Twists and turns in the body: an imaging spectrum

Life is full of twists and turns. These surprises can sometimes be wonderfully invigorating. Twists and turns can also occur in the body, however, sometimes with dangerous consequences. Torsion and volvulus are important causes of acute abdominal pain. The clinical symptoms and signs associated with torsion and volvulus are often non-specific and are difficult to diagnose clinically. Clinicians frequently rely on imaging methods to make the diagnosis. Prompt and accurate diagnosis is important to avoid the life-threatening complications of torsion and volvulus. Therefore, it is helpful to be familiar with the features of torsion and volvulus.

Introduction

Torsion and volvulus often pose challenges for clinicians due to the non-specific symptoms and signs. Since these conditions are difficult to diagnose clinically, clinicians often rely on imaging methods to make the diagnosis. Prompt and accurate diagnosis is important to avoid the life-threatening complications of torsion and volvulus. In this article, the relevant clinical features and common radiological features of some conditions of torsion and volvulus are discussed.

Gastric volvulus

Gastric volvulus occurs when there is an abnormal rotation of the stomach. It is a surgical emergency that requires prompt diagnosis and treatment. Gastric volvulus occurs most commonly in elderly people. The condition is usually divided into three subtypes based on the type of rotation: organoaxial, mesenteroaxial, and a mixture of organoaxial and mesenteroaxial.

In organoaxial volvulus, the stomach rotates along its long axis, which is a line drawn between the cardia and the pylorus, with the greater curvature being displaced superiorly and the lesser curvature located more caudally in the abdomen. In mesenteroaxial volvulus, the stomach rotates on an axis perpendicular to the long axis of the stomach along a line joining the middle of the lesser curvature to the greater curvature, with resultant displacement of the antrum above the gastroesophageal junction. Organoaxial volvulus is the most common type and accounts for approximately two thirds of incidence of gastric volvulus.

Causes of gastric volvulus include congenital abnormalities such as lengthening of the gastrohepatic omentum and gastrocolic ligament, and weakness of the gastrophrenic ligament. The condition is usually associated with a large sliding or para-oesophageal hiatus hernia. Other predisposing factors include phrenic nerve palsy, eventration of the diaphragm, and traumatic diaphragmatic hernia.

The severity of symptoms depends on the direction and degree of rotation. Acute symptoms tend to occur when the rotation is at or beyond 180°. The clinical presentation of acute gastric volvulus includes violent retching with little vomitus produced, severe epigastric pain, and difficulty in passing a nasogastric tube, also known as the Borchardt triad. The clinical presentation of chronic recurrent volvulus includes intervals of dyspeptic pain.

Radiographic findings from plain radiographs may include intrathoracic air, indicating herniation of a portion of the stomach above the diaphragm. On barium study, the stomach may be inverted, with the greater curvature above the lesser curvature or the pylorus above the cardia (Fig 1a, 1b). Barium studies may also evaluate the passage of ingested oral contrast material into the duodenum. Computed tomography (CT) may help confirm rotation of the herniated stomach (Fig 1c). Differential diagnoses based on imaging features include hiatus hernia, postoperative changes as for oesophagectomy with gastric pull through, and epiphrenic diverticulum.
Volvulus complicating transmesenteric hernia

Internal hernia is a rare condition, occurring in 0.5 to 4.1% of patients with intestinal obstruction. Transmesenteric hernia accounts for less than 8% of internal hernia. About 35% of transmesenteric hernias occur during childhood and may be related to congenital mesenteric defects. In adults, most mesenteric defects are related to surgery, trauma, or inflammation. The incidence of transmesenteric hernias is increasing, which may be related to the increased frequency of surgical procedures in which a Roux-en-Y loop is constructed that may predispose a patient to development of an internal hernia. A volvulus may complicate transmesenteric hernia and cause hernial strangulation and intestinal gangrene. The clinical presentation often includes signs and symptoms of acute small bowel obstruction.

As a mesenteric defect is not well visualised, observation of clustering of small bowel loops and abnormalities of the mesenteric vessels seen by CT is important for the diagnosis of transmesenteric hernia complicated by volvulus. Computed tomographic features of abnormalities of the mesenteric vessels include an engorged and stretched mesenteric vascular pedicle and converging mesenteric vessels located at the entrance of the hernial sac. Other CT features include medial displacement of the descending colon, dilated small bowel, and presence of a transition point between dilated and non-dilated small bowel. A differential diagnosis to consider based on the imaging features is closed loop obstruction. Volvulus complicating transmesenteric hernia could result in bowel gangrene and perforation, which could be detected by CT.

Sigmoid volvulus

The sigmoid colon is the most common site of colonic volvulus and accounts for 60 to 75% of all patients with colonic volvulus. The aetiology of sigmoid volvulus remains uncertain, but includes chronic constipation, a high-fibre diet, and sigmoid colon redundancy. The clinical presentation includes non-specific abdominal pain and symptoms of bowel obstruction.

Radiographic findings include a large air-filled sigmoid colon with a coffee bean–like shape, arising...
from the pelvis and extending cranially beyond the level of the transverse colon (Fig 3a). Computed tomographic features include abnormal position of the sigmoid colon and whirling of the mesentery at the level of the volvulus (Fig 3b). Differential diagnoses based on imaging features include acute ileus, toxic megacolon, and distal colon obstruction.

The prognosis of sigmoid volvulus depends on the disease stage, timing of surgery, and co-morbidities. Complications of sigmoid volvulus include bowel gangrene and perforation. The highest mortality rate is for patients with clinical signs and symptoms of peritonitis. Imaging methods, such as CT, could help with earlier diagnosis, resulting in earlier management of sigmoid volvulus. Management of sigmoid volvulus involves relief of obstruction by a non-operative method via endoscopy for viable volvulus. For patients with failed decompression and intestinal ischaemia and perforation, resection and anastomosis may be considered.

Caecal volvulus
Caecal volvulus is a rotational twist of the right colon on its axis. Caecal volvulus accounts for 25 to 40% of colonic volvulus. The causes of caecal volvulus include congenital defect in the attachment of the right colon, postpartum ligamentous laxity and a mobile caecum, chronic constipation, and laxative use.

Radiographic features include a dilated gas-filled viscus in the left upper quadrant or mid abdomen. Caecal volvulus could be diagnosed by
contrast enema study or CT. In contrast enema study, there is usually a beak-like tapering at the level of the volvulus, and usually only a small amount of contrast material is able to pass beyond the volvulus. At CT, the twisted mesentery and the abnormally positioned caecum at the left upper/mid-abdomen can be demonstrated.

Caecal volvulus may lead to bowel ischaemia and perforation, depending on the duration of symptoms. These complications can be detected by CT. Differential diagnoses based on imaging features include sigmoid volvulus, acute ileus, and distal colon obstruction.

**Transverse colon volvulus**

Transverse colon volvulus is rare, accounting for 5 to 10% of colonic volvulus. Contrast enema study can show the characteristic beak-like tapering of the colon at the level of the volvulus. As transverse colon volvulus is rare and therefore unexpected, this condition is usually diagnosed by CT. Diagnostic features on CT include features of bowel obstruction and mesenteric twist at the level of the volvulus.

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**FIG 4. Torsion of the uterus in a postmenopausal woman who underwent emergency hysterectomy and oophorectomy**

(a) Axial computed tomographic (CT) image showing the uterine cervix with a whirled appearance (arrow). (b) Oblique coronal CT image showing the uterine cervix with a whirled appearance (arrow). (c) Axial CT images of the abdomen in the (i) non-contrast, (ii) arterial, (iii) portovenous, and (iv) delayed phase showing lack of contrast enhancement of the uterus compatible with gangrenous changes. (d) Intra-operative photo showing a gangrenous uterine body, bilateral fallopian tubes, and ovaries (photograph courtesy of the Department of Obstetrics and Gynaecology, Pamela Youde Nethersole Eastern Hospital, Hong Kong; reprinted with permission)
Complications of transverse colon volvulus include bowel gangrene and perforation.

Torsion of the uterus

Torsion of the uterus is defined as a rotation of the uterus on its long axis of more than 45°. Causes of uterine torsion include abnormal foetal presentation, fibroid, congenital uterine anomaly, pelvic adhesions, and adnexal masses. Uterine torsion is a rare condition; since 1909, when it was first described, only about 200 cases of uterine torsion have been reported. Since this is a rare condition, the clinical course, prognosis, and mortality rate is not well documented. The clinical presentation varies from non-specific mild abdominal discomfort to acute abdomen with shock.

Plain radiograph and CT findings of gas in the cavity of a twisted uterus have been described as a feature of torsion of the uterus. By ultrasound, torsion of a myomatous uterus may be suspected if fibroids shown on previous ultrasound scans have changed position. By CT, a whirled structure in the uterine cervix, representing twisting at the uterine cervix, may be seen (Fig 4a, 4b). In patients with haemorrhagic infarction of the uterus secondary to torsion, areas of hyperdensities and lack of contrast enhancement may be seen on CT (Fig 4c). Features of uterine torsion shown by magnetic resonance imaging (MRI) have been described in the literature. The wall of the upper vagina changes from the normal H configuration to an X-shaped configuration in torsion of the uterus. Differential diagnoses based on imaging features include ovarian or adnexal torsion and massive infarct inside a leiomyoma. Uterine torsion may progress to gangrenous changes in the uterus (Fig 4d), which can be detected by CT. Hysterectomy should be considered for postmenopausal women with uterine necrosis caused by prolonged torsion. For uncomplicated cases in premenopausal women, detorsion of the uterus may be considered. Bilateral plication of the round or uterosacral ligaments may be considered to prevent recurrence of uterine torsion.

Tubo-ovarian torsion

Tubo-ovarian torsion is a gynaecological emergency requiring prompt surgical intervention. Ovarian torsion is frequently associated with an ipsilateral ovarian tumour or cyst, which occurs in 50 to 81% of patients. Ovarian torsion can also occur in healthy ovaries, usually in paediatric patients, in whom the adnexa are especially mobile. Patients with ovarian torsion often present with abdominal pain.

Ultrasound findings of adnexal torsion are non-specific. The role of ultrasound in the early diagnosis of adnexal torsion is not yet fully established. Computed tomography and MRI are commonly used to detect features of ovarian torsion. Common imaging features by CT and MRI include eccentric wall thickening of adnexal cystic masses and a tubular mass–like structure, representing a thickened fallopian tube (Fig 5a). Other features...
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References


