% to 20% of individuals with Meckel's diverticulum, manifesting by clinical symptoms that determine the diagnosis. The diagnosis is as a rule made intraoperatively. Meckel's diverticulum is detected on 1% to 3% of laparotomies. Clinically, it is most commonly manifested as intestinal obstruction, inflammation and perforation with consequential peritonitis or intestinal hemorrhage. More than a half of complications develop in childhood and early adolescence. The histopathologic structure of Meckel's diverticulum corresponds to that of small intestine, with a note that lymphatic vessels are less developed, as differentiated from the appendix. On histopathology, some

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30% of Meckel's diverticula contain heterotopic tissues such as gastric, duodenal, jejunal and colonic mucosa, and pancreatic tissue.

A case of perforated callous ulcer of Meckel's diverticulum on the base of heterotopic gastric mucosa is presented.

Case Report

A. M., a man born in 1983, was admitted to surgery emergency unit on September 5, 2003, for the clinical picture of acute abdomen. History revealed the onset of pain in the entire abdomen two days before, accompanied by several episodes of vomiting elevated body temperature (up to 38 °C). He had not visited physician between the onset of disease and admission to surgery department, where he presented for worsening of his general condition and severe diffuse abdominal pain. On admission, the patient was pale, dehydrated, languid, adynamic, with impaired general condition and walking with difficulty. The abdomen was diffusely sensitive to palpation, with muscular defense of the entire abdomen. Digitorectal examination revealed sensitivity of the entire Douglas' space.

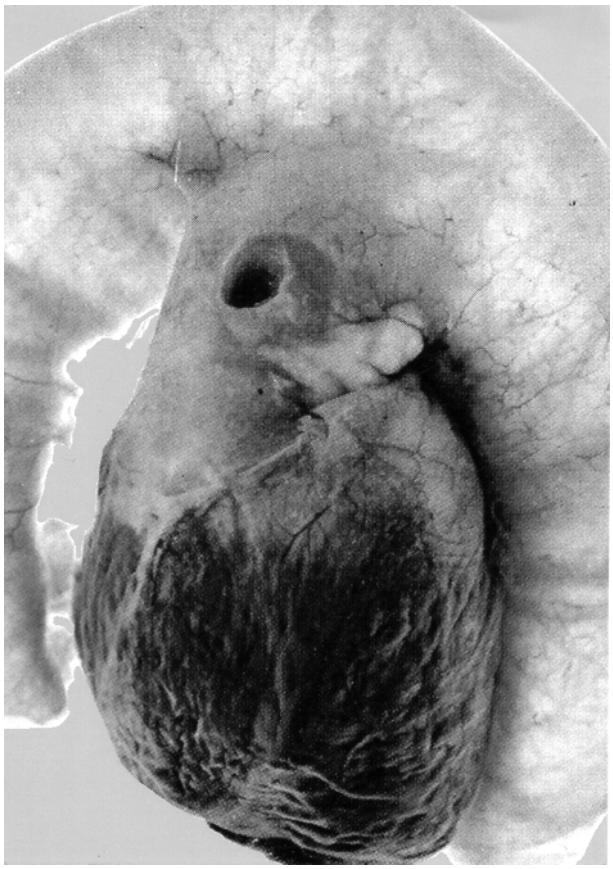

Fig. 1. Gangrenous perforated Meckel's diverticulum.

Laboratory findings: leukocytes 26.4; differential blood count: segmented 0.82; nonsegmented 0.03; lymphocytes 0.17; erythrocytes 5.3; hemoglobin 129; hematocrit 0.41. Urine: acetone positive; sediment: 20-30 leukocytes *per* field. Axillary temperature elevated (T_{ax}=38.2 °C); rectal temperature (T_{rec}=39.1 °C). Lung x-ray: normal; native x-ray of abdomen in upright position showed several minor levels in the small intestine curvatures.

Operative therapy was indicated by the clinical picture of acute abdomen and suspicion of acute perforated appendix. On September 5, 2003, explorative laparotomy was performed in general anesthesia after brief preoperative preparation and examination. Intraoperatively, a macroscopically unchanged appendix in lateral position, with abundant malodorous, purulent grayish-brown content was found in the abdomen, with signs of diffuse peritonitis. As acute appendicitis was not confirmed on laparotomy, we decided to perform additional exploration of the abdomen, starting with small intestine examination from the ileocecal valve orad. At 80 cm from the ileocecal valve we found gangrenous inflamed perforated Meckel's diverticulum (Fig. 1). The diverticulum was of a thumb size with perforation orifice on the base, located on the mesenterial aspect of the intestine. Due to the localization, the perforation orifice was located in the triangle formed by the base of the diverticulum, ileum and corresponding mesenterium. Such a localization of Meckel's diverticulum and perforation orifice required resection of the diverticulum, and segments of the intestine and mesenterium, along with terminoterminal anastomosis (Fig. 2c). Histopathologic finding indicated a callous perforated ulcer of Meckel's diverticulum on the base of heterotopic gastric mucosa. Appendectomy was also performed, and abdominal swab was obtained for aerobic and anaerobic bacteriology. The postoperative course was uneventful. The patient was prescribed a combination of antibiotics (gentamicin, cefuroxime, metronidazole), which did not require any modificiation upon the antibiotic sensitivity report and identification of causative agents. The peristalsis was restituted on postoperative day 3. The patient's general condition improved considerably, he turned afebrile and the operative wound healed *per primam*. On postoperative day 8, the sutures were removed,

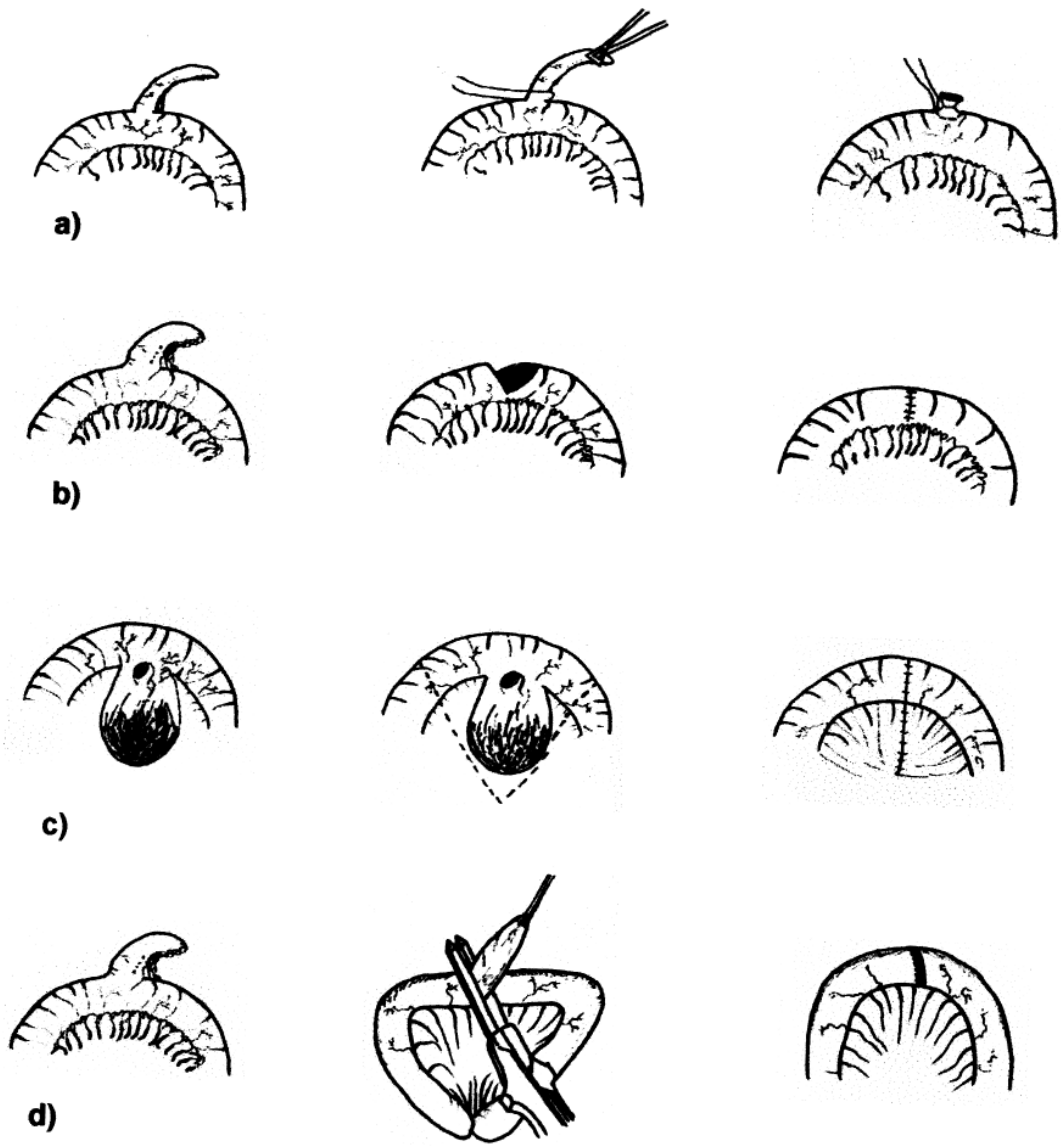

Fig. 2. Operative treatment of Meckel's diverticulum: (a) diverticulectomy; (b) wedge resection of diverticulum; (c) partial intestinal resection; (d) laparoscopic diverticulectomy.

and the patient was discharged from the hospital on day 14 in good general condition, with normal abdominal finding and normal peristalsis. Control examination on day 7 of discharge showed complete regression of all signs of peritonitis and normal palpatory finding of the abdomen.

Discussion

Meckel's diverticulum is found in 2%-3% of laparotomy procedures. In 1808, J. F. Meckel, an anatomist from Halle (1781-1832), described it in detail as a sacculation of a part of ileum, actually a rudiment of embryonic communication between the intestinal canal and yolk sac. Meckel's diverticulum is a persisting proximal part of the omphalomesenteric duct which should normally involute by the sixth week. Canal persistence may be total or partial. In partial persistence, the remnant part may be attached to the umbilicus in the form of solid or cystic tumor, umbilical fistula or some other form, or to the intestine in the form of enterogenous cyst or Meckel's diverticulum (Fig. 3).

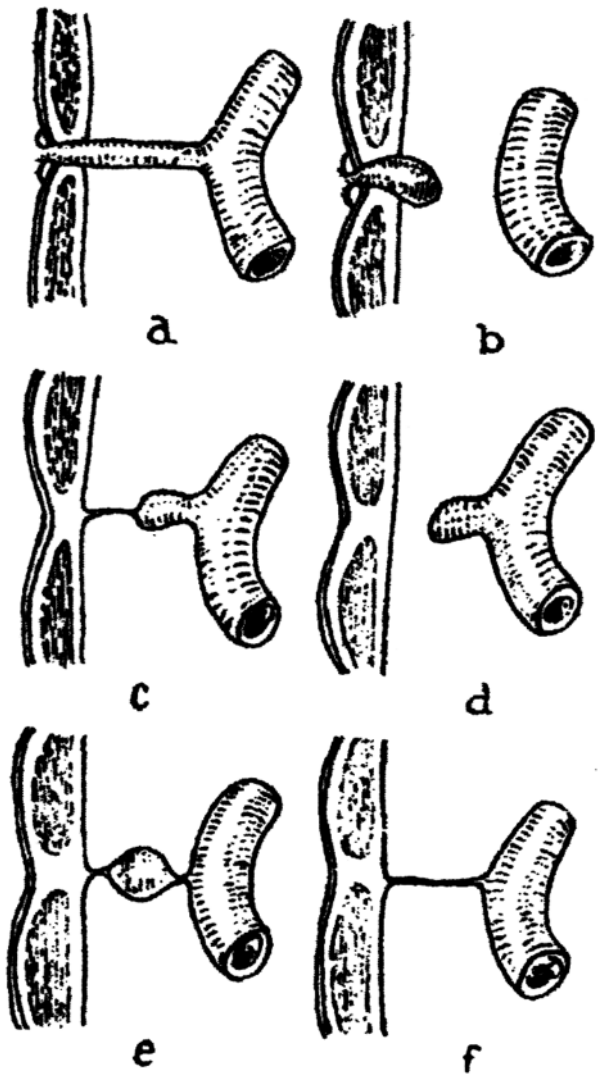

Fig. 3. Anomalies due to impaired omphalomesenteric duct obliteration (according to Neff; Lijec Vjesn 1977;99:599).

The histopathologic structure of Meckel's diverticulum corresponds to the structure of small intestine, with a note that lymphatic vessels are less developed, as differentiated from the appendix. On histology, some 30% of Meckel's diverticula may be found to contain heterotopic tissues such as gastric, duodenal, jejunal and colonic mucosa, and pancreatic tissue[1-3]. In the majority of cases, Meckel's diverticulum remains asymptomatic, however, complications develop in 15% to 20% of individuals manifesting with clinical symptoms that determine the diagnosis of Meckel's diverticulum. The diagnosis of the condition is generally made intraoperatively. The condition is clinically manifested with intestinal obstruction, inflammation and perforation with peritonitis or intestinal hemorrhage[4]. About 50% of the complications develop in childhood and early adolescence, with a high male predominance (male to female ratio, 3:1). Based on our own experience and literature reports, we point to the relevance of Meckel's diverticulum in the casuistics of emergency surgery. The great variation of the forms and complications of the disease make the diagnosis of Meckel's diverticulum extremely difficult. It is mostly detected when inflammatory complications mimicking the clinical picture of acute appendicitis have already set in[5]. There are no pathognomonic symptoms of pathologic changes in Meckel's diverticulum, therefore the diagnosis is generally only intraoperatively established. In 50% of patients, the condition manifests with painless hemorrhage from lower intestinal tract due to diverticulum ulceration. This is also the most common cause of severe intestinal hemorrhage in childhood, usually occurring in children below age 10. Approximately 30% of Meckel's diverticula manifest with the symptoms of intestinal obstruction, with strangulation at the time of operation in 50% of cases. Chronic abdominal pain is explained as a sequel of peptic ulceration of Meckel's diverticulum. The ileus caused by Meckel's diverticulum usually occurs in the form of volvulus or invagination (Fig. 4). Diverticular hernia is an impacted herniation containing Meckel's diverticulum that is completely or partially impacted in the form of Littre's hernia[6,7].

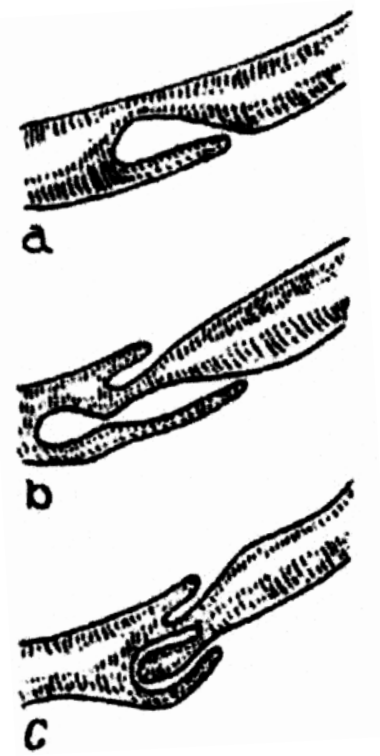

Fig. 4. Schematic presentation of the development of intestinal invagination due to Meckel's diverticulum (according to Neff; Lijec Vjesn 1977;99:599).

Diverticular tumors are various growths in the umbilical region with tumor characteristics, containing elements of diverticulum structure. The most common benign neoplasms include cystoma, adenoid tumor and granuloma, whereas most common malignant tumors are carcinoid, epithelioma and sarcoma.

Meckel's diverticulum hemorrhage originates from peptic ulceration of the ectopic gastric mucosa. Parietal cells of this mucosa, like those normally found in the stomach, have the ability to concentrate technetium 99m Na-pertechnetate, thus the method of identifying Meckel's diverticulum with ectopic mucosa is based on this affinity. This diagnostic procedure is highly useful in children, where it produces reliable diagnostic information, while detecting 60%-65% of cases in adults. False-positive findings generally result from other intra-abdominal processes, whereas false-negative findings are usually due to inadequate amount of ectopic mucosa that may occasionally be necrotic, or to the reduced isotope passage time because of heavy hemorrhage irrigating the isotope and preventing its accumulation in Meckel's diverticulum[8,9]. Ultrasonography is also employed in the diagnosis of Meckel's diverticulum, and it is efficient if performed by experienced staff, taking into account the difficulty in differential diagnosis against acute appendicitis[10]. Identification of a fixed cystic structure with marginal hyperemia by color Doppler is suggestive of inflamed Meckel's diverticulum. When the structure is surrounded by a hyperechogenic layer, perforation should be suspected[11]. Major diverticulous dilatation can be visualized on irrigography by fractionated intestinal passage or retrograde filling of terminal ileum (Fig. 5).

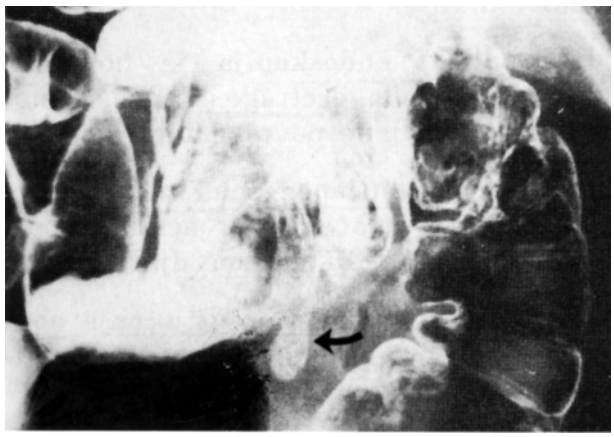

Fig. 5. Meckel's diverticulum visualized by fractionated intestinal passage.

Meckel's diverticulum cannot be visualized by abdominal computed tomography or magnetic resonance imaging unless the lumen contains a coprolith or foreign body[12]. Selective abdominal angiography enables the source of bleeding in Meckel's diverticulum to localize. Like any other rudimentary organ, Meckel's diverticulum is prone to inflammation, which is the most common complication in adults. History data and clinical picture are identical to those in appendicitis, therefore histological grading ranges from catarrhal through phlegmonous to gangrenous inflammation, with or without perforation, and with development of mostly diffuse peritonitis due to free localization in the abdominal cavity. Foreign bodies, generalized inflammatory disease, ulcerous lesions of the gastrointestinal tract, tuberculosis and typhoid have been implicated as the cause of inflammation; chronic ulcerative diverticulitis on the heterotopic mucosa base has been described as a separate entity[13-16]. Preoperative diagnosis of Meckel's diverticulum is extremely rare. In spite of the great progress in diagnostic tools, there is no efficient and reliable diagnostic procedure for this condition. In case of clinical suspicion, multiple diagnostic procedures are needed to improve the likelihood of preoperative diagnosis. However, laparoscopy should be more frequently employed as a diagnostic method. Atwood was the first to perform resection of Meckel's diverticulum by laparoscopic route in 1992, to be followed by many cases of not only laparoscopic diagnosis but also of endoscopic resection with or without mini-laparotomy. The resection by endoscopic access can be done by a stapler (Fig. 2d). In the majority of cases, the clinical picture of acute appendicitis is the basis of indication for operative treatment. The treatment of Meckel's diverticulum and its complications is almost exclusively operative. In the presence of perforation or inflammatory lesions in the area of diverticulum (diverticulitis), or in case of broad-base diverticulum, resection of the intestinal segment with diverticulum and terminoterminal anastomosis are indicated (Fig. 2c). In other cases, diverticulectomy alone should be performed[17] (Fig. 2a). On the operation of a bleeding Meckel's diverticulum, the potential involvement of the entire intestinal circumference by ectopic mucosa should be considered. Therefore, resection of the intestinal segment with diverticulum rather than just diverticulum excision should be done in the management of this complication. Unfortunately, direct visual inspection or palpation of the diverticulum is not reliable in detecting ectopic mucosa. What should be

the procedure in patients with macroscopically unchanged Meckel's diverticulum detected on abdominal exploration? Considering the possible complications that occur in every fifth patient with Meckel's diverticulum, diverticulectomy or diverticulum resection should be performed[18]. The surgeon should neglect this principle only in patients where the operative risk would greatly increase with this operation. In the past 20 years, many studies have reported on 3.5% morbidity and 0.2% mortality in case of Meckel's diverticulum removal in children and adults. In case of symptomatic diverticulum resection, the morbidity increases 1.5-fold and mortality by 1.5%. Definitive decision on the need of asymptomatic Meckel's diverticulum removal will be made by the surgeon himself. The following criteria have to be taken into account on deciding on asymptomatic Meckel's diverticulum resection: male sex, age less than 40, type of surgery necessitating laparotomy, size and localization of the diverticulum, narrow implantation base, and presence of palpable ectopic mucosa[4,6,19,20].

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Sažetak

PERFORIRANI MECKELOV DIVERTIKUL – PRIKAZ SLUČAJA

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Prikazuje se slučaj perforiranog kaloznog ulkusa Meckelova divertikula na osnovi heterotopne želučane sluznice kod dvadesetogodišnjeg muškarca. Slučaj je relativno rijedak i neuobičajen, te zanimljiv zbog lokalizacije i patohistološkog supstrata. Prijeoperacijsko dijagnosticiranje Meckelova divertikula iznimno je rijetko. Usprkos velikom napretku u dijagnostici još uvijek nema učinkovitog i pouzdanog dijagnostičkog postupka. U slučaju kliničke sumnje treba primijeniti višestruke dijagnostičke pretrage kako bi se povećali izgledi za postavljanje prijeoperacijske dijagnoze. Meckelov divertikul uglavnom se otkriva onda kad nastanu upalne komplikacije koje oponašaju kliničku sliku akutnog apendicitisa. Ne postoje znakoviti simptomi patoloških promjena kod Meckelova divertikula, pa se dijagnoza najčešće postavlja intraoperacijski, kao i u ovdje prikazanom slučaju. Laparotomija je učinjena zbog kliničke slike difuznog peritonitisa. Za vrijeme operacije nađen je gangrenozno upalno promijenjen perforirani Meckelov divertikul, udaljen 80 cm od ileocekalne valvule. Divertikul je bio veličine ručnog palca s perforacijskim otvorom na bazi, a bio je smješten na mezenterijskoj strani crijeva. Zbog takvog položaja perforacijski otvor se je nalazio u trokutu baze divertikula, ileuma i pripadajućeg mezenterija. Takav smještaj Meckelova divertikula i perforacijskog otvora zahtijevao je reseckiju divertikula, dijela crijeva i pripadajućeg mezenterija, te terminoterminalnu anastomozu. Patohistološki nalaz ukazivao je na kalozni perforirani ulkus Meckelova divertikula, na osnovi heterotopne želučane sluznice. Kako se je opisani Meckelov divertikul sastojao od svih slojeva stijenke ileuma, bilo je izvan svake sumnje da se radi o pravom Meckelovom divertikulu. Poslijeoperacijski tijek je kod bolesnika protekao uredno te je otpušten iz bolnice četrnaestog dana poslije operacije u dobrom općem stanju s urednim abdominalnim nalazom.

Ključne riječi: *Meckelov divertikul – kirurgija; Meckelov divertikul – patologija; Meckelov divertikul – komplikacije; Laparoskopija*