

Volvulus of the gastrointestinal tract

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Abstract

Volvulus describes the twisting of the intestine or colon around its mesentery. Intestinal obstruction and/or ischaemia are the most common complications of volvulus. Within the gastrointestinal tract, there is a preponderance towards colonic volvulus. The sigmoid is the most commonly affected segment, followed by the caecum, small intestine and stomach. Distinguishing between the differing anatomical locations of gastrointestinal volvulus can be challenging, but is important for the management and prognosis. This article focuses on the main anatomical sites of gastrointestinal volvulus encountered in clinical practice. The aetiology, presentation, radiological features and management options for each are discussed to highlight the key differences.

Key words: Gastrointestinal volvulus; Surgery; Volvulus

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Introduction

Volvulus, derived from the Latin ‘volvere’, was first used to describe the twisting of the intestine or colon around its mesentery and was reported as early as 1550BC (Gingold and Murrell, 2012). Any part of the gastrointestinal tract can be affected, but the sigmoid colon, caecum, small bowel and stomach are most commonly affected. While transverse colon and splenic flexure volvulus have been described, they are extremely rare. The clinical manifestation of gastrointestinal volvulus is obstruction as a result of occlusion of the lumen, and sigmoid volvulus is the third most common cause of large bowel obstruction after malignancy and diverticular disease (Abdelrahim et al, 2022). Caecal volvulus accounts for only 1–3% of all cases of colonic obstruction (Chaudry et al, 2015) and has a reported incidence of 2.8–7.1 cases per million annually (Atamanalp, 2010). Small bowel volvulus tends to be a disease of childhood and is usually associated with failure of normal embryological gut development. Its incidence is approximately one per 6000 live births. Gastric volvulus can present in both adults and children with the latter accounting for 10–20% of all cases (Hope, 2023). The incidence in adults is harder to estimate as patients with intermittent gastric volvulus may go undiagnosed.

In recent years there have been developments in the investigations and management options for gastrointestinal volvulus. Clinicians need to understand the differences in presentation of gastrointestinal volvulus, depending on the anatomical location, as prompt recognition and appropriate management are vital to reduce morbidity and mortality. This article focuses on the main anatomical sites of gastrointestinal volvulus encountered in clinical practice, discussing the aetiology, presentation, radiological features and management options for each to highlight key differences.

Demographics, pathophysiology and presentation

Sigmoid

The sigmoid colon is the most common site of volvulus. It is usually seen in older people with a median age of 80 years at presentation and is more prevalent in males (Abdelrahim et al, 2022). This is thought to be partly a result of the narrower male pelvic inlet as well as a less compliant abdominal wall. The main risk factor is chronic constipation as this causes elongation of the sigmoid colon over time (Atamanalp, 2010). The pathophysiology of sigmoid volvulus is multifactorial. The sigmoid colon lies in the left lower abdomen and has a relatively long mesentery which is wider than it is long – these factors allow the sigmoid to twist on itself (Atamanalp, 2010).

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The main presenting symptoms of sigmoid volvulus are constipation, abdominal distension and pain (Atamanalp, 2010). Patients often present more than 48 hours after symptoms began. In slim patients it may be possible to palpate the affected loop, but it is uncommon to elicit abdominal tenderness on examination. If present, it usually indicates ischaemia and/or perforation (Selvaraj and Palaniswamy, 2010). In addition, patients who elicit abdominal tenderness may present with signs of systemic shock.

Caecal

About a quarter of all cases of colonic volvulus are caecal volvulus (Kazi et al, 2022) and it is typically seen in patients aged 30–60 years. Females account for up to 80% of cases (Chaudry et al, 2015). There are several risk factors for caecal volvulus but a mobile caecum as a result of incomplete mesenteric fixation is a key element. In addition, a deep, narrow mesentery can promote torsion of the caecum (Chaudry et al, 2015) and previous abdominal surgery has been identified in up to 50% of patients with caecal volvulus (Hasbahceci et al, 2012). The caecum can rotate about two axes. Organoaxial is seen in 90% of cases and results from abnormal axial rotation of the caecum, usually clockwise, causing the mesentery to twist. Bascule describes the caecum folding anteriorly over the ascending colon; this causes less vascular compromise because there is reduced mesenteric rotation (Rout and Pillai, 2021).

Caecal volvulus often presents similarly to small bowel obstruction, with the predominant presenting complaints being abdominal pain and distension as well as nausea and vomiting (Hasbahceci et al, 2012). Some differentiating features indicating caecal volvulus rather than other causes of bowel obstruction include right lower quadrant pain, a palpable mass and intermittent pain that is relieved when passing flatus (Chaudry et al, 2015).

Small bowel

Small bowel volvulus is more common in children (Huang et al, 2005), usually presenting in the first few weeks of life. It can occur in adults, but accounts for only 1% of all causes of bowel obstruction. Small bowel volvulus results from torsion around the dorsal mesentery caused by intestinal malrotation in most cases (Lepage-Saucier et al, 2010). Intestinal malrotation occurs during the first trimester of pregnancy and results in an abnormal position of the small bowel and caecum as well as a narrow, stalk-like mesentery. In addition, the broad band which usually runs from the duodenojejunal junction to the ileocaecal junction, preventing the bowel from twisting on itself, can be abnormally located within the abdominal cavity. The resulting band (Ladd's band) can compress the bowel, causing obstruction. The underlying cause of intestinal malrotation is not fully understood, but there may be a hereditary component.

The primary symptoms of small bowel volvulus are abdominal distension and bilious vomiting. Abdominal tenderness, particularly alongside haemodynamic compromise, suggests ischaemia and warrants emergent investigation and management given the high mortality rate of small bowel volvulus (Coste et al, 2023).

Gastric

Gastric volvulus is rotation of the stomach beyond 180°. Its peak incidence is during the fifth decade with equal prevalence between males and females (Rashid et al, 2010). Most cases are associated with a paraoesophageal hiatus hernia with organoaxial rotation most common. Gastric volvulus can be primary or secondary: primary occurs in the context of neoplasia, adhesions or an abnormality in the attachments of the stomach, whereas secondary gastric volvulus is caused by disorders of gastric anatomy or function.

Gastric volvulus can be challenging to diagnose clinically as it can mimic other, more common presentations (eg myocardial infarction). Approximately 70% of patients present with a combination of severe epigastric pain, retching and an inability to pass a nasogastric tube (Mazaheri et al, 2019). In addition, some patients may have chronic or intermittent gastric volvulus causing them to present with episodic dysphagia, bloating, reflux or pain, so the diagnosis only becomes apparent during upper gastrointestinal endoscopy (Masjedzadeh and Alavinejad, 2015).

Investigations

Blood tests

Patients presenting with suspected gastrointestinal volvulus require prompt investigation to confirm the diagnosis or identify other significant pathology. Initial blood laboratory tests can indicate certain volvulus complications. A raised white blood cell count and neutrophil ratio can indicate intestinal necrosis, while electrolyte imbalance may reflect the obstructive nature of gastrointestinal volvulus (Aftab et al, 2014).

Plain film radiography

Plain abdominal X-ray is usually the first-line investigation for patients presenting with suspected lower gastrointestinal volvulus. Sigmoid volvulus can be identified on abdominal X-ray alone in approximately 85% of cases (Selvaraj and Palaniswamy, 2010). Findings include a dilated sigmoid colon with a ‘coffee bean’ or ‘omega’-like appearance (Figure 1), a loop of bowel with a twisted ‘whirlpool’ pattern, loss of haustral markings in the affected segment, distended bowel proximal to the obstruction, air–fluid levels in the distended portion of the colon, bowel wall thickening and oedema (Selvaraj and Palaniswamy, 2010). Caecal volvulus is often seen as an air-distended caecum with visible haustra in the right lower quadrant (Figure 2), but may also appear as non-specific large bowel obstruction (Rout and Pillai, 2021). It is difficult to differentiate small bowel volvulus from small bowel obstruction on abdominal X-ray. The main findings are distention of the small bowel proximal to the site of obstruction, with collapsed bowel beyond it (Lepage-Saucier et al, 2010). Both chest and abdominal X-ray may be of diagnostic yield in the initial investigation of suspected gastric volvulus, but organoaxial volvulus is challenging to diagnose on plain images alone. Chest X-ray may show a retrocardial air-filled mass, with abdominal X-ray demonstrating a distended fluid-filled stomach (Rashid et al, 2010).

Fluoroscopy and ultrasound

In children with suspected small bowel volvulus, an upper gastrointestinal contrast study is the first-line radiographic investigation. While the sensitivity for malrotation without volvulus is up to 96%, identifying malrotation with volvulus is less sensitive at approximately



Figure 1. Abdominal X-ray demonstrating ‘coffee bean’ sign associated with sigmoid volvulus.

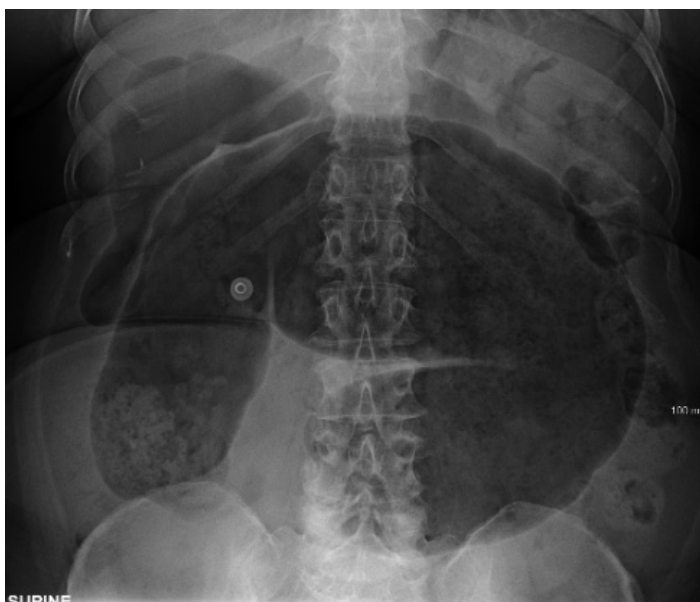


Figure 2. A distended caecum consistent with caecal volvulus.

40% (Stephens et al, 2012). Findings include a corkscrew sign, tapering of the bowel at the obstruction site and bowel in a malrotation position. Ultrasound is an alternative mode of imaging for children with suspected small bowel volvulus. It is easier to perform than a contrast study with reported sensitivity of up to 96%. Ultrasound findings may include the superior mesenteric artery and superior mesenteric vein wrapping around each other (Lepage-Saucier et al, 2010).

In adults, fluoroscopic studies can be useful in the diagnosis and in some cases treatment of lower gastrointestinal volvulus (Schwab et al, 1985). However, multiple attempts are often needed for therapeutic benefit and carries a risk of bowel perforation if the colon is over-distended. With availability of more sensitive, cross-sectional imaging along with alternative treatments, fluoroscopic studies are less often performed (Atamanalp, 2010). Diagnostic upper gastrointestinal endoscopy may also identify gastric volvulus with findings including the presence of a paraoesophageal hernia, fluid-filled tortuous stomach and inability to reach the pylorus (Cardile and Do, 2011).

Computed tomography

In adults with suspected gastrointestinal volvulus, computed tomography is the most sensitive (93%) and specific (96%) imaging modality (Visalli et al, 2021). It can identify potentially ischaemic segments as well as visceral perforation. For sigmoid volvulus, computed tomography demonstrates bowel obstruction in addition to whirling of the mesentery, which distinguishes it from other causes of large bowel obstruction (Visalli et al, 2021). Whirling of the mesentery is an important feature on computed tomography of gastrointestinal volvulus, and is also present in caecal and small bowel volvulus (Lepage-Saucier et al, 2010). Other findings on computed tomography include the ‘bird beak’ sign in caecal volvulus, which demonstrates tapering of the proximal and distal bowel to the point of torsion (Rout and Pillai, 2021), and multiple transition points in small bowel volvulus (Figure 3) (Lepage-Saucier et al, 2010). The presence of a hiatal hernia, transition point at the pylorus, stenosis at the hernia neck, abnormal positioning of the stomach and evidence of ischaemia are all computed tomography findings which may be present in gastric volvulus (Figure 4).

Management

Management of gastrointestinal volvulus varies, depending on the patient’s condition, severity of symptoms and comorbidities as well as the location of the volvulus. In most cases, the primary aim is prompt decompression to allow return of function and reduce

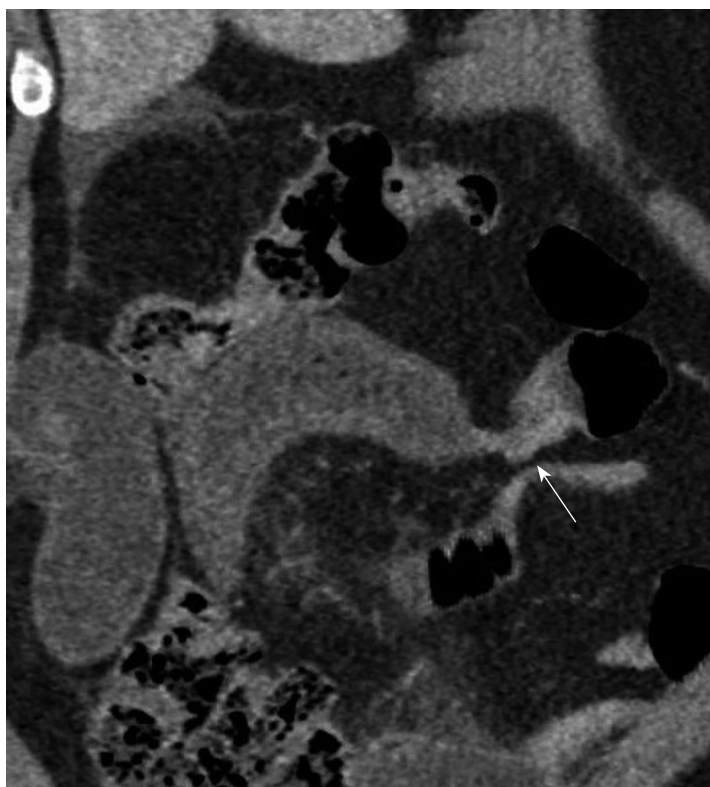


Figure 3. Computed tomography showing transition point in small bowel volvulus (arrow).

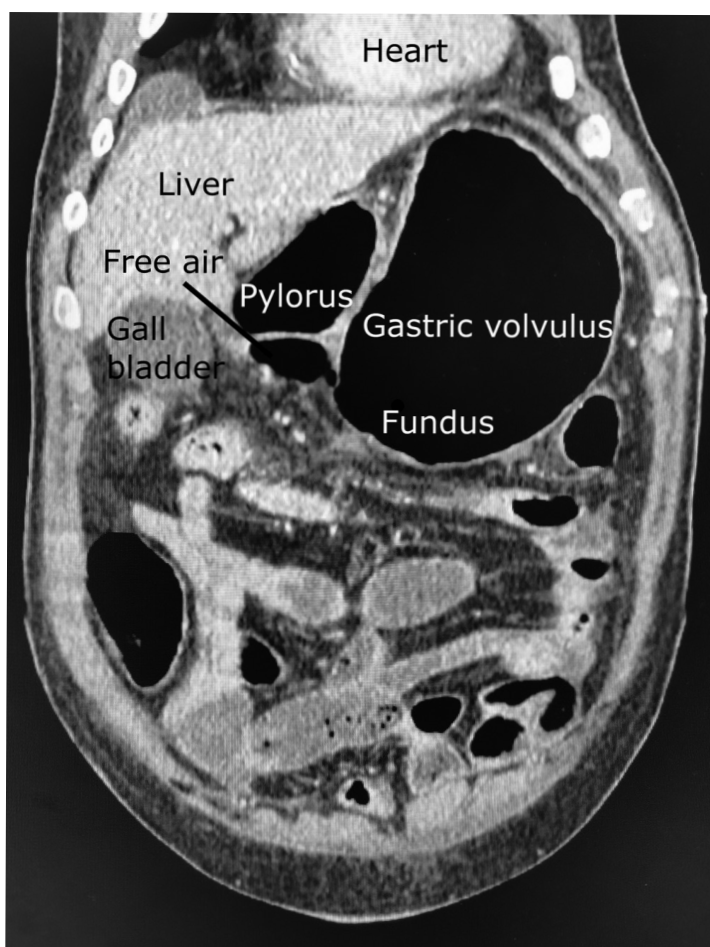


Figure 4. Gastric volvulus with evidence of perforation.

the risk of ischaemia. For sigmoid, caecal and gastric volvulus this can be achieved via non-operative approaches initially. The presence of ischaemic or necrotic tissue (seen in approximately 25% of cases of sigmoid volvulus) requires immediate surgical intervention and resection of the affected segment (Tian et al, 2023). In some patients, a non-operative, palliative approach may be appropriate, so it is important to discuss goals of care with the patient and their family.

Non-operative

In haemodynamically stable patients with sigmoid volvulus, endoscopic decompression is attempted (Abdelrahim et al, 2022). This involves passing a flexible or rigid sigmoidoscope into the colon and decompressing the volvulus by untwisting the colon with gentle pressure or using a flexible endoscopic grasper. The success rate is 80–90% (Abdelrahim et al, 2022). Percutaneous endoscopic colostomy can be considered in patients considered high risk for surgery (Tian et al, 2023). The sigmoid colon is fixed to the anterior abdominal wall with the aim of preventing recurrence. This can be achieved with either single or double percutaneous endoscopic colostomy tube fixation. Single point fixation has higher recurrence rates, but causes less morbidity which may be important in more frail patients (Frank et al, 2016).

Endoscopic management of caecal volvulus is less effective with a success rate of about 30% (Consorti and Liu, 2005), so is limited to those unfit for major intervention. Gastric volvulus decompression can be achieved by passing a nasogastric tube, but if this does not work endoscopic decompression should be performed. If endoscopy is the diagnostic tool for the volvulus, a combined diagnostic and therapeutic procedure can be performed. Direct endoscopic visualisation also allows assessment of the mucosa for the presence of ischaemia and/or necrosis and high success rates for decompression have been reported (Zuiki et al, 2016).

Operative

Despite the effectiveness of non-operative management of gastrointestinal volvulus, many patients experience recurrence and so surgery should be considered during or after the index admission. Sigmoid and caecal volvulus have recurrence rates of up to 50% and 30% respectively, resulting in repeated admissions (Hardy et al, 2022). Patients who undergo elective surgery following successful decompression have a higher overall survival rate at 2 years than patients who undergo decompression alone (Moro-Valdezate et al, 2022). Gastric volvulus is associated with recurrence rates of up to 64% (Zuiki et al, 2016). Multiple surgical approaches to gastrointestinal volvulus have been described and the decision as to which to use depends on many factors.

In sigmoid volvulus, most patients undergo a sigmoid colectomy and end colostomy (Hartmann's procedure). Primary anastomosis may be suitable in some but carries the risk of anastomotic leak in a patient recovering from major abdominal surgery (Kazem Shahmoradi et al, 2021). Sigmoidopexy is an alternative in frail, high-risk patients, but is still associated with high rates of recurrence (23%) and surgical site infection compared with sigmoidectomy (Orban et al, 2022).

Operative management of caecal volvulus usually requires resection via a right hemicolectomy (Mahendran et al, 2022). Where endoscopic decompression is successful, laparoscopic approaches can be used to minimise morbidity (Ramírez-Ramírez et al, 2017). Caecopexy is an alternative in patients who do not require bowel resection, but is time consuming and associated with recurrence rates of around 40% (Tsushimi et al, 2008). Similarly, caecostomy, while less morbid in the short term, has a high recurrence rate of volvulus and incidence of longer-term complications (eg fistula formation); as such, 89% of surgical procedures for caecal volvulus involve bowel resection (Ramírez-Ramírez et al, 2017).

Surgical approaches to the management of gastric volvulus are varied. Ischaemic or necrotic tissue requires gastrectomy which may be total or subtotal depending on the extent of involvement. Where there is no evidence of vascular compromise, reduction of the intra-thoracic stomach with an anti-reflux procedure is advocated for most patients (Teague et al, 2000). Even in the acute setting, minimally invasive approaches are safe and

effective. Gastropexy is an alternative in higher-risk patients, with open, laparoscopic or endoscopic approaches. Rarer cases (eg congenital diaphragmatic hernia) often require a mixed approach, combining fixation of the stomach in the correct anatomical orientation with repair of the hernial defect.

The mainstay of treatment for small bowel volvulus is surgical, but varies depending on the underlying cause. A Ladd's procedure is performed for paediatric small bowel volvulus caused by malrotation or Ladd's bands. If there is no concern about bowel viability then surgical reduction without resection can be performed (Lepage-Saucier et al, 2010). In small bowel volvulus caused by adhesions alone, adhesiolysis with or without bowel resection is performed and in the case of internal hernia, reduction and repair of the defect is required (Li et al, 2017).

Outcomes

Despite improvements, gastrointestinal volvulus is still associated with significant morbidity and mortality. Decompression alone in sigmoid volvulus has greater 2-year mortality rates than surgery (Moro-Valdezate et al, 2022). However, emergency surgery is not without risk, with a 5% mortality rate reported for a Hartmann's procedure. Increased rates of surgical site infection, pneumonia and perioperative myocardial infarction are reported for emergency surgery for sigmoid volvulus compared with elective resection as well as lower rates of minimally invasive approaches. Emergency surgery is usually required for an ischaemic sigmoid colon, but definitive surgery has been delayed to the elective setting, following decompression and close observation of the patient, with favourable results (Yasuda et al, 2020). Percutaneous endoscopic colostomy has a mortality rate of around 5% (Frank et al, 2016). Outcomes following sigmoid volvulus reflect the patients it affects with increasing age a risk factor for increasing mortality.

Surgical intervention is usually required for caecal and small bowel volvulus. With improved diagnostics and advances in perioperative care, the mortality of emergency resection has decreased from 39% to 6.7% for caecal volvulus (Rout and Pillai, 2021) and is approximately 8% for small bowel volvulus in adults. In children, the presence of ischaemia is associated with greater mortality, as high as 9%. However, longer-term outcomes following small bowel resections are favourable, with most patients achieving autonomous enteral feeding.

Gastric volvulus is associated with high rates of mortality – as high as 57% in the acute setting (Chau and Dufel, 2007). This is thought to be partly a result of delayed diagnosis which increases the risk of developing ischaemia. Some studies report a mortality as low as 16% with prompt diagnosis while others demonstrate no major postoperative complications in expedited surgery (Teague et al, 2000). While ischaemia of the stomach is a significant risk factor for mortality, other consequences of gastric volvulus, such as aspiration pneumonia, can contribute to a poor outcome. Therefore, it is important to have gastric volvulus in the differential of any patient presenting with symptoms of gastric outlet obstruction.

Conclusions

Gastrointestinal volvulus is a surgical emergency which requires prompt recognition and management to reduce morbidity and mortality. The hallmark signs are those of gastrointestinal obstruction and some patients may present with features of vascular compromise. The immediate management is to resuscitate the patient and decompress the volvulus. In most cases, surgery must be considered to prevent recurrence, but this may not be suitable for all, and an individualised approach is necessary.

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Key points

- Colonic volvulus is more common than small bowel volvulus, with sigmoid being the most common site.
- The hallmark signs of gastrointestinal volvulus are those of obstruction and vascular compromise.
- Patients presenting with suspected gastrointestinal volvulus require prompt investigation to confirm the diagnosis or identify other significant pathology.
- Surgery must be considered to prevent recurrence, but an individualised approach is necessary.

Conflicts of interest

The authors declare that there are no conflicts of interest.

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