

# Multidetector Computed Tomography Findings of Mesenteroaxial Gastric Volvulus Combined with Torsion of Wandering Spleen: A Case Report and Literature Review

유주 비장의 염전과 동반된 장간막축성 위 염전의 다중검출기 전산화단층촬영 소견: 증례 보고 및 문헌 고찰

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Gastric volvulus, defined as an abnormal rotation of stomach, may be idiopathic or secondary to abnormal fixation of intraperitoneal visceral ligaments. Wandering spleen is a movable spleen resulting from absence or underdevelopment of the splenic supporting ligaments that suspend the spleen to its normal position in the left part of the supramesocolic compartment of the abdomen. Wandering spleen increases the risk of splenic torsion. Both gastric volvulus and splenic torsion are potentially life-threatening if not urgently managed with surgery. Prompt and accurate diagnosis based on multidetector computed tomography (MDCT) is crucial to prevent unforeseen complications. Gastric volvulus and coexistent torsion of wandering spleen is a very rare condition. Herein, we described a case of gastric volvulus associated with wandering spleen and intestinal non-rotation in a 15-year-old girl focusing on MDCT findings.

## Index terms

Stomach Volvulus  
Wandering Spleen  
Ligaments  
Intestines  
Multidetector Computed Tomography

## INTRODUCTION

Gastric volvulus is defined as an abnormal degree of rotation of one part of the stomach around another (1). Gastric volvulus may lead to severe complication such as gastric ischemia, perforation, and even death. The mortality rate is reportedly 30–50% (2). Wandering spleen is defined as a movable spleen that can migrate from its normal position to any part of the abdomen or pelvis. Splenic torsion itself is a rare condition with an annual incidence of < 0.2% with or without association of wandering spleen (3). Splenic torsion is potentially fatal, if not ur-

gently managed with surgery. It may cause ischemia, infarction, and even necrosis of the spleen (1). Gastric volvulus and wandering spleen can occur independently. However, these disease entities share a common congenital etiology of anomalous intraperitoneal visceral attachment originating from the dorsal mesogastrium. To our knowledge, only a few cases have been reported previously in literature. Herein, we described a case of gastric volvulus associated with wandering spleen and intestinal non-rotation in a 15-year-old girl, focusing on the multidetector computed tomography (MDCT) findings.

Received August 28, 2015

Revised September 17, 2015

Accepted October 13, 2015

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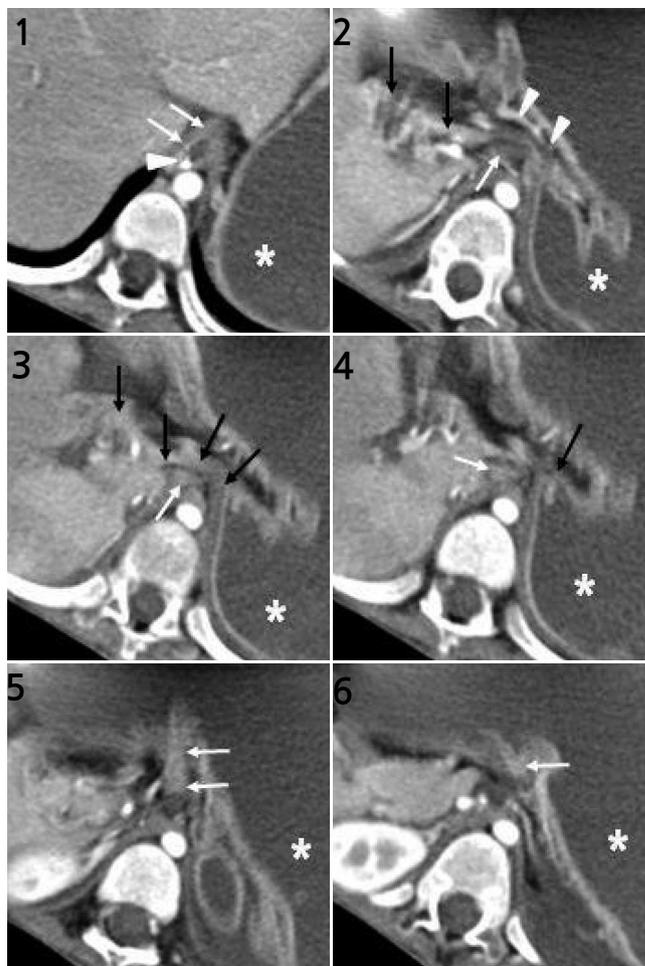
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## CASE REPORT

A 15-year-old girl presented at the emergency department with abdominal distention and unusual irritability. She had no underlying disease except for spastic cerebral palsy and no history of fever, trauma, toxic ingestion and previous operation. The physical examination revealed a firm, ovoid mass in the epigastric area that was non-tender. The plain radiograph of abdomen showed markedly distended stomach from diaphragm to umbilicus level. Bowel loops were unremarkable, showing no dilatation. Nasogastric tube insertion was performed for initial management. The laboratory tests were in normal range. Contrast-enhanced abdominal CT examination on a 128-detector-row CT scanner (Definition AS+, Siemens Medical Solutions, Forchheim, Germany) was performed to evaluate distended stomach. Contrast enhanced CT images demonstrated anterosuperiorly rotated gastric antrum and posteroinferiorly rotated fundus. The results indicated that the antrum was located above the gastroesophageal junction with decussate appearance, suggestive of mesenteroaxial gastric volvulus (Fig. 1A). The tip of the nasogastric tube was placed in the distal esophagus. There was no associated diaphragmatic defect. The spleen was located in the midline of supramesocolic compartment, just anterior to the pancreas that was medially displaced with kinking its tail portion (Fig. 1B-E). The splenic artery from celiac trunk was rotated in counter clockwise direction (Fig. 1D), indicating its torsion. On contrast-enhanced abdominal CT examination, the spleen showed decreased enhancement, suggesting an ischemic state. The upside-down positional change of the right gastroepiploic artery, a vascular landmark of the gastrocolic ligament, was also noted (Fig. 1E). The third and fourth portions of the duodenum and jejunal loops were located in the right side of abdomen. The patient underwent laparoscopic surgery. Surgical finding confirmed mesenteroaxial gastric volvulus. The torsion state of wandering spleen was also noted due to lack of ligamentous attachment. The gastrosplenic ligament was absent. The spleno-renal ligament and the gastrocolic ligament were underdeveloped and not fixed. Duodenum and duodenojejunal junction were not fixed on the retroperitoneum. Splenopexy and gastropexy were performed. The patient recovered uneventfully and was discharged on the fifth postoperative day.

## DISCUSSION

Gastric volvulus is usually divided into 2 main subtypes including organoaxial and mesenteroaxial. Organoaxial volvulus is more common than mesenteroaxial volvulus and accounts for about two-thirds of cases of gastric volvulus. Organoaxial volvulus occurs when the stomach rotates along its long axis. The greater curvature is displaced superiorly and the lesser cur-

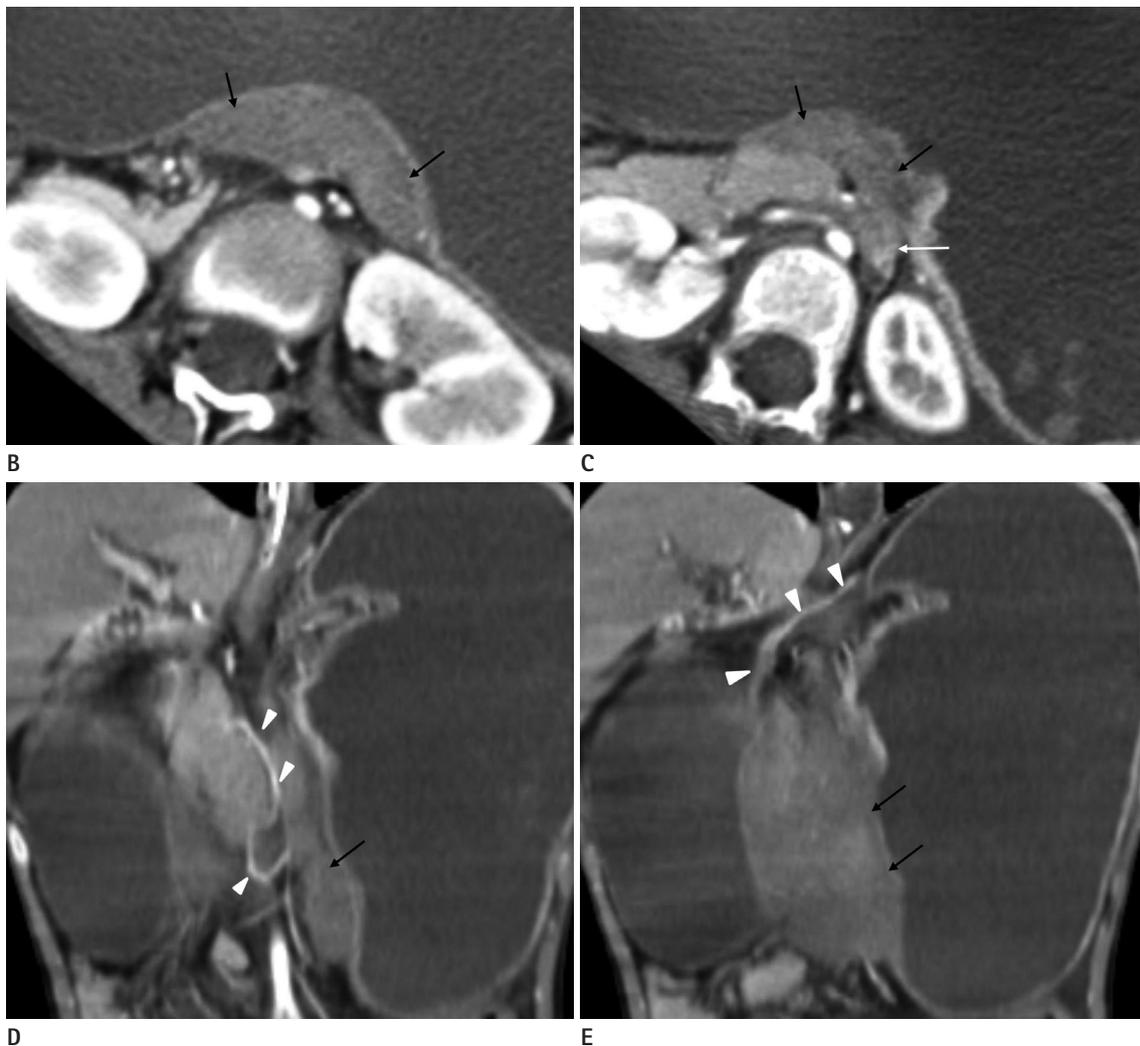


**A**  
**Fig. 1.** A 15-year-old girl with acute mesenteroaxial gastric volvulus, torsion of wandering spleen and intestinal non-rotation.

**A.** Consecutive axial images (order is marked by numbers 1 through 6) from contrast-enhanced CT demonstrate abnormal rotation of the distended stomach (\*) with displacement of the antrum above the gastroesophageal junction, which indicates mesenteroaxial gastric volvulus. The tip of nasogastric tube is located in the distal esophagus (arrowhead in 1). The antrum (black arrows in 2) is located above the gastroesophageal junction (white arrows in 1, 2, and 3) with decussate appearance. The duodenum is stretched (black arrows in 3 and 4) across the gastroesophageal junction (white arrows in 3 and 4). The left gastric artery is observed (arrowheads in 2). The gastroesophageal junction (white arrows in 1 through 6) is located below the antrum.

vature is located more caudally in the abdomen (4). In adults, this type of volvulus most commonly occurs in the setting of trauma or paraesophageal hernia and those conditions that allow the stomach to rotate along its long axis (4). On the other hand, a large Bochdalek hernia is a predisposing factor for gastric volvulus in children (4). Mesenteroaxial volvulus is much less common than organoaxial volvulus, but it is a surgical emergency and warrants prompt diagnosis and treatment. It occurs when the stomach rotates along its short axis, the transgastric axis (a line connecting the middle of the lesser curvature with the middle of the greater curvature). Mesenteroaxial volvulus

results in displacement of the antrum above the gastroesophageal junction (4). Rotation is usually partial ( $< 180^\circ$ ) and is not associated with an underlying diaphragmatic defect (4). The etiology of gastric volvulus is thought to be secondary to congenital underdevelopment or acquired laxity of the supporting ligament of stomach such as the gastrohepatic, the gastrosplenic, the gastroduodenal, and the gastrophrenic ligaments, allowing approximation of cardiac and pyloric ends of the stomach, and leading to gastric volvulus (2). The unusually long gastrohepatic ligament is reportedly a predisposing factor for the development of mesenteroaxial gastric volvulus (2).



**Fig. 1.** A 15-year-old girl with acute mesenteroaxial gastric volvulus, torsion of wandering spleen and intestinal non-rotation. **B, C.** Axial contrast-enhanced CT images reveal rotated spleen in counter clockwise direction resulting in decreased perfusion (black arrows in **B** and **C**). The spleen is observed anteriorly to the pancreas. The pancreas is medially displaced with kinking in its tail portion (white arrow in **C**). **D, E.** Coronal reformatted CT images show that the splenic artery (arrowheads in **D**) from celiac trunk is twisted in counter clockwise direction. The hypoattenuated spleen is located in the midline of upper abdomen (black arrows in **D** and **E**). The right gastroepiploic artery (arrowheads in **E**) runs superomedially. The upside-down positional change of the right gastroepiploic artery as a vascular landmark of the gastrocolic ligament is also noted.

Splenic hypermobility may also be congenital or acquired (5). Congenital wandering spleen is caused by the absence or underdevelopment of splenic suspensory ligaments during fetal development. The dorsal mesogastrium fails to fuse with the posterior peritoneum, leading to absence or underdevelopment of one or all of splenic supporting ligaments such as the gastrosplenic, the splenorenal, the phrenicocolic and the phrenicosplenic ligaments (1). Among these, the spleen is anchored mainly by the gastrosplenic and the splenorenal ligaments (5, 6). Acquired wandering spleen is caused by weakening of these ligaments due to several conditions such as hormonal effects of pregnancy, abdominal wall laxity and trauma (5). In addition, the absence of the spleen in the left upper quadrant can lead to gastric volvulus in asplenic patients (7).

In our case, the gastrosplenic ligament was absent. The splenorenal ligament and the gastrocolic ligament were underdeveloped and not fixed. These are considered as predisposing factors of coexistent gastric volvulus and torsion of wandering spleen.

Radiographic findings of gastric volvulus include a single bubble appearance of the stomach with air-fluid level. CT may show gastric volvulus and associated conditions such as perforation of the stomach, diaphragmatic defect or wandering spleen with or without complication. The CT manifestations of wandering spleen include an absence of the spleen in its normal position. It may mimic abdominal or pelvic mass. A whirled appearance of non-enhancing, twisted splenic vessels suggests acute torsion of wandering spleen. Low attenuated splenic tissue as compared with normal splenic tissue or even liver may be observed (3, 8), as in our patient. The "rim" sign, i.e., higher density of the splenic capsule than the parenchyma, is another feature of splenic infarct and coexistent collateral circulation (5). A thick, enhancing pseudocapsule, representing omental and peritoneal adhesions may be seen in wandering spleen with chronic or intermittent torsion (8). If the pancreatic tail is involved, a whirling of pancreatic tissue and fat at the medial border of the displaced spleen may be observed on CT (8). In our case, the splenic artery and spleen partially twisted in counter clockwise direction. The pancreas was also displaced medially, and the tail portion of pancreas was kinked by the spleen, suggesting torsion of wandering spleen. The "rim" sign was not observed in our patient. Absence of the peritoneal attachment

possibly hindered development of the collateral vessels supplying the spleen.

In our case, coronal reformatted CT images were helpful to trace vascular landmarks of the splenorenal ligament and the gastrocolic ligament. Upside-down positional change of the right gastroepiploic artery, a vascular landmark of the gastrocolic ligament, was observed easily on the coronal reformatted CT images. MDCT enables addition of isovoxel reconstruction images and the reformatted images facilitate the tracing of positional changes of the intraperitoneal ligaments.

Gastropexy is usually the treatment of choice for gastric volvulus. Splenopexy is also the procedure of choice to prevent future torsion when a viable wandering spleen is found at surgery (1). On the other hand, the treatment for malrotation in adults is still controversial when there is no volvulus or herniation.

In conclusion, knowledge of MDCT findings of gastric volvulus and combined wandering spleen torsion is important to make an accurate diagnosis and prevent unforeseen complications due to delayed or missed diagnosis.

## REFERENCES

1. Liu HT, Lau KK. Wandering spleen: an unusual association with gastric volvulus. *AJR Am J Roentgenol* 2007;188:W328-W330
2. Lianos G, Vlachos K, Papakonstantinou N, Katsios C, Baltogiannis G, Godevenos D. Gastric volvulus and wandering spleen: a rare surgical emergency. *Case Rep Surg* 2013;2013:561752
3. Lubner MG, Simard ML, Peterson CM, Bhalla S, Pickhardt PJ, Menias CO. Emergent and nonemergent nonbowel torsion: spectrum of imaging and clinical findings. *Radiographics* 2013;33:155-173
4. Peterson CM, Anderson JS, Hara AK, Carezza JW, Menias CO. Volvulus of the gastrointestinal tract: appearances at multimodality imaging. *Radiographics* 2009;29:1281-1293
5. Ben Ely A, Zissin R, Copel L, Vasserman M, Hertz M, Gottlieb P, et al. The wandering spleen: CT findings and possible pitfalls in diagnosis. *Clin Radiol* 2006;61:954-958
6. Chawla S, Boal DK, Dillon PW, Grenko RT. Splenic torsion. *Radiographics* 2003;23:305-308
7. Garcia JA, Garcia-Fernandez M, Romance A, Sanchez JC.

Wandering spleen and gastric volvulus. *Pediatr Radiol* 1994; 24:535-536

dren with wandering spleen. *AJR Am J Roentgenol* 1991; 156:151-153

8. Herman TE, Siegel MJ. CT of acute splenic torsion in chil-

## 유주 비장의 염전과 동반된 장간막축성 위 염전의 다중검출기 전산화단층촬영 소견: 증례 보고 및 문헌 고찰

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위 염전은 위의 일부 또는 전부의 비정상적인 회전을 의미한다. 위 염전은 특발성으로 발생할 수 있지만 더 많은 경우에서 복강 내 장기 인대의 비정상적인 고정으로 인해 이차적으로 발생한다. 유주 비장은 비장을 정상위치인 좌상복부에 고정시키는 장기인대의 일부 혹은 전부의 무형성 혹은 발달부전에 의한 가동적인 비장을 말한다. 유주 비장이 있을 경우 비장 염전의 위험이 증가한다. 위 염전과 비장의 염전은 빠른 수술적 교정이 요구되는 응급질환이다. 합병증 발생을 막기 위해서는 빠르고 정확한 진단이 중요하다. 위 염전과 유주 비장의 염전이 동반되는 경우는 매우 드물다. 이에 저자들은 위 염전과 유주 비장의 염전, 그리고 장 비회전이 동반된 15세 환자의 증례를 다중검출기 전산화단층촬영 소견을 중심으로 보고하고자 한다.

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