Midgut volvulus is a very uncommon cause of acute abdominal distress in adults [1]. Midgut volvulus is mostly related to intestinal malrotation, and it is rarely associated with postoperative adhesions and a bulky diet after fasting [2]. Although acquired jejunoileal diverticula are uncommon and asymptomatic in the majority of patients, the association of midgut volvulus and a large small-bowel diverticulum has been mentioned only in a radiologic report [3]. To the best of our knowledge, this condition has never been reported in the Korean literature. Therefore, we present our imaging findings of midgut volvulus associated with a large, small-bowel diverticulum in an adult, together with a review of the literature.

**Case Report**

A 77-year-old woman presented with acute, cramping epigastric pain and she had bilious vomiting for 1 day. She had a history of severe abdominal pain persisting for several hours, and these symptoms occurred two or three times for a year during the past 30 years. The physical examination revealed epigastric tenderness without any peritoneal signs. The laboratory findings were all within normal limits.

A contrast-enhanced abdomen CT showed the typical whirl sign of the mesenteric root resulting from loops of bowel and mesenteric vessels twisted several times around the superior mesenteric artery (Fig. 1A). The diagnosis of midgut volvulus was suggested, but the severe abdominal pain of a cramping nature subsided sev-
Fig. 1. Midgut volvulus associated a large small-bowel diverticulum in a 77-year-old woman.
A. Contrast-enhanced CT scan shows the typical whirl sign (arrows) of the mesenteric root. This is resulting from twisted loops of bowel and mesenteric vessels several times around the superior mesenteric artery (arrowhead).
B. Contrast-enhanced CT scan, 5 cm below A, reveals a large sized sac-like structure (arrows) filled with a stool-like mass of digested food in the left side of lower abdomen. This is a finding of a large, small-bowel diverticulum.
C. Small bowel series shows typical corkscrew appearance (open arrows) of the proximal small bowel loops, a characteristic finding of midgut volvulus. The duodenjejunal junction is located just to the left of midline and to the right of its expected position, a finding suggestive of intestinal malrotation. About a 5.5×4 cm sized divertuculum (arrows) is also showing in the mesenteric border of distal jejunum.
D. Spot radiograph of a small bowel series showing a large diverticulum (arrows) filled with a large well-defined mass lesion, which might be a bezoar or impacted fecal material.
eral hours after CT, and only the mild intermittent peri-
umbilical pain persisted.

A small bowel series was performed during the next 6
days and these tests demonstrated the typical corkscrew
appearance of the proximal small bowel loops, a charac-
teristic finding of midgut volvulus. The duodenojejunal
junction was located to the right of its expected position,
a finding that is very suggestive of intestinal malrota-
tion. In addition, about a 5.5×4 cm sized diverticulum
was shown in the mesenteric border of distal jejunum
(Fig. 1C). The lumen of the diverticulum was filled with
a large well-defined mass-like lesion, which might have
been a bezoar, or possibly impacted fecal material [Fig.
1D]. The retrospective analysis of the CT revealed a
large sized sac-like lesion filled with stool-like mass of
digested food in the lower abdomen (Fig. 1B).

Surgical exploration confirmed midgut volvulus and a
large jejunal diverticulum. There was no bowel necrosis
present. The adhesions from recurrent episode of volvu-
lus were lysed, the small bowel was untwisted and exci-
sion of the diverticulum was performed. The patient did
well after the operation and she has had no return of
symptoms upon follow-up for 1 year.

Discussion

Midgut volvulus is the torsion of a segment or of all of
small bowel and its mesentery, leading to a closed-loop
obstruction and the vascular compromise to the bowel.
It is a potentially fatal surgical emergency. Midgut
volvulus is mostly related to intestinal malrotation, and
it’s rarely associated with pregnancy, postoperative ad-
hesion, bulky diet after fasting and mass lesions, such as
mesenteric lipoma or large pedunculated subserosal my-
oma that may act as a leading mass. Any disturbance in
the normal 270° counterclockwise return of the intest-
tine into the abdominal cavity could produce a range of
rotational and attachment abnormalities. The lack of
normal peritoneal attachment predisposes the bowel to-
wards development of a volvulus, with the twisting oc-
curring around its attachment point and fulcrum, the su-
perior mesenteric artery [4]. In infancy, intestinal malro-
tation almost always presents with a high intestinal ob-
struction as a result of duodenal compression, obstruc-
tion and often volvulus. However, intestinal malrotation
in adults is usually an incidental finding, and it presents
as chronic nonspecific gastrointestinal tract symptoms
and chronic intermittent midgut volvulus, or less com-
monly, as acute abdominal pain [5, 6]. The nonspecific
clinical manifestations of midgut volvulus make diagno-
sis difficult in adults. In this regard, imaging studies play
an important role in the diagnosis.

Diagnosis of midgut volvulus can be made by means
of ultrasound, CT and small bowel sevies. A gray-scale
ultrasound finding of midgut volvulus is a whirl-like
mass in the right upper abdomen and color Doppler ul-
trasound shows a whirl sign with a clockwise rotation of
the SMV around the SMA [7]. CT is also very useful in
diagnosis of midgut volvulus, as well as its complication
of ischemia. CT reveals the characteristic whirl sign;
twisted loops of bowel and the branching mesenteric
vessels create swirling strands of soft-tissue attenuation
within a background of mesenteric fat attenuation, giv-
ing the appearance of a hurricane on a weather map [8,
9]. The volvulus causes the mesenteric veins and lym-
phatics to become congested. Thickening of bowel wall
and intraperitoneal fluid or gas in the bowel wall can al-
so suggest the associated bowel infarction. A small bow-
el series may demonstrate a spiral or corkscrew appear-
ance resulting from a small bowel’s wrapping around
the superior mesenteric artery, which is diagnostic of
midgut volvulus.

The incidence of jejunoileal diverticula is 1.1 to 2.3%,
and it is found upon enteroclysis, at postmortem by in-
sufflating the intestine with air or during major abdomi-
al surgical procedures [10]. Jejunoileal diverticula are
asymptomatic in the majority of patients, but they may
be the underlying cause of vague, chronic symptoms
and such acute complications that include obstruction,
hemorrhage and perforation. Mechanical intestinal ob-
struction occurs in 2.3% to 4.6% of the cases of je-
junoileal diverticulosis [11]. This may be the result of
pressure on the intestinal wall from distended diverticu-
la, inflammatory mass associated with diverticulitis,
stricture or adhesions from diverticulitis, intussusce-
p tion at the site of the diverticulum, enteroliths devel-
oped within the diverticula, or volvulus of the diverticu-
la-containing segment [10].

In 1998, Chou et al. reported CT findings of a large
small-bowel diverticulum in five cases [3]. It was inter-
esting that in all five cases, the CT demonstrated that
midgut volvulus coexisted with a large, small bowel di-
verticulum, as was seen in our case. All the diverticula
were larger than 3 cm and located in the jejunum. The
authors mentioned that it was not clear whether these
two conditions have any direct relationship or not.
However, a large, small-bowel diverticulum might play
a predisposing role in the occurrence of a midgut volvu-
lus for the following reasons. (1) It may act as a leading mass if it were filled with fluid, and (2), it may interfere with the returning of an abnormally moved small-bowel loop and make the small-bowel rotate still further until a volvulus occurs.

In our case, both CT and a small bowel series showed the typical imaging findings of midgut volvulus. In addition, a small bowel series showed the underlying intestinal malrotation and a large jejunal diverticulum (more than 3 cm). A retrospective CT analysis can also detect a large jejunal diverticulum, because of its large size (> 3 cm), its different intraluminal contents as compared with the surrounding small-bowel loops and the absence of valvular conniventes [3]. Indeed, the size of the diverticulum may play an important role in inducing small-bowel volvulus.

Considering the patient’s past history of recurrent cramping abdominal pain, the chronic abdominal symptoms are thought to be from a chronic intermittent midgut volvulus precipitated by intestinal malrotation and a large jejunal diverticulum.

In summary, a midgut volvulus associated with intestinal malrotation is uncommonly seen in adults, especially with a large small-bowel diverticulum. Awareness of the imaging findings and the clinical significance of a large small-bowel diverticulum associated with midgut volvulus can be helpful for the exact diagnosis and the management of this rare condition when it presents in the adult with recurrent abdominal pain.

References