Chapter

Gastric Volvulus

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Abstract

Gastric volvulus is one of the most worrisome complications related to large paraesophageal hernias. It is a medical emergency that requires high index of suspicion and prompt management and operation during the index admission. Here we discuss the pathophysiology and classification of gastric volvulus, clinical and radiological presentation, and treatment options. The approaches described here include endoscopic, laparoscopic, robotic and open. We advocate for the first three approaches and usually save the open approach for certain redo operations or patients with significant adhesions from prior mediastinal or foregut surgeries.

Keywords: gastric volvulus, paraesophageal hernia, gastropexy, endoscopy, hernia

1. Introduction

Gastric volvulus, from the Latin volvere (meaning 'to roll'), is an uncommon clinical entity, occurring in both adult and pediatric populations and defined as the pathological rotation of the stomach beyond 180 degrees. It was first described by Berti in 1866 based on the autopsy of a woman who died of closed loop obstruction and Berg described the first operation in 1897. It is considered a life-threatening emergency due to formation of a closed loop obstruction with strangulation which can progress to gastric ischemia, necrosis and perforation [1–9].

Its true incidence is unknown because besides being a rare condition, many chronic cases are never diagnosed. The clinical presentation is variable and may range from an intermittent non-specific abdominal pain to acute abdomen requiring emergency surgery. The mortality rate for acute volvulus ranges from 30–50%, highlighting the importance of early diagnosis and treatment [2, 3, 5, 10].

2. Pathophysiology

Primary gastric volvulus refers to the absence of diaphragmatic defects or intra-abdominal abnormality causing the volvulus, accounting for approximately 30% of cases [2, 6, 10]. The stomach is fixed to the abdominal wall by the gastrocolic, gastrohepatic, gastrophrenic, and gastrosplenic ligaments. Together with the gastroesophageal junction and the pylorus, these ligaments provide anchorage and prevent malrotation. When these mechanisms fail, the patient may be at risk of primary gastric volvulus [5, 6].

Secondary gastric volvulus may arise due to disorders of gastric anatomy or gastric function or abnormalities of adjacent organs such as the diaphragm or spleen. Up to 75% are associated with a paraesophageal hernia (PEH), diaphragmatic hernia, wandering spleen, abdominal adhesions, diaphragmatic eventration, phrenic nerve paralysis, or other diaphragmatic or intraabdominal conditions [1–3, 5, 6, 10, 11].

Risk factors include age over 50, gastric ligament laxity, pyloric stenosis, gastroduodenal tumors, diaphragmatic injury and eventration, left lung resection, or pleural adhesions [2].

The fifth decade is the age group with the highest incidence with children less than one year old making up 10–20% of cases. No association with either sex or race has been reported [2, 3, 5, 6, 10].

3. Classification

Several anatomopathological classifications have been proposed, and the most complete one was proposed by Von Haberer and Singleton, modified by Carter in 1978 describing three types of gastric volvulus according to the axis of rotation: organoaxial, mesenteroaxial and combined [1, 2, 5, 11].

Organoaxial volvulus is a rotation of the stomach around a longitudinal axis passing through the cardia and the pylorus. It is the most common form, occurring in approximately 60% of cases. The most common causes of this subtype are paraesophageal hernias and diaphragmatic eventration. It causes the greater curvature of the stomach to rest superior to the lesser curvature, resulting in an 'inverted' stomach. The distinguishing feature of this variant is that it lies in the horizontal plane when viewed on plain radiography **Figure 1** [1, 2, 5, 11].

The second type of gastric volvulus is mesenteroaxial. It is a less common subtype, comprising approximately 29% of cases. Rotation occurs along a transverse axis, passing through the midpoints of the small and the great curvature. This type is more likely found in the pediatric population and is rarely described in adult individuals. Strangulation is less likely to occur due to spontaneous detorsions with recurrent acute episodes **Figure 2** [1, 2, 5, 11].

The third and rarest subtype of gastric volvulus is when the stomach rotates about both the organo-axial and mesenteroaxial axes resulting in a combined volvulus [1, 2, 5, 11].

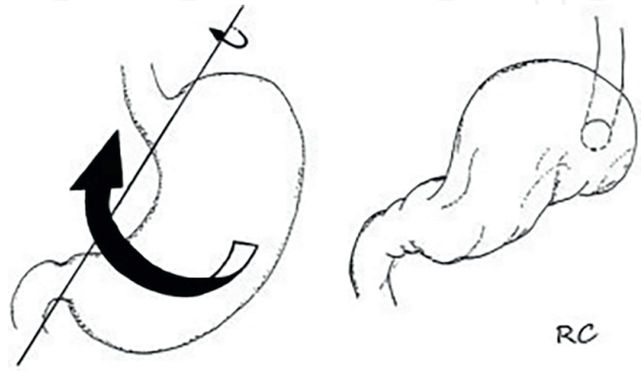

Figure 1.
Organoaxial volvulus.

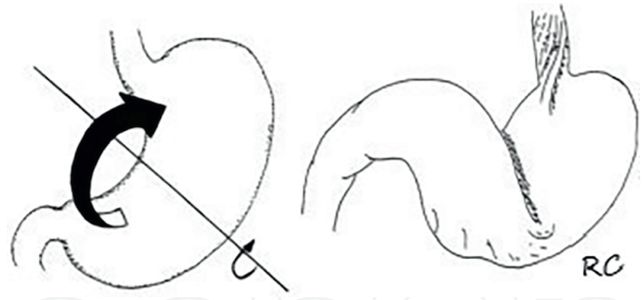

Figure 2.
Mesenteroaxial volvulus.

4. Clinical presentation

The clinical presentation of patients with gastric volvulus depends on the speed of onset, type of volvulus and degree of obstruction [1, 5].

Given that gastric volvulus is a rare condition, it is rarely considered at the top of the differential diagnoses when a patient presents with abdominal, or chest pain associated with nausea and vomiting [5].

The classic symptoms, known as "Borchardt's triad," consist of:

- Nonproductive vomiting
- Epigastric pain, and
- Difficulty inserting a nasogastric (NG) tube

However, these symptoms may not be present in as many as 25% of patients. Hematemesis may also be seen and is thought to occur due to mucosal sloughing as a result of ischemia or a mucosal tear due to retching [1, 2, 4–6, 10].

On physical exam there are a variety of possible characteristic findings such as gastric sounds audible in the chest, abdominal distention and dullness to percussion. Once the disease has progressed to peritonitis, abdominal wall rigidity and rebound tenderness may also be found [6].

In contrast, chronic or intermittent gastric volvulus may present with nonspecific symptoms which may go unnoticed. These include mild upper abdominal pain, chest pain, dysphagia, bloating, early satiety, heartburn, and occasionally symptoms of pancreatitis. Such features may be protracted and are often misattributed to other upper gastrointestinal disorders such as peptic ulcer disease [4–6, 11].

Laboratory findings include [6]:

- Elevated markers of inflammation (e.g., white cell count, c-reactive protein)
- Electrolyte abnormalities (e.g., hypokalemia, hypochloremic metabolic alkalosis)
- Elevated pancreatic enzymes; and
- Anemia (related to mucosal ulceration)

Reported complications of gastric volvulus include ulceration, perforation, hemorrhage, pancreatic necrosis, and omental avulsion. On rare occasions, rotation of the stomach may even cause disruption of the splenic vessels resulting in hemorrhage and splenic rupture [5, 12].

5. Diagnosis

Diagnosis based on physical examination findings and symptoms alone is difficult, therefore a high index of suspicion is required, as it is a condition with a high mortality rate in acute cases [3, 4].

The gold standard is a barium swallow, which has a very high sensitivity and specificity for diagnosing gastric volvulus [10]. However, the increased availability of computed tomography has displaced barium swallow to a second place in the diagnostic armamentarium.

The diagnosis is frequently made by an abdominal radiograph and an upper gastrointestinal series, although the results may be normal during the asymptomatic period [2, 4, 11, 13].

In a typical presentation of gastric volvulus, an erect abdominal radiograph may demonstrate double air-fluid levels in the antrum and fundus, a single air bubble with no additional luminal gas or a distended fluid-filled stomach. Chest radiographs also can demonstrate a retrocardiac, air-filled mass. These features may be absent in cases of intermittent obstruction and therefore further imaging is often necessary to confirm diagnosis [5].

Upper gastrointestinal series can provide information on the rotation of the stomach and passage of ingested oral contrast material into the duodenum [4]. However, it is usually not performed routinely in mild cases due to the vagueness of symptoms and low suspicion of gastric volvulus.

Most patients, particularly those with acute abdominal pain, undergo CT scan. CT of the abdomen or chest typically demonstrates a dilated stomach, often abnormally positioned in the chest. A swirl sign may also be evident. CT also defines other anatomic abnormalities, such as diaphragmatic defects, and excludes other abdominal pathology as the source of symptoms [6]. The most frequent and sensitive CT findings of volvulus are stenosis at the hernia neck and transition point at the pylorus [4]. CT findings of ischemia including gastric wall edema, lack of contrast enhancement of the gastric wall, perigastric fluid, pneumatosis of the gastric wall, pleural effusion, and pneumoperitoneum could also be seen [2, 4, 11, 13].

Gastric volvulus can sometimes be initially diagnosed through upper endoscopy where tortuous appearance of the stomach and difficulty or inability for the endoscope to reach the pylorus may be found [2, 11]. It is also typical to see the pylorus adjacent to the esophagogastric junction on retroflexion.

6. Treatment

The treatment of acute gastric volvulus is medical, endoscopic and/or surgical.

6.1 Initial management

Initial treatment involves stabilization of the patient, balanced crystalloid resuscitation, correction of electrolyte abnormalities and urgent upper endoscopy with

placement of NG tube for decompression, which will assist with reduction of the gastric volvulus and evaluation of the mucosa [6, 11, 14]. Blood-based resuscitation should be considered for patients with chronic anemia from this condition or presenting with acute upper gastrointestinal bleed. In the presence of suspected perforation or ischemia, broad spectrum antibiotics should be administered early [14].

Some authors consider that chronic gastric volvulus can be managed conservatively with prokinetic agents and antisecretory therapy [2].

Immediate surgical consultation should be obtained, particularly in the case of an acute volvulus where the risk of vascular compromise and death are high [5].

Urgent surgery is mandated in the following instances [6]:

- Inability to decompress the stomach with a nasogastric tube or endoscopy
- Gastric perforation
- Mediastinal collection
- Shock or hypotension refractory to resuscitation
- Severe sepsis

6.2 Endoscopy

An upper endoscopy may be initially attempted to manually reduce the hernia in stable patients, particularly when unable to pass an NG tube. If successful, this will allow further assessment of the extent of damage as a result of the volvulus and will allow time to resuscitate the patient prior to surgery. Many times decompression of the stomach with a nasogastric tube will result in reduction of the volvulus [3, 14].

The airway should be secured prior to endoscopic intervention to avoid aspiration during the procedure. Once the endoscope is inserted, esophageal and gastric contents can be suctioned and NG or orogastric tube can be guided under endoscopic visualization into the stomach for decompression [14].

Endoscopic derotation with endoscopic gastropexy via percutaneous endoscopic gastrostomy (PEG) tube has been described as conservative first-line management in patients with isolated gastric volvulus and high surgical risk [5, 10, 11, 14]. The rationale for placement of a PEG tube is that it helps prevent recurrent volvulus by fixing the stomach to the abdominal wall in its normal orientation. In the rare case that PEG is used as the sole therapy, a second PEG tube will be needed to prevent future rotation. In such cases, one PEG is placed in the usual position in the gastric body while the other is placed more distal in the stomach [14].

However, the risk of gastric perforation with endoscopic therapy as main treatment is significant and patients should therefore be considered carefully for conservative treatment [2, 10]. There is also a risk of recurrence due to inadequate fixation, persistence of predisposing factors such as hernias and adhesions from previous surgeries, and the potential that the fixation point will act as an axis for further rotations **Figure 3** [11].

6.3 Surgery

Surgical management is aimed at ensuring gastric viability [15]. The principles of treatment of gastric volvulus include decompression of the stomach with reduction

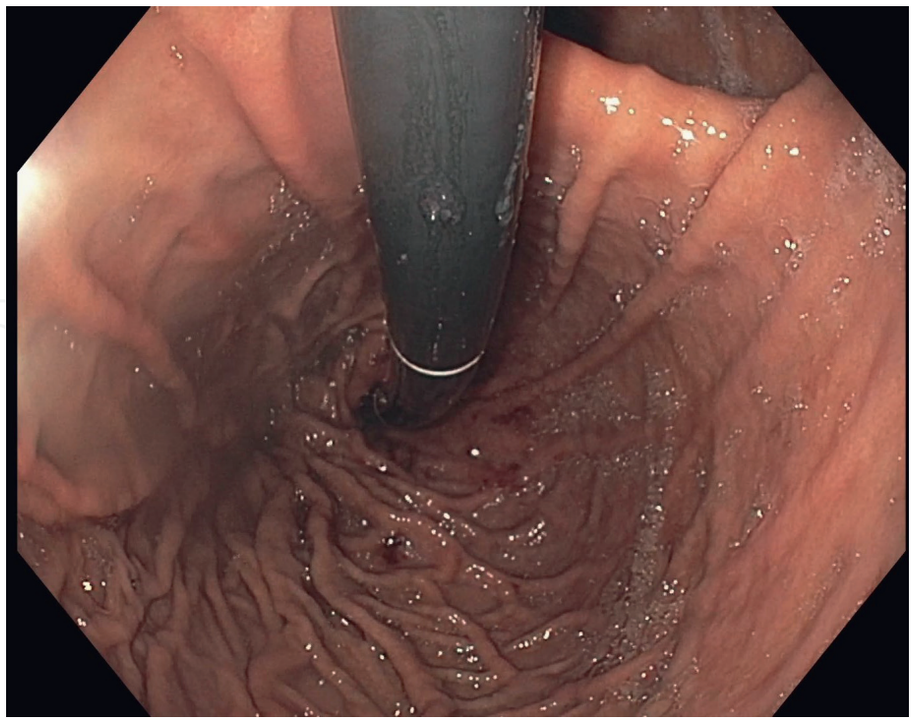

Figure 3.
Endoscopic view of devolvulized stomach.

of the volvulus to restore the stomach to a more normal anatomic position, followed by gastropexy and correction of the intra-abdominal factors predisposing to volvulus and thus preventing future stomach rotation. Gastric resection is necessary if full-thickness necrosis is present [5–7, 11, 16].

Traditionally, open surgery has been the preferred approach, allowing broad access to the abdominal cavity [1, 2, 6, 17]. Patients demonstrating signs of metabolic derangement or necrosis might benefit from open transabdominal damage-control laparotomy for reduction and relief of ischemia or resection of necrotic tissue and planned second look for definitive repair [14].

Due to the paucity of literature comparing laparoscopic and open surgery it is difficult to compare their respective outcomes. However, laparoscopic surgery has largely demonstrated its usefulness in elective surgery for chronic gastric volvulus and increasingly in cases of acute volvulus [7, 11, 12, 16–18]. Koger and Stone in 1993 described the first successful laparoscopic treatment of acute gastric volvulus by performing reduction and gastropexy [11]. Over time, good results with laparoscopic approaches have been described for gastric volvulus in stable patients, but its use in cases of perforation remains controversial [19].

Channer et al. have reported successful reduction of organoaxial gastric volvulus using standard laparoscopic foregut port placement in a small series [12]. Yates et al. have modified the port configuration to allow for sutured gastropexy of the distal gastric body and antrum [18].

In high-operative risk patients, management of gastric volvulus with laparoscopic paraesophageal hernia (PEH) repair can result in significant perioperative morbidity and mortality, and in the presence of severe thoracoabdominal musculoskeletal deformities the repair may turn into a technically challenging one [18].

Laparoscopic gastropexy requires much shorter operative time compared with laparoscopic PEH repair, possibly resulting in less perioperative morbidity and mortality for patients [8, 18]. Many technical variations of gastropexy have been reported in the literature and include [1, 5, 12, 17]:

- Simple fixation of stomach to the anterior abdominal wall, including using T-fasteners (Ross Products Division, Abbott Laboratories, Columbus, Ohio) [12] and intracorporeal suturing
- Gastrostomy tube placement
- Suturing the lesser curvature to ligamentum teres or a free edge of liver
- Posterior fixation of the greater curvature to the peritoneum and colonic mesentery
- Fixation of the fundus to the undersurface of the diaphragm

In the past, more definitive procedures that were performed included gastropexy with colonic displacement (Tanner's procedure), fundoantral gastrostomy (Oozler's operation), gastrojejunostomy and gastrocolic disconnection. However, these are rarely used nowadays.

Laparoscopic approach with excision of the hernia sac, re-approximation of the diaphragmatic crura, anti-reflux procedure and gastropexy, when indicated, has been tolerated, securing the stomach intra-abdominally and preventing migration of the stomach to an intrathoracic position. Complete excision of the hernia sac can also help to eliminate one of the causes of recurrence [12].

Due to the robust collateral circulation of the stomach, gastric necrosis is unusual, but the stomach should always be thoroughly examined for evidence of ischemia after reduction of the gastric volvulus. When it occurs, gastric necrosis is usually located at the fundus, which is a location amenable to partial resection with a linear stapler [6]. It is crucial to perform an intraoperative upper endoscopy to be able to evaluate the condition of the mucosa and the repair performed.

In the rare case of full thickness necrosis of the stomach with absence of perfusion after reduction of volvulus, a total gastrectomy may be required, leaving the esophagus and duodenum in discontinuity, placing a feeding jejunostomy tube and creating a diverting esophagostomy at the initial surgery for damage control. Once the patient is more stable, they can be taken back for definitive repair with esophagojejunal reconstruction or colonic interposition [6].

While there has been debate in the literature concerning the indications of an additional anti-reflux procedure when repairing a diaphragmatic defect, Fundoplication, especially if the wrap is sutured to the crura, has shown to decrease recurrence in patients with hiatal hernia [2, 10]. An anti-reflux procedure should be performed routinely in patients with PEH [12, 20].

More recently robotic-assisted surgery has been gaining popularity in General Surgery, and there are increasing reports demonstrating that robotic approach to the management of GERD and PEH repair is safe and effective with low complication rates [21, 22]. To date, there are very few case reports of robotic repair

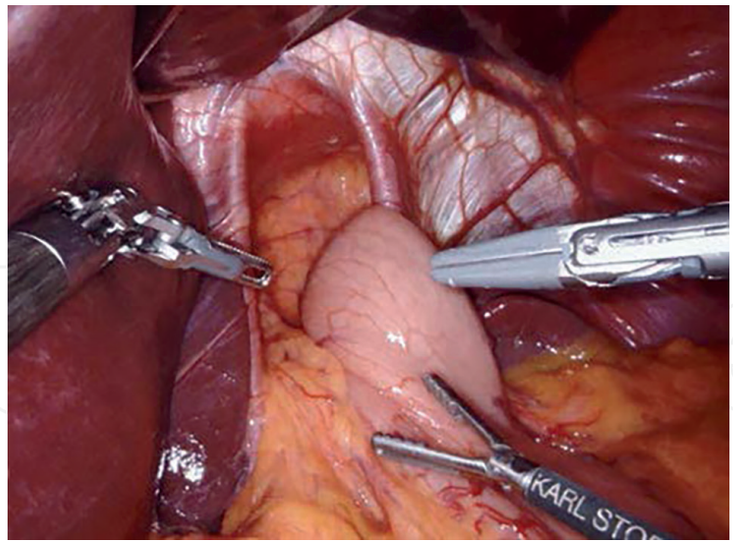

Figure 4.
Robotic repair of paraesophageal hernia presenting with a gastric volvulus.

of paraesophageal hernia with finding of gastric volvulus in children and adults **Figure 4** [21, 23–25].

6.4 Postoperative considerations

Postoperatively, patients should be admitted to an appropriate level of care based on clinical condition. Antiemetics should be scheduled to help prevent retching and vomiting. Currently there are no guidelines on postoperative use of NG tube or timing of enteral feeding.

Some authors tend to leave an NGT in situ, while others do not routinely leave one. Some surgeons perform a barium swallow within the first 2 postoperative days to interrogate the hernia repair, assess gastric emptying and evaluate for the presence of an esophageal leak [7, 14, 15]. We do not routinely follow this approach at our institution, unless there has been transmural gastric violation requiring repair or partial gastrectomy.

There is variety in practice with respect to feeding after surgery. We sequentially advance diet (full liquids, puree or blended diet and soft diet) for a period of 6 weeks to allow the edema at the site of the operation to resolve. Other surgeons discharge patients on a soft diet for 2 to 3 weeks after emergency repair of gastric volvulus [7, 15].

When placing a gastrostomy tube, Yates et al. typically leave it connected to a gravity bag for 12 to 24 hours postoperatively. Thereafter, the tube is selectively opened for symptoms of gastric distention (nausea, vomiting, and bloating). None of the patients in their series needed to use the gastrostomy tube for gastric decompression beyond 24 hours postoperatively [18].

7. Conclusion

The diagnosis of gastric volvulus requires familiarity with the presenting signs and symptoms. Early diagnosis is critical to timely intervention. Surgeon experience and patient physiology will drive the surgical approach.

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Conflict of interest

The authors declare no conflict of interest.

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