



ORIGINAL ARTICLE / Digestive

Multidetector-row computed tomography (MDCT) features of small bowel obstruction (SBO) caused by Meckel's diverticulum



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KEYWORDS

Meckel's diverticulum;
Multidetector computed tomography;
Intestinal obstruction;
Small intestine;
Intussusception

Abstract

Objectives: To report the multidetector-row computed tomography (MDCT) findings of small bowel obstruction (SBO) caused by Meckel's diverticulum.

Materials and methods: Ten patients (9 men and 1 woman; age range, 2–44 years; median age, 21 years) with surgical proven Meckel's diverticulum who presented SBO on the preoperative MDCT were included in the study.

Results: On MDCT, all patients presented with SBO, either high-grade ($n=6$) or low-grade obstruction ($n=4$). Meckel's diverticulum was identified in five patients ($n=5$, 50%) on preoperative MDCT. In the five patients in whom a diverticulum was not seen on preoperative MDCT, MDCT showed a transition site on ileum with dilated proximal loops ($n=3$), pneumoperitoneum ($n=1$), jejuno-jejunal intussusception ($n=1$). Transition zone was located near midline in four patients (4/5, 80%).

Conclusion: The diagnosis of Meckel's diverticulum complicated SBO can be made with certainty when the diverticulum is visualized on preoperative MDCT. However, the preoperative diagnosis is difficult if the Meckel's diverticulum is not noted on the MDCT. When the obstructive processes are visualized in the lower abdomen or pelvis, particularly near the midline, one should keep in mind that SBO may be caused by Meckel's diverticulum without prior surgical history.

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Meckel's diverticulum is a congenital anomaly of the gastrointestinal system attributable to incomplete obliteration of the omphalomesenteric duct. Meckel's diverticulum has an incidence of 1–2% in the general population, and most of the diverticula remain asymptomatic. The lifetime complication rate of Meckel's diverticulum is approximately 4% and includes symptomatic complications such as bleeding, obstruction, and inflammation [1–3]. On computed tomography (CT), Meckel's diverticulum may appear as a fluid- or air-filled blind-ending pouch that arises from the antimesenteric side of the distal ileum. However, CT has low sensitivity for the detection of uncomplicated Meckel's diverticulum because its appearance mimics that of a normal bowel loop. Complicated Meckel's diverticulum represents an important cause of acute abdominal pain [3,4], and most cases with inflamed Meckel's diverticulum may be visualized on CT. However, diagnosis of secondary intestinal obstruction caused by Meckel's diverticulum is most difficult [5].

The purpose of this study was to describe the MDCT features of SBO caused by Meckel's diverticulum in 10 patients who were evaluated by MDCT before undergoing surgery.

Materials and methods

This study was approved by the hospital's Institutional Review Board, and the requirement of informed consent was waived for this retrospective study.

Patient groups

Based on a review of medical records for the time period from January 2006 to December 2014, 43 patients with Meckel's diverticulum were searched, and among them, 17 patients were pathologically confirmed. The seven patients are excluded from final enrollment because four patients were discovered during surgery for another primary reason (such as traumatic small bowel perforation, adhesive ileus, appendectomy, and sigmoid volvulus) and three patients showed no small bowel obstruction on CT. The remaining 26 patients were excluded because they did not pathologically confirm (three had intestinal bleeding, and others had suspected Meckel's diverticulitis on CT, with relevant clinical features, but received only symptomatic treatment and observation).

Ten patients (median age 21; range, 2–44 years) included in our final analysis had surgically-proven disease, and SBO on abdominal CT scan. All patients who had undergone preoperative MDCT had subsequent surgically confirmed Meckel's diverticulum-related complications.

MDCT technique

Because CT examinations had been performed with various types of equipment over a long period, the scanner techniques and protocols varied. Two patients underwent CT scanning at a referring hospital.

The CT examinations were performed using all variable channel (4–128) multidetector-row CT (MDCT) scanners. The instrument used most frequently was a 128-detector-row MDCT scanner (Definition AS+, Siemens Medical Solutions, Forchheim, Germany), which was used in six

patients. These CT examinations were performed after injection of intravenous contrast medium (Iopromide, Ultravist 300; Bayer Healthcare, Berlin, Germany). The images were acquired during the portal venous phase (70-second delay after contrast injection), including the region from the dome of the diaphragm to the symphysis pubis. The CT parameters were as follows: 100 kVp, quality reference current, 220 mAs; detector configuration 0.6 × 32 mm; pitch, 1.25; rotation time 0.5 seconds; section thickness 4.0 mm; reconstruction interval 4 mm; and reconstruction kernel B30f. Tube current modulation with CARE Dose 4D (Siemens Medical Solutions) was applied. Routine transverse and coronal images were reconstructed on the scanner's standard workstation (Syngo Multi-Modality Work Place, Siemens Medical Solutions).

The images were retrospectively reviewed by a consensus of three experienced abdominal radiologists. Studies were evaluated for the following:

- visualization and localization of Meckel's diverticulum on the preoperative MDCT, which defined as blind-ending out-pouching sac like structure arising from distal ileum;
- complication type of Meckel's diverticulum;
- location of SBO;
- grade of SBO, which categorized as high-grade obstruction was considered present if there was a 50% difference in caliber between the proximal dilated bowel and the distal collapsed bowel, or complete evacuation of the contents of the bowel segments distal to the obstruction point [6];
- identification of a normal appendix;
- other associated findings.

Radiology reports were reviewed, to determine the patient presenting complaint and the prospective preoperative diagnosis offered at the time of initial MDCT interpretation.

Results

Ten patients (9 males and one female) were enrolled in this study, and their detailed characteristics are summarized in Table 1. The average age was 21 years (range 2–44). All patients complained of abdominal pain. In addition, three patients had diarrhea, five had vomiting, and one had fever to 39.5°C. Review of radiology records showed that the prospective MDCT diagnosis raised the possibility of SBO caused by Meckel's diverticulum in five of the ten patients. In five patients, the CT interpretation offered prospectively was SBO of uncertain cause. SBO was graded as high ($n=6$) or low ($n=4$).

Of the five diverticula visualized, the location was in the midline in two patients, slightly to the right of midline in one, and to the left of midline in one. The diverticulum was located in the right lower quadrant in one patient. All diverticula were located on the terminal branch of the superior mesenteric artery (Fig. 1). Diverticulitis was present in three patients, with evidence of inflammatory changes, such as mural thickening, mural enhancement, and soft tissue stranding with adjacent fluid collections. Of these, perforated diverticulitis was pathologically proven in two patients with extraluminal free air, and small bowel enterocolitis was present in one patient, but there was

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