

## A case of cecal volvulus in a cerebral palsy patient: Usefulness of multidetector computed tomography for preoperative diagnosis

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**ABSTRACT** A 39-year-old man, bedridden because of cerebral palsy, was admitted to our hospital with abdominal distension and polypnea. Emergent dynamic computed tomography (CT) revealed markedly distended bowel with air-fluid levels in the lower abdomen, confirmed to be the cecum by following the bowel loops in a retrograde fashion from the rectum. So-called “bird beak” and “whirl” signs were observed on the coronal reconstruction image. On the basis of these CT findings, cecal volvulus was suspected and emergent surgery was performed. Laparotomy revealed a 180 degrees clockwise rotation of the ileocecal portion of the colon around the ileocecal mesentery. The patient was successfully treated by surgical intervention with no complications. Volvulus of the cecum is a rare but important cause of acute abdomen and is associated with a high mortality rate. Multidetector CT is considered fundamental in the prompt and accurate diagnosis of this condition.

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Key words : Cecal volvulus, Cerebral Palsy, Multidetector Computed Tomography

### INTRODUCTION

Cecal volvulus (torsion of the cecum around its own mesentery) is a rare cause of acute abdomen. This condition is responsible for 1.0%-1.5% of all cases of adult intestinal obstruction and 25%-40% of all volvulus involving the colon<sup>1)</sup>.

Prompt and accurate diagnosis is vital for saving the patient's life, because delay in surgical treatment may lead to an increased incidence of bowel necrosis with its associated higher

mortality<sup>2)</sup>. However, cecal volvulus may present considerable difficulty in diagnosis. Classically, abdominal radiographs have been obtained for initial diagnostic imaging, but they rarely contribute to a definitive diagnosis because of the non-specific nature of their findings<sup>3)</sup>. In current clinical practice, multidetector computed tomography (MDCT) is being increasingly used to aid in the differential diagnosis of acute abdomen, and several recent studies show the usefulness of this modality

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for the accurate diagnosis of cecal volvulus<sup>4-6</sup>.

Herein, we report a case of volvulus of the cecum in a cerebral palsy patient; cecum volvulus was suspected preoperatively on the basis of MDCT findings and was successfully confirmed and treated by prompt surgical intervention.

### CASE REPORT

A 39-year-old man was admitted to our hospital with abdominal distension and polypnea. He had a history of epilepsy and postictal encephalopathy and had been bedridden from a young age because of cerebral palsy. Physical examination revealed a firm, distended abdomen with decreased bowel sounds. Laboratory examination on admission showed an elevated white blood cell count (13,970 cells/ $\mu$ L), C-reactive protein level (46.18 mg/dL), and creatine kinase level (359 U/L).

A plain abdominal radiograph revealed a markedly distended loop of bowel in the lower abdomen

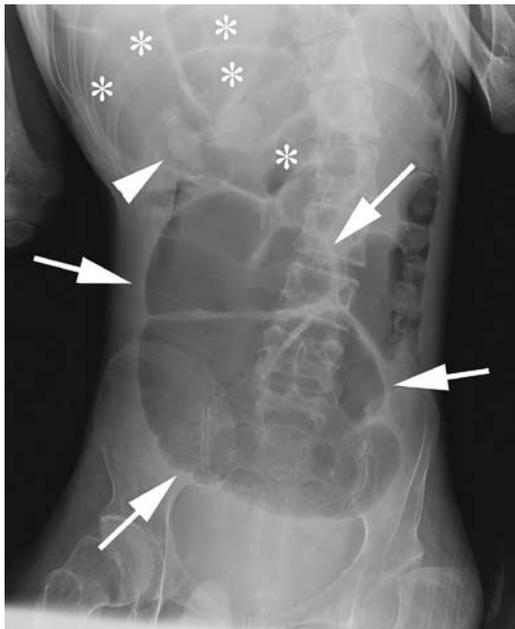
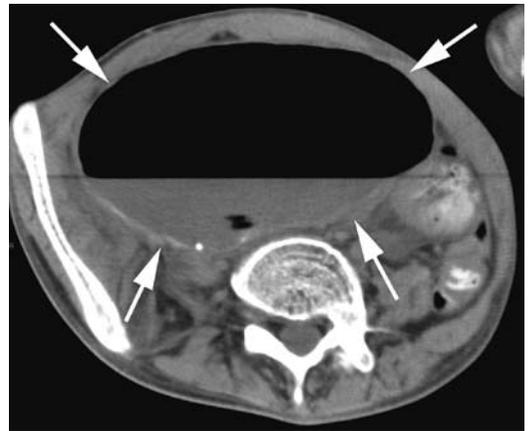


Fig. 1. Plain abdominal radiograph on admission. Markedly distended bowel (arrows) is visible in the lower abdomen along with moderately distended small intestine in the upper abdomen (asterisks). The arrowhead indicates a percutaneous gastrostomy tube.

(Fig.1). This distended bowel was suspected to be the colon, because it displayed haustra-like structures. In addition, moderately distended small intestines were observed in the upper abdomen (Fig.1). Subsequently, emergent dynamic CT was performed using a 16-row MDCT scanner (Aquilion 16; Toshiba, Tokyo, Japan). The CT revealed a markedly distended loop of bowel with an air-

(A)



(B)



Fig. 2. Abdominal computed tomography images on admission. (A) An axial image of the lower abdomen. The arrows indicate the markedly distended cecum. (B) A coronal reconstruction image. The "bird beak" sign is seen in the right lower abdomen (arrow).

fluid level in the lower abdomen (Fig.2A); this was confirmed to be cecum by following the bowel in a retrograde fashion from the rectum. The distended cecum tapered precipitously, appearing as a “bird beak,” on the coronal reconstruction image (Fig. 2B), leading to the collapse of the ascending colon. The so-called “whirl” sign was also recognized at the transition zone between the distended and collapsed bowel by using the paging method on the coronal reconstruction images. The left-sided colon was almost entirely collapsed. The narrowed terminal ileum was observed behind the distended cecum, and the oral side of the intestine was dilated with air-fluid levels. On the basis of these imaging findings, volvulus of the cecum with small intestine ileus was suspected and emergent surgery was performed.

Laparotomy revealed a distended cecum with extended necrosis and adhesions to the ileum and omentum. The ileocecal portion of the bowel was rotated clockwise (from the caudal view) by 180 degrees around the ileocecal mesentery (Fig.3). The terminal ileum was located behind the distended cecum. After detorsion of the volvulus, ileocecal resection and ileostomy was performed.

No complications were observed after surgery, and the patient was discharged on the 14th hospital



Fig. 3. Intraoperative photograph. The arrows indicate the distended cecum. The arrowheads indicate the ascending colon. The terminal ileum, located behind the cecum, is not depicted.

day.

## DISCUSSION

An abnormal fixation of the cecum to the posterior parietal peritoneum is a prerequisite for volvulus of the cecum. According to a previous autopsy study, the cecum is mobile enough to allow the development of a volvulus in 11% of adults<sup>7)</sup>. In addition, several other factors, including abdominal surgery, pregnancy, and chronic constipation, may predispose individuals with a mobile cecum to the development of volvulus<sup>3, 8)</sup>. We assume that a combination of congenital mobility of the cecum with chronic atonic bowel because of prolonged bed rest was the cause of cecal volvulus in our patient. A previous report described a case, similar to ours, of cecal volvulus in a cerebral palsy patient; the authors mentioned that cerebral palsy may contribute to delays in diagnosis, as well as to high morbidity and mortality rates, because of impaired communication and behavior, motor and sensory deficits, and altered reactions to pain in these patients<sup>9)</sup>. Therefore, objective findings including radiological imaging may play an especially important role in the accurate diagnosis of volvulus in patients with cerebral palsy.

There are two types of cecal volvulus: the axial torsion type and the loop type<sup>10, 11)</sup>. In the axial torsion type, as in our present case, the cecum twists in the axial plane, rotating clockwise or counterclockwise around its long axis with the cecum remaining in the right lower quadrant. In the loop type of volvulus, the distended cecum both twists and inverts, moving to occupy the left upper quadrant of the abdomen. Radiological findings may reflect the difference between these types; a previous study revealed that the dilated cecum was observed in the lower abdomen on CT scans in all cases of the axial torsion type, whereas it was observed in the upper abdomen in all cases of the loop type<sup>6)</sup>. There is another variant of cecal

volvulus, termed as cecal bascule, which occurs when the cecum folds anteriorly without any torsion<sup>10, 11)</sup>.

On plain abdominal radiographs, cecal volvulus is seen as a rounded focal collection of air-distended bowel, with haustral creases, that resembles a “coffee bean”<sup>11)</sup> or “comma”<sup>2)</sup>. Several other findings, such as little or no gas in the distal colon and dilation of small bowel with air-fluid levels, are known to be useful for the diagnosis of cecal volvulus<sup>3)</sup>. However, these findings are not specific and therefore may be misinterpreted as small-bowel obstruction. A previous review article showed that a correct preoperative diagnosis on the basis of plain abdominal radiography findings alone was made in only 17% of cecal volvulus cases<sup>3)</sup>.

Although barium enema has shown a relatively high diagnostic yield for cecal volvulus in previous studies<sup>3)</sup>, the procedure is somewhat cumbersome and takes a considerable length of time. Furthermore, the possibility of bowel ischemia or other disease processes outside the bowel wall cannot be evaluated using barium enema<sup>11)</sup>. In current clinical practice, MDCT is used more commonly than barium enema as the diagnostic modality for acute abdomen.

The diagnosis of colonic volvulus on CT is facilitated by following the colon proximally from the rectum<sup>4)</sup>. The “bird beak” and “whirl” signs are useful CT findings for identifying the site of obstruction. The bird beak sign describes the appearance of a bowel loop that progressively tapers and converges at the torsion site<sup>11)</sup>. The whirl sign represents swirling strands of soft-tissue attenuation, comprising the twisted loops of bowel and branching mesenteric vessels, against a background of mesenteric fat attenuation<sup>12)</sup>. A previous study showed that the whirl sign was observed on CT scans of all patients with colonic volvulus<sup>4)</sup>. In another study, the whirl sign was visible in all cases of axial torsion and loop type

cecal volvulus, whereas there was no visible whirl sign in cases of cecal bascule<sup>6)</sup>. Further, we would like to emphasize the usefulness of multiplanar reconstruction (MPR) images. In our present case, coronal reconstruction images facilitated the recognition of both the bird beak and whirl signs. MDCT allows for the use of thin collimation and acquisition of reconstructed images in any arbitrary plane with a spatial resolution similar to that of the axial plane<sup>13)</sup>. In the setting of bowel obstruction, MPR may aid in determining the site and level of obstruction<sup>14)</sup>.

In conclusion, cecal volvulus is a rare but critical cause of acute abdomen and is associated with a high mortality rate. MDCT is considered fundamental in the prompt and accurate diagnosis of cecal volvulus. Identification of the distended cecum and signs indicating torsion points (i.e., bird beak and whirl signs) may be helpful in reaching the correct diagnosis.

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