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## Acute gastric volvulus: a deadly but commonly forgotten complication of hiatal hernia

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### ABSTRACT

Gastric volvulus is a rare condition resulting from rotation of the stomach beyond 180 degrees. It is a difficult condition to diagnose, mostly because it is rarely considered. Furthermore, the imaging findings are often subtle resulting in many cases being diagnosed at the time of surgery or, as in our case, at autopsy. We present the case of a 76-year-old man with an extensive medical history, including coronary artery disease with multiple bypass grafts, who became diaphoretic and nauseated while eating. His presumptive diagnosis at arrival to the hospital was an acute coronary event; however, his initial cardiac work-up was negative. A computed tomography scan revealed a type III hiatal hernia. The following day, after consistent complaints of nausea and episodes of nonbloody emesis, he suddenly became hypotensive, tachycardic and had an episode of coffee-ground emesis. Subsequently, the patient's condition suddenly deteriorated and resuscitation attempts were unsuccessful. The autopsy revealed a partially sliding hiatal hernia, which was consistent with the radiologic impression. Additionally, a gastric volvulus was present with extensive, focally transmural necrosis involving the body/fundus. Gastric volvulus is a rare entity with variable, nonspecific clinical presentations, which requires a high level of suspicion for radiologic diagnosis. Acute cases have a high mortality rate and require emergency surgery. This case highlights the value of autopsy in the diagnosis of unsuspected cases of gastric volvulus when death occurs prior to surgical intervention.

### Keywords

Stomach Volvulus; Hernia, Hiatal; Autopsy

### CASE REPORT

We present the case of a 76-year-old man with an extensive medical history including hypertension, hyperlipidemia, coronary artery disease with multiple bypass grafts, diabetes mellitus, gastroesophageal reflux disease, prostate cancer status postradical prostatectomy, and transient ischemic attack. The patient became diaphoretic while eating a large

meal, and because of his cardiac history, the family called fire rescue. The patient was transported to our emergency department and treated en route for a presumptive acute coronary event.

Upon arrival, the physical exam was significant for hypertension with a blood pressure of 176/86 mmHg. The laboratory work-up revealed mild leukocytosis

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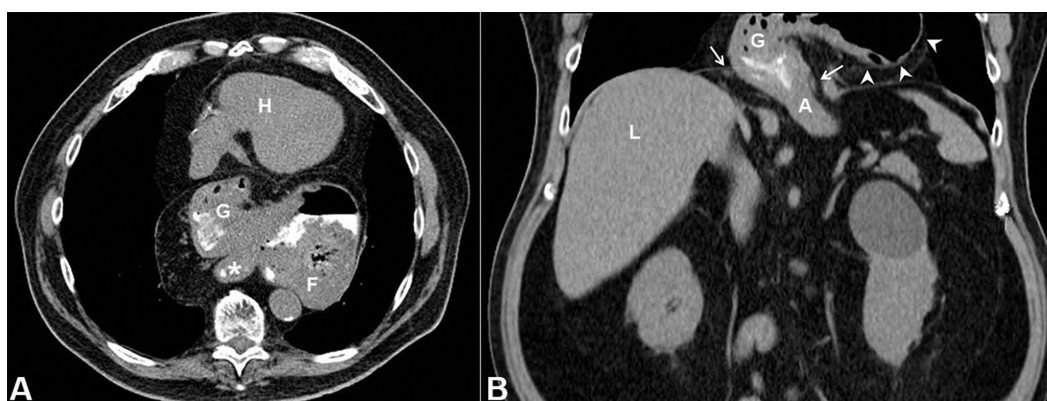
with 79% neutrophils and normocytic anemia. Cardiac troponins were not elevated. An electrocardiogram showed sinus bradycardia. A computed tomography (CT) scan revealed a type III hiatal hernia with an intra-thoracic gastroesophageal junction (Figure 1). The patient was admitted to the telemetry unit with a plan for a stress test and blood pressure control.

The following day, the patient denied chest pain yet continued to report nausea with an episode of nonbloody emesis. A nasogastric tube was placed with subsequent improvement of the nausea; however, the patient removed it. He soon had a second episode of nonbloody emesis and refused replacement of the nasogastric tube. Within hours, the patient suddenly became hypotensive and tachycardic, and continued

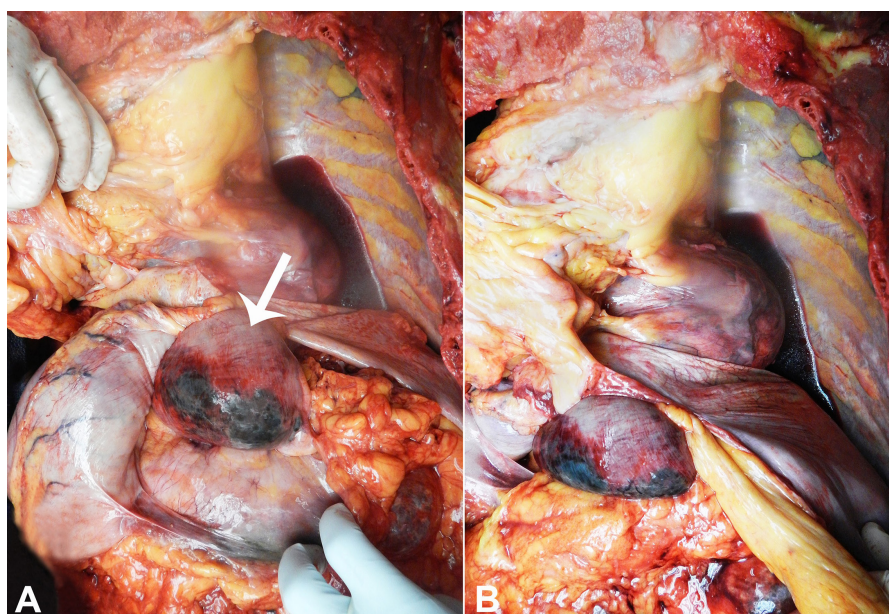
to complain of nausea. Soon after, he was noted to have active coffee-ground emesis and his condition suddenly deteriorated with pulseless electrical activity. After multiple attempts to resuscitate him, the patient died.

## AUTOPSY FINDINGS

The autopsy revealed a partially sliding hiatal hernia, as seen on the imaging. Additionally, the stomach was noted to be enlarged, abnormally rotated, and discolored (Figure 2A), with a significant portion located above the left hemi-diaphragm (Figure 2B). Upon opening the stomach, abundant coffee-ground material was noted admixed with food.



**Figure 1.** Unenhanced abdominal CT from a prior study demonstrating a large type III hiatal hernia, with the majority of the stomach located within the thoracic cavity. **A** - Axial plane. **B** - Coronal plane. A = gastric antrum; F = gastric fundus; G = gastric body; H = heart; L = liver; arrowheads = gastric greater curvature; white arrows = diaphragmatic hiatus; \* = gastroesophageal junction.



**Figure 2.** Autopsy photos. **A** - Enlarged and tortuous stomach with focal full-thickness wall discoloration (arrow); **B** - Significant portion of stomach above the left hemi-diaphragm.

There was extensive gastric mucosal necrosis that was focally transmural involving the gastric body and the fundus with associated areas of ulceration with adherent blood (Figure 3A). Also, there was a sharp line of demarcation showing the sparing of the antrum and pylorus (Figure 3B). The diagnosis of organoaxial gastric volvulus with strangulation and necrosis was made.

Gastric contents were found within the trachea extending into the most distal branches of the bronchial tree (Figure 4). Microscopically, there were bilateral and diffuse intrabronchial and intraalveolar food particles consistent with bronchoaspiration (Figure 5).

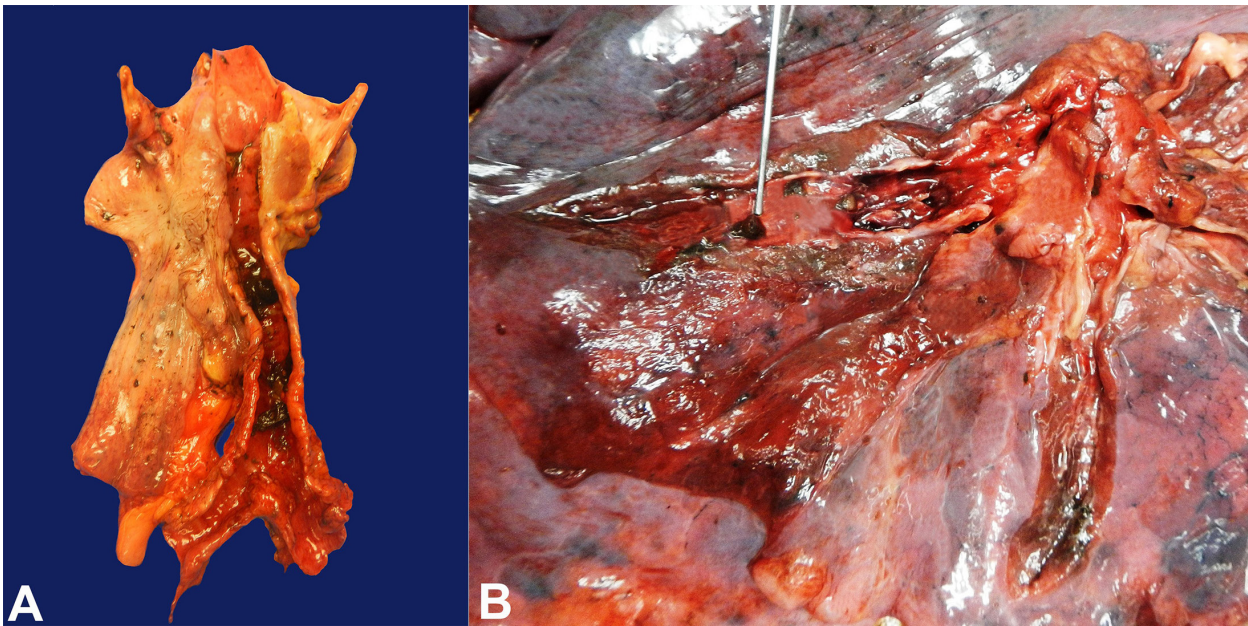
There was cardiomegaly (445 g) with mild biventricular hypertrophy. Three intact coronary artery bypass grafts were identified with mild and focal partially occlusive atherosclerosis at the anastomotic sites (Figure 6). No evidence of acute myocardial infarction was present.

## DISCUSSION

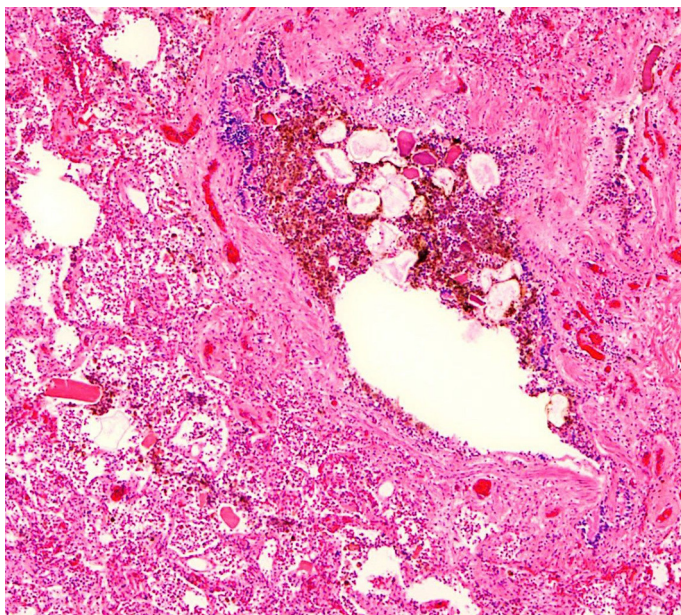
Gastric volvulus is defined as an abnormal rotation of the stomach beyond 180 degrees.<sup>1-3</sup> It is a rare clinical condition, and because many chronic cases are never diagnosed its precise incidence is unknown. The first case was reported by Berti in 1866, and the first surgical intervention was performed by Berg in 1895.<sup>3,4</sup> The clinical presentation is variable and may range from an acute abdomen necessitating emergency surgery to chronic, nonspecific abdominal complaints. The classic symptoms, known as “Borchardt’s triad,” consist of nonproductive vomiting, severe and constant epigastric pain, and difficulty inserting a nasogastric tube; however, they may not be present in as many as 25% of patients.<sup>5</sup> There are no predilections for a particular gender or race; however, most cases occur in middle-aged patients, and up to 75% are associated with a paraesophageal hiatal hernia, abdominal



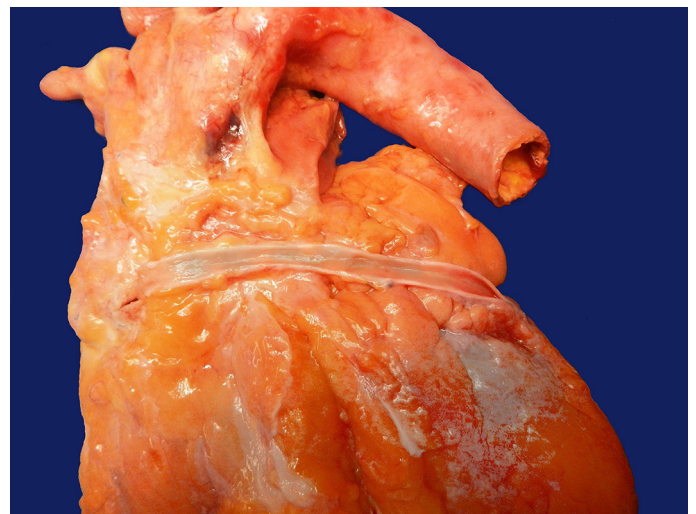
**Figure 3.** Gross appearance of the stomach. **A** - Extensive gastric mucosal necrosis of gastric body/fundus with ulcerations; **B** - Formalin-fixed stomach with a sharp line of demarcation showing the sparing of the antral/pyloric mucosa.



**Figure 4.** **A** - Gross finding of the trachea with coffee-ground material within the lumen; **B** - Gross photo of the lung with coffee-ground material within the distal bronchial tree (probe).



**Figure 5.** Photomicrography of the lung showing food particles within bronchi and alveoli (H&E, 20X).



**Figure 6.** Gross finding of the heart showing an intact, clean bypass graft from the aorta to the circumflex coronary artery branch.

adhesions, or other diaphragmatic or intraabdominal conditions.<sup>3</sup>

According to the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES), there are four types of hiatal hernias. In type I hernias, or sliding hiatal hernias, the gastroesophageal junction migrates above the diaphragm while the stomach remains in its longitudinal alignment and the fundus remains below the gastroesophageal junction. In type II hernias, or pure paraesophageal

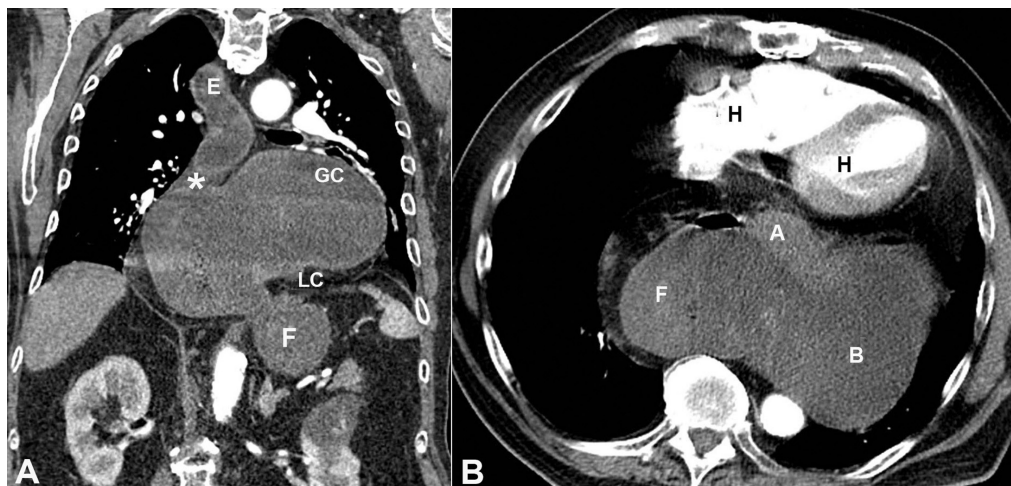
hernias, the gastroesophageal junction remains in its normal anatomic position, but a portion of the fundus herniates through the diaphragmatic hiatus adjacent to the esophagus. Type III hernias are a combination of types I and II. In these hernias, both the gastroesophageal junction and the fundus herniate through the hiatus with the fundus situated above the gastroesophageal junction. In type IV hernias, another structure (e.g. the omentum or the bowel) is present within the hernia sac along with the stomach.<sup>6</sup>

Due to its rarity, variable clinical presentation, lack of specific diagnostic tests, and imaging studies that are difficult to interpret, a high index of clinical suspicion is required for the diagnosis of gastric volvulus, an entity with a high mortality rate in acute cases.<sup>5</sup> Acute cases may be misdiagnosed as a nonsurgical gastrointestinal issue.<sup>2</sup> Acute cases are a surgical emergency since the abnormal rotation can result in gastric outlet obstruction, vascular compromise leading to necrosis (as seen in our case), or even perforation. While necrosis and perforation are uncommon complications due to collateral circulation, their development is associated with mortality rates up to 60%.<sup>5</sup> In the event a patient is too unstable to proceed to surgery immediately, an upper endoscopy may be attempted to manually reduce the hernia. If successful, this will allow further assessment of the extent of the tissue damage as a result of the volvulus and will allow time to resuscitate the patient prior to surgery.<sup>7</sup>

There are four subgroups of gastric volvulus according to the axis of rotation. In type 1, or organoaxial rotation, the stomach rotates around the pylorus-cardia axis. This is the most common type, comprising approximately 60% of cases, and may lead to obstruction at the gastroesophageal junction, the pylorus, or both—or even strangulation and vascular

compromise. In type 2, or mesenteroaxial rotation, the stomach rotates around the lesser–greater curvature axis. The most important risk factor in this type is laxity of the gastrosplenic ligament. Type 3 is a combined form and is the least common, accounting for only 2% of cases. Type 4 is “unclassified” and accounts for approximately 10% of cases.<sup>5</sup>

The most difficult aspect of diagnosing gastric volvulus is the consideration of it.<sup>5</sup> Imaging studies with barium or CT scans can aid in the diagnosis; however, the findings may be subtle and easily overlooked if volvulus is not in part of the differential diagnosis.<sup>2,5</sup> After an intraoperative diagnosis of gastric volvulus, a review of the imaging studies will occasionally show that findings typical of volvulus had been present, and that a preoperative diagnosis was not made because this entity was not considered.<sup>5</sup> While our patient’s prior imaging studies showed only a hiatal hernia, most cases of volvulus are associated with this condition. While rare, gastric volvulus should be considered in patients with a history of hiatal hernia or other diaphragmatic defects that present with or develop acute abdominal symptoms. A postmortem review of imaging studies performed at the time of admission revealed evidence of gastric volvulus (Figure 7), but as is often the case, these subtle findings were not initially appreciated.



**Figure 7.** Contrast-enhanced CT of the abdomen performed on admission. **A** - Coronal images demonstrate the upward rotation of the stomach along its long axis, which is new compared to the prior study, resulting in inversion of the gastric greater curvature (GC) above the lesser curvature (LC) consistent with organoaxial gastric volvulus. Marked gastric distension and retention/reflux of debris into the superior portion of the intrathoracic esophagus (E) reflect obstruction at the level of the diaphragmatic hiatus. A portion of the gastric fundus (F) has herniated back into the abdominal cavity, which is also likely contributing to obstruction. **B** - Axial images also demonstrating organoaxial gastric volvulus. The marked gastric distension with abrupt transition to normal caliber at the gastric antrum (A), which is compressed as it passes through the diaphragmatic hiatus, indicates this as the level of obstruction. B = gastric body; F = gastric fundus/body; H = heart; \* = gastroesophageal junction.

## CONCLUSION

Gastric volvulus is a rare entity with a high mortality rate when presenting acutely. Therefore, it should be considered in the differential diagnosis in patients presenting with acute abdominal symptoms, particularly when there is a medical history of hiatal hernia or other diaphragmatic defects.<sup>1-5</sup> This case highlights the value of autopsy in the diagnosis of unsuspected cases of gastric volvulus when death occurs prior to surgical intervention. Without an autopsy, the underlying cause of death in this patient would not have been diagnosed.

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**Conflict of interest:** None

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