CASE REPORT

Second-look laparostomy for perforated gangrenous gastric volvulus to prevent total gastrectomy

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Accepted 25 April 2018

SUMMARY

A 42-year-old Caucasian woman presented to the emergency department with severe upper abdominal pain and vomiting. Clinically, she was septic, and abdominal examination suggested peritonitis. Following immediate resuscitation, the patient was stabilised and underwent urgent contrast-enhanced CT of the abdomen and pelvis. This revealed a mesenteroaxial gastric volvulus with traction on the mesentery and a small volume of free fluid. She underwent laparotomy revealing gangrenous gastric fundus perforation complicated by persistent intraoperative hypotension. This mandated a damage-control approach for the patient's safety entailing a limited-sleeve gastrectomy and laparostomy formation. Stabilisation in the intensive care unit allowed for a safer return to the operating room. On second look 24 hours later, previously ischaemic non-viable-looking portions of the stomach had recovered their blood supply. The patient was discharged 31 days postoperatively after recovering from the operations, postoperative wound infections and pleural effusions.

BACKGROUND

Gastric volvulus occurs when there is abnormal rotation of the stomach by $\geq 180^\circ$, creating a closed loop obstruction. This may occur acutely or cause chronic intermittent symptoms of epigastric discomfort and retching. First described by Berti in 1866, it is a rare clinical entity requiring a high index of suspicion for diagnosis.¹ Borchardt's triad of severe epigastric pain, retching and inability to pass Ryle's tube occurs in 50%–70% of cases.^{2–3} Although the chronic form may be managed conservatively,^{3–5} acute gastric volvulus (AGV) often requires surgery. Complications associated with AGV include ischaemia, gangrene, perforation, omental avulsion, pancreatic necrosis and splenic rupture. Despite the stomach's rich blood supply, strangulation and ischaemia are reported to occur in up to 28% of patients with AGV.^{6,7}

The rarity of the condition, delay in diagnosis, and the burden and complications of gastric resection contribute to high mortality rates of 30%–50%.^{5–8} We report, to the best of our knowledge, the first case of gastric volvulus managed by second-look laparostomy as part of a damage-control paradigm preventing total gastrectomy.

CASE PRESENTATION

A 42-year-old woman with no significant medical history presented to the emergency department at a UK district general hospital with severe cramping non-radiating upper abdominal pain of 6 hours

duration associated with two episodes of vomiting. She reported no change in bowel habits and no urinary symptoms. This was the index episode of such pain. Her social history included drinking alcohol socially and smoking 7–10 cigarettes per day.

On examination, she was alert but clearly distressed by the pain. Vital signs revealed a pulse rate of 100 beats per minute, respiratory rate of 20 breaths per minute, temperature of 36.5°C, oxygen saturation of 100% on room air and blood pressure of 127/74 mm Hg. Abdominal examination findings were consistent with peritonitis with generalised tenderness, guarding and rebound tenderness. She was resuscitated as per advanced life support guidelines including high-flow oxygen, large-bore intravenous access in two arms (for obtaining blood samples and administering intravenous antibiotics and resuscitative crystalloid boluses immediately) and analgesia prior to carrying out further investigations or interventions.

INVESTIGATIONS

Blood tests showed a leucocytosis of $15.0 \times 10^9/L$, neutrophilia of $13.0 \times 10^9/L$, C reactive protein <5 and haemoglobin 13.8 g/dL. Arterial blood gas analysis revealed a pH of 7.1 and base excess of -11.2 . An erect chest radiograph showed a retrocardiac distended stomach with elevated left hemidiaphragm and no pneumoperitoneum (figure 1). As the patient was stabilised with the initial resuscitative measures but was exhibiting features of peritonitis, an urgent contrast-enhanced CT scan of the abdomen and pelvis was performed. This showed a mesenteroaxial gastric volvulus with traction on the mesentery and a small volume of free fluid (figures 2 and 3).

TREATMENT

Following review by the consultant surgeon and anaesthetist on call, she was prepared and transferred to the operating room (OR). A gastroscopy was initially performed to assess the state of gastric mucosa and determine the possibility of endoscopic reduction which is increasingly reported in the literature as a growing consideration owing to the high mortality of emergency operative repair. A large ischaemic-looking area within the stomach was identified, and 100 mL of altered blood was aspirated. The gastroscopy was abandoned at this stage and a laparotomy performed.

To cite: Okeny PK, Abbassi O, Warsi A. *BMJ Case Rep* Published Online First: [please include Day Month Year]. doi:10.1136/bcr-2017-223060

Figure 1 Retrocardiac distended stomach with elevated left hemidiaphragm.

At laparotomy, there was gastric volvulus and a band adhesion at the hiatus with more than two-thirds of the stomach within the chest cavity. Adhesions near the hiatus were divided; both the crus and sac were mobilised to facilitate gentle reduction of the stomach back into the abdominal cavity. There was an approximately 5×5 cm perforation from a gangrenous area on the greater curve with most of the rest of the stomach appearing ischaemic. The rest of the intra-abdominal organs were normal.

The short gastrics and gastrohepatic ligament were divided; distal oesophagus was mobilised. Using a TLC75 (blue stapler), a limited greater curve excision was performed, incorporating the fundus followed by thorough wash of the peritoneal cavity with 15 L of warm saline. Nasojejunal feeding tube inserted 20 cm

Figure 2 Coronal view showing mesenteroaxial gastric volvulus.

Figure 3 Sagittal view showing mesenteroaxial gastric volvulus.

distal to the duodenojejunal flexure. Unfortunately, the patient exhibited hypotension intraoperatively that persisted refractory to inotropes, worsening acidosis and coagulopathy. This mandated a damage-control approach prioritising the patient's safety in favour of definitive management. A damage-control laparostomy was performed with planned second look within 24 hours. This would allow for reassessment of gastric viability with potential major gastric salvage after resuscitation and stabilisation in the intensive care unit (ICU) as opposed to major gastric resection. The laparostomy was fashioned using a technique well described in damage-control surgery literature involving a 'sandwich' of abdominal packs and fenestrated dressing interposed with large-bore drains placed on each side of the abdominal cavity.^{9 10} We used a large (60×45 cm) fenestrated transparent Incise drape without peeling apart the components. This was laid on top of the bowel. Six abdominal packs were laid on top of this drape. Two large bore suction drains were laid on either side of the wound on top of the packs. This was sandwiched by using a second large sticky transparent Incise drape to cover the laparostomy wound.

With a blood pressure of 94/60 mm Hg, pulse rate of 102 beats per minute, lactate of 4.2 mmol and International Normalised Ratio (INR) of 2.3, she was kept mechanically ventilated and given 4 units of fresh frozen plasma. Twenty-four hours following continued resuscitation in the ICU, her pH had improved to 7.41, BE -1.4 and lactate of 2.7. This allowed for a safer return to the OR for a second look with a view to definitive operative intervention. The whole stomach appeared viable with restored flow and peristalsis and an intact staple line. Gastropexy to two points on the anterior abdominal wall and hiatal defect closure with three interrupted 1/0 Ethibond sutures was performed. The abdominal cavity was closed after extensive lavage. She was returned to ICU and was extubated 24 hours later. Her post-operative course is summarised in [table 1](#).

DISCUSSION

We have presented a case of a 42-year-old woman with AGV who was treated using second-look laparostomy which resulted

Table 1 Summary of key postoperative events following a second-look laparostomy

Postoperative day	Event(s)	Action(s)
Day 1	Nasogastric (NJ) feeding rate: 10mL/hour. Extubated later that evening.	
Day 2	Desaturating: SpO ₂ 88%.	CXR: bilateral pleural effusions. Chest drains inserted; 800 mL and 500 mL from left and right, respectively.
Day 6	Postoperative ileus.	NJ feeds stopped, TPN continued, NGT free drainage.
Day 12	Repeat CT scan showed mediastinal and abdominal fluid collections.	CT-guided and USS-guided drainage of intra-abdominal collection.
Day 14	Transfer to surgical HDU.	
Day 19	Follow-up CT scan: reduction in size of mediastinal collection.	
Day 28	Stepped down to the general ward.	
Day 31	Discharged home.	

CXR, chest X-ray; HDU, High Dependency Unit; NGT, Nasogastric tube; TPN, Total Parental Nutrition; USS, Ultrasound scan.

in a limited gastrectomy and salvage of most of the stomach. Gastric volvulus has been classified into various types depending on the presentation, aetiology and mechanism of volvulus.

Depending on the mechanism, organoaxial volvulus (60%) is the most common followed by mesenteroaxial and the combined/mixed types.^{3 4} This classification was first described by Singleton in 1940.¹¹ Figure 4 illustrates the mechanism of the twist. Up to 70% of volvulus is thought to be secondary to hiatus hernia, eventration of diaphragm and/or phrenic nerve injury, adhesions, gastric/duodenal ulcer or post Nissen fundoplication.^{3-5 12 13} The remaining 30% are termed primary and are thought to be due to laxity of supporting gastric ligaments.

Compared with more than a decade ago, chronic as opposed to AGV has become more common.^{3 5 14} This may be attributed to improvement in diagnostic capacity over the years. When acute volvulus does occur, there is a risk of strangulation which coupled with closed loop obstruction, progressive gastric dilatation and ischaemia may lead to necrosis and perforation.⁸ Our patient presented with acute gangrenous mesenteroaxial volvulus secondary to hiatus hernia. This patient was previously asymptomatic and reported no symptoms of volume reflux or regurgitation. In a review of 38 cases of gastric volvulus, Carlos

*et al*¹⁵ found 50% of patients to have been asymptomatic prior to acute presentation.¹⁶

The patient had a definitive diagnosis after the CT scan (figures 2 and 3) which is the gold standard for the diagnosis of gastric volvulus.^{4 17} Other imaging studies include a chest radiograph (which would show a retrocardiac air–fluid level), plain abdominal radiograph (which would show gastric dilatation). A barium swallow is useful in cases of chronic volvulus.

Immediate resuscitation and reduction or derotation of the volvulus are mandatory in order to prevent physiological decompensation and progressive gastric ischaemia and necrosis/perforation. Staged laparotomy was initially used by trauma surgeons on physiologically decompensated trauma patients with the lethal triad of acidosis, coagulopathy and hypothermia. This concept termed damage-control surgery has been extended to non-trauma patients^{18 19} and involves initial resuscitation and optimisation, abbreviated initial laparotomy, ICU resuscitation followed by return to theatre for definitive repair.

Presence of severe sepsis/septic shock, acidosis (pH <7.25), hyperlactaemia (≥ 3 mmol), old age (>70 years old), multiple comorbidities (≥ 3) have been proposed as criteria for damage-control surgery in non-trauma patients.¹⁹ Our patient fulfilled three criteria: severe sepsis, acidosis and hyperlactaemia.

We aimed to preserve as much gastric volume as possible and prevent complications associated with gastric resection such as anastomotic (oesophageal) leaks, duodenal stump leaks, pulmonary complications, prolonged intraoperative time and/or blood loss and dumping syndrome.^{20 21} A 10-year review by Selby *et al*²² of 238 patients undergoing total gastrectomy found the most common early complications to be anaemia (20.2%) and pulmonary (including pleural effusion, hypoxia, pneumonia/pneumonitis, atelectasis). Oesophageal leaks were the most common major adverse event requiring invasive intervention in 10% of cases.

The main complications that occurred in this patient were bilateral pleural effusions with hypoxia, postoperative ileus and mediastinal and intra-abdominal fluid collections.

The first successful operation for gastric volvulus was reported by Berg in 1897.²³ Currently, laparoscopic and endoscopic approaches in the treatment of AGV are widely reported in the literature.^{5 24 25} Laparoscopic repair has become the most popular approach for the management of gastric volvulus in a stable patient without peritonitis. Outcomes following laparoscopic management of acute and chronic gastric volvulus are reported to be superior to those obtained after open surgery.^{5 26 27}

The role of endoscopy in the management of gastric volvulus involves assessment of degree of gastric mucosal ischaemia,

Figure 4 Diagrammatic illustration of mesenteroaxial (short axis) and organoaxial (long axis) gastric volvulus.¹⁶ GC, Greater curvature; GOJ, Gastroesophageal junction; LC, Lesser curvature.

decompression of the stomach and endoscopic reduction using the alpha loop manoeuvre.^{28–32} This approach is useful in elderly high-risk patients who may not be able to tolerate general anaesthesia. In patients with a background of poor oral intake, percutaneous endoscopic gastrostomy with gastropexy may be performed.^{29–32} In the acute setting, emergency reduction of the twisted stomach may allow time for adequate resuscitation and optimisation of the patient before definitive surgery.³⁰

In high-risk patients with chronic volvulus, a conservative approach has been reported. This is, however, associated with recurrence rates of up to 64%.³³ Reported options for definitive therapy in AGV include total or partial gastrectomy, anterior gastropexy, Tanner's operation, Opolzer's operation and Nissen fundoplication with or without Collis gastroplasty.⁴ This patient had hiatal repair and anterior gastropexy.

Limited gastric resection followed by second-look laparotomy is a novel technique that can be considered and used to salvage the majority of the stomach, averting the significant morbidity and mortality burden associated with total gastrectomy.

Learning points

- Limited stapled gastric resection followed by second-look laparotomy for acute ischaemic/gangrenous gastric volvulus may help salvage much of the stomach for select cases and after careful consideration.
- This approach may help reduce morbidity and mortality associated with this condition and that of total gastrectomy.

Contributors PKO obtained patient consent, collected patient data, designed and wrote the first draft of manuscript. OA participated in collection of data including images and review of manuscript. AW performed the surgery and provided academic review of the manuscript.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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