



“ROLE OF X-RAY AND COMPUTED TOMOGRAPHY IN VOLVULUS OF GASTROINTESTINAL TRACT AT TERTIARY CARE CENTER”

Radio-Diagnosis

Dr. Jay Hapani	Assistant Professor, Department Of Radiology, Pandit Deendayal Upadhyay Government Medical College & Civil Hospital, Rajkot, Gujarat, India.
Dr. Karankumar Pravinbhai Solanki	Resident Doctor, Department Of Radiology, Pandit Deendayal Upadhyay Government Medical College & Civil Hospital, Rajkot, Gujarat, India.
Dr. Hiral Hapani	Associate Professor, Department Of Radiology, Pandit Deendayal Upadhyay Government Medical College & Civil Hospital, Rajkot, Gujarat, India.
Dr. Mradula Bhat	Resident Doctor, Department Of Radiology, Pandit Deendayal Upadhyay Government Medical College & Civil Hospital, Rajkot, Gujarat, India.
Dr. Anjana Trivedi	Professor And Head Of Department, Department Of Radiology, Pandit Deendayal Upadhyay Government Medical College & Civil Hospital, Rajkot, Gujarat, India.

ABSTRACT

A study titled "Role Of X-ray and Computed Tomography In Volvulus Of Gastrointestinal Tract At Tertiary Care Center" investigated the use of imaging for diagnosing GI volvulus. Volvulus is a common cause of acute abdominal pain, and prompt diagnosis is critical. The study included 25 adult patients with surgically confirmed volvulus.

KEYWORDS

INTRODUCTION:-

Volvulus involving the gastrointestinal (GI) tract is a common cause of acute abdominal pain. It can involve any site along the entire GI tract i.e. stomach, small bowel, small intestine, cecum, transverse colon and sigmoid colon. Sigmoid volvulus is the most common of these bowel segments and accounts for 60%-75% of cases of intestinal volvulus. Patients commonly present with non-specific complaints, including variable degrees of acute onset pain associated with bloating, nausea, and/or vomiting. It is rarely diagnosed just on the basis of clinical symptoms, and hence, radiologists play a vital role in not only diagnosing but also in evaluating the probable etiology leading to volvulus. They also prognosticate the patient based on the imaging findings. For diagnostic evaluation, plain radiography, fluoroscopy, and computed tomography (CT) are commonly used.

Intestinal volvulus is a broad term that describes the torsion of bowel around its mesentery. Torsion results in narrowing of the lumen at the point of rotation and compromise of the vessels that supply the torsed gut.

In order for a vessel to be compressed and obstructed, the force that the torsion imparts on the vessel needs to be greater than the pressure of blood within. Hence, the first vessel to be compromised is the vein resulting in venous stasis with mesenteric injection; if the torsion is not corrected venous infarction and bowel perforation may occur. Depending on the torsion, arterial compromise may occur causing frank bowel ischemia.

If the patient presents late, symptoms like fever, constipation and bloody stools may occur. This occurs because the mesentery becomes extremely tightly twisted such that its blood supply is cut off, resulting in an ischemic bowel. At this stage, there can be a paradoxical relief from pain, as due to bowel ischemia, there is damage to the nerve endings supplying the ischemic bowel, which relieves the pain, but the patient's blood counts continue to increase as infarcted tissue acts as a breeding ground for infection.

Although there is a difference in age at which a particular volvulus occurs, in adults, the sigmoid colon is the most affected, followed by the cecum, while in children, the small intestine is more commonly involved. There are various risk factors that are common at all ages, including intestinal malrotation, Hirschsprung disease, and abdominal adhesions (Ladd's bands or postsurgical). In children, most cases of volvulus are primary, i.e., due to congenital causes like abnormally long or short mesentery of affected organs, Ladd's band, or malrotation. High fiber diet, postsurgical adhesions and chronic constipation are identified as risk factors only in adults.

Within The Abdomen, There Are 4 Main Mesenteries And Hence, 4 Types Of Volvulus:

- Gastric volvulus
- Midgut volvulus
- Cecal volvulus
- Sigmoid volvulus

Sigmoid volvulus is the most common, accounting for 60% of cases of intestinal volvulus.

• Age Wise Distribution Of Different Types Of Volvulus Children

1. Mesenteroaxial gastric volvulus
2. Midgut volvulus

Adults

1. Organoaxial gastric volvulus
2. Cecal volvulus
3. Sigmoid volvulus

Gastric Volvulus:-

The stomach is a relatively uncommon site of volvulus. Patients with acute gastric volvulus typically present with epigastric pain, nausea, and vomiting. A useful clinical triad for identifying gastric volvulus, the Borchartd triad consists of sudden epigastric pain, intractable retching, and inability to pass a nasogastric tube into the stomach.

Gastric volvulus is usually divided into two main subtypes: organoaxial and mesenteroaxial. Organoaxial volvulus is far more common than mesenteroaxial volvulus and accounts for approximately two-thirds of cases of gastric volvulus.

Organoaxial volvulus occurs when the stomach rotates along its long axis and becomes obstructed, with the greater curvature being displaced superiorly and the lesser curvature located more caudally in the abdomen. The antrum rotates anterosuperiorly, and the fundus rotates posteroinferiorly. In adults, organoaxial volvulus most commonly occurs in the setting of a post traumatic or paraoesophageal hernia that allows the stomach to move abnormally along its long axis.

Mesenteroaxial volvulus is much less common than organoaxial volvulus. It occurs when the stomach rotates along its short axis, with resultant displacement of the antrum above the gastroesophageal junction. Rotation is usually partial (less than 180°) and is not associated with an underlying diaphragmatic defect. However, some patients may have a complex gastric volvulus, with both organoaxial and mesenteroaxial components.

Midgut Volvulus: -

Mesenteroaxial volvulus is much less common than organoaxial volvulus. It occurs when the stomach rotates along its short axis, with resultant displacement of the antrum above the gastroesophageal junction. Rotation is usually partial (less than 180°) and is not associated with an underlying diaphragmatic defect. However, some patients may have a complex gastric volvulus, with both organoaxial and mesenteroaxial components.

Conventional radiography usually yields nonspecific findings and is rarely helpful in making a diagnosis. On the other hand, fluoroscopic upper GI and small-bowel examinations may reveal the characteristic abnormal position of most of the small bowel in the right abdomen and the resultant abnormal location of the ligament of Treitz.

On upper GI images, the ligament of Treitz normally is located at or to the left of the left L1 pedicle. In patients with malrotation, the ligament of Treitz is abnormally positioned, usually below and to the right of the left L1 pedicle. In the presence of a midgut volvulus, the twisted segment (usually a proximal segment) of small bowel has a characteristic corkscrew-like appearance on fluoroscopic images.

At contrast enhanced computed tomography (CECT) swirling of vessels in the mesenteric root is seen at the site of the volvulus. CT also allows detailed evaluation of the bowel, especially to look for signs of malrotation like change in superior mesenteric vessel relationship to anteroposterior or complete reversal with abnormal location of duodenojejunal flexure at the midline to the opposite side of the gastric fundus, along with abnormal placement of small and large bowel loops and ischemia like abnormal enhancement or non-visualization of the bowel wall with or without omental infarcts.

Cecal Volvulus: -

Cecal volvulus accounts for ~10% of all intestinal volvulus. They occur in comparatively younger patients ~30-60 years old, as compared with sigmoid volvulus. Congenital failure of bowel fixation to the retroperitoneum is a common predisposing factor as it allows the proximal colon to be free and mobile and thus prone to twisting. Acquired causes include those which cause restriction of the bowel at a fixed point, like an adhesion, abdominal mass or scarring from calcified lymph nodes, around which the bowel rotates. There are two types of cecal volvulus: Cecum twists in the axial plane, there is rotation in a clockwise or counter-clockwise direction around the long axis, which relocates cecum in the right lower quadrant, and Loop type of cecal volvulus, there is both twist and inversion such that the cecum occupies the left upper quadrant of the abdomen. The terminal ileum is also twisted along with the cecum. A gas-filled appendix can be seen.

This variant is more prone to causing small bowel obstruction as the terminal ileum is also involved. There is another variant called "cecal bascule". It occurs when the cecum folds anteriorly without any torsion due to its loose attachment to its mesentery.

The plain radiograph imaging of colonic volvulus is characteristic and often sufficient for diagnosis. There is marked distension of the large bowel loop. The long axis of the distended loop extends from the right lower quadrant to the epigastrium or the left upper quadrant with the caliber of the cecum, often exceeding 9 cm.

The obstruction is usually complete; hence, the distal colon is empty and the proximal small bowel is distended. During the contrast enema, the distal colon collapses, and there is beak-like tapering at the level of the volvulus. At CT, the cecum appears dilated and abnormally positioned in the upper mid and left abdomen, with the long axis of the dilated segment tracking back to the level of the volvulus where the classical whirl sign is seen.

In cases of incomplete or recently resolved complete volvulus, a split wall sign is seen, which refers to mesenteric fat seen indenting or invaginating the wall of the bowel.

Transverse Colon Volvulus: -

It is the rarest site of colonic volvulus seen in < 5% of cases but is associated with the highest mortality. Abnormal fixation of the long mesentery of the transverse colon is the most common predisposing factor. Conventional radiography is not helpful. Contrast enema study shows the characteristic beaklike tapering at the level of twist. The diagnosis is usually made on CT, which shows proximal bowel

obstruction and the classic mesenteric swirl sign.

Sigmoid Volvulus: -

The sigmoid is the most common site of colonic volvulus and accounts for 60-75% of all cases of colonic volvulus. It is generally considered to be an acquired condition which occurs in old age because its prevalence increases among those with chronic constipation and sigmoid colonic redundancy secondary to high fiber diet, pregnancy, hospitalization or Chagas disease.

It is of two types: organoaxial volvulus and mesenteroaxial volvulus. Plain radiographic findings diagnostic of sigmoid volvulus include a large air-filled bowel loop arising from the pelvis and extending cranially beyond the level of the transverse colon called the northern exposure sign. Other features include the coffee bean sign i.e. coffee bean-like shape that the dilated sigmoid colon

The closed-loop sign, which describes the U-shaped closed-loop appearance of the colon dilated between the two points of obstruction at the site of the volvulus; white-stripe sign, the obliquely oriented vertical white lines that represent the opposed walls of the dilated bowel loop (the center line) and the outer walls of the bowel loop on either side i.e. three-line sign. In an enema study, the beak sign is seen as similar to the cecal volvulus. It may also help to achieve a reduction of the volvulus. At CT, the signs are similar to cecal volvulus.

MATERIALS & METHODS: -

Outdoor and indoor patients referred to radiodiagnosis Department of Radiology, Pandit Deendayal Upadhyay Government Medical College & Civil hospital, Rajkot, Gujarat, India, for X-ray and Computed Tomography with clinical parameters suggesting gastrointestinal volvulus were included in the study.

25 adult patients with surgically confirmed GI volvulus were included.

Inclusion Criteria:

- Age ≥ 18 years
- Underwent both X-ray and/or CT imaging before surgery
- Operative confirmation of volvulus

Exclusion Criteria:

- Incomplete imaging records
- No surgical confirmation

RESULTS: -

Table 1: - Sex Distribution Of Various Pathologies In Studied Population.

SEX	NO. OF PATIENTS	PERCENTAGE (%)
MALE	15	60%
FEMALE	10	40%
Total	25	100%

Table 2: - Type Of Volvulus.

VOLVULUS TYPE	NO. OF PATIENTS	PERCENTAGE (%)
SIGMOID VOLVULUS	13	52%
CECAL VOLVULUS	6	24%
MIDGUT VOLVULUS	4	16%
GASTRIC VOLVULUS	2	8%
Total	25	100%

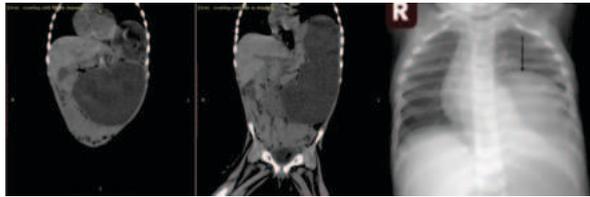
Table 3: - X-ray And Ct Findings.

X-RAY FEATURE	NUMBER OF CASES (n=25)
COFFEE BEAN SIGN	9 (all sigmoid cases)
DISTENDED BOWEL LOOPS	12
NONSPECIFIC GAS PATTERNS	7
NORMAL X-RAY	3
CT FEATURE	NUMBER OF CASES (n=25)
WHIRL SIGN	19
BEAK SIGN	14
BOWEL WALL THICKENING / ISCHEMIA	6
CLOSED LOOP OBSTRUCTION	8
PNEUMATOSIS INTESTINALIS	2

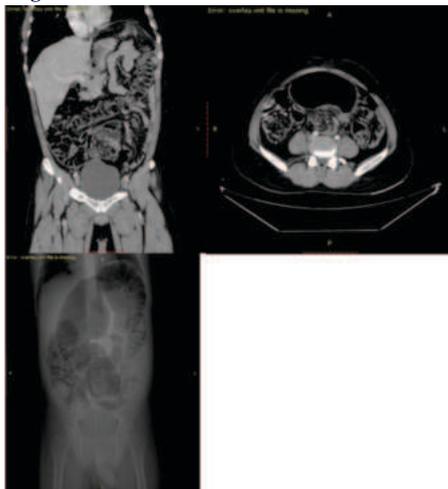
In a Tertiary care setting with access to CT, it should be used whenever possible, especially when:

- X-ray is inconclusive
- The patient is worsening
- Bowel ischemia is suspected

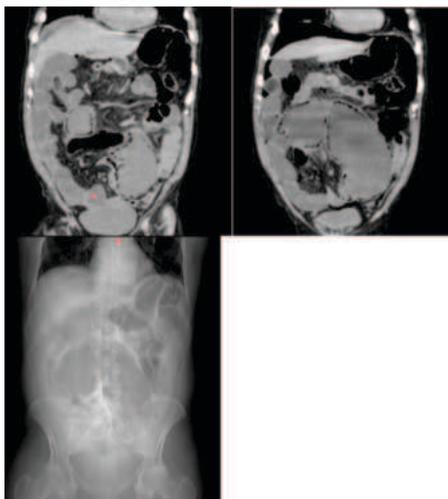
Case 1: - Gastric Volvulus



Case 2: - Sigmoid Volvulus



Case 3: - Cecal Volvulus



DISCUSSION:-

Volvulus of the gastrointestinal (GI) tract is a common cause of acute abdominal pain that requires prompt diagnosis. Radiologists play a crucial role in diagnosing and evaluating the etiology of volvulus using imaging techniques such as plain radiography, fluoroscopy, and computed tomography (CT). The condition involves the torsion of a bowel segment around its mesentery, which can lead to lumen narrowing and compromised blood supply. Initial compromise affects the veins, causing venous stasis and mesenteric injection. If uncorrected, this can progress to venous infarction and bowel perforation. Arterial compromise may also occur, leading to frank bowel ischemia.

Sigmoid volvulus is the most frequent type, accounting for 60%-75% of intestinal volvulus cases. It is generally considered an acquired condition in older adults and is associated with chronic constipation and a high-fiber diet. In adults, the cecum is the next most affected site, while in children, the small intestine is more commonly involved. The

article presents a study of 25 adult patients with surgically confirmed GI volvulus. The study's results are consistent with the general prevalence, showing that sigmoid volvulus was the most common type, occurring in 13 patients (52%). Cecal volvulus was found in 6 patients (24%), midgut volvulus in 4 patients (16%), and gastric volvulus in 2 patients (8%). The male-to-female ratio in the study population was 15 males (60%) to 10 females (40%).

X-ray: While not always conclusive, X-rays can show characteristic signs. The "coffee bean sign" was a specific finding for sigmoid volvulus, present in all 9 cases where it was observed. Other X-ray findings included distended bowel loops (12 cases) and non-specific gas patterns (7 cases), while 3 patients had a normal X-ray.

CT: CT is highly effective, especially when X-rays are inconclusive or ischemia is suspected. The most common CT feature was the "whirl sign," found in 19 of the 25 patients. Other significant CT findings included the "beak sign" (14 cases), "closed loop obstruction" (8 cases), and signs of complications such as bowel wall thickening/ischemia (6 cases) and pneumatosis intestinalis (2 cases).

This data underscores the importance of a multi-modal approach to diagnosing volvulus. While plain radiographs can provide initial clues, CT is essential for definitive diagnosis, evaluating the extent of bowel compromise, and guiding surgical planning.

CONCLUSION:-

Imaging plays an indispensable role in diagnosing GI volvulus. The study confirms the high prevalence of sigmoid volvulus and highlights the diagnostic power of CT. While X-ray can offer initial clues, CT is essential for definitive diagnosis, particularly for identifying complications and guiding surgical intervention in a tertiary care setting.

REFERENCES:-

1. Peterson CM, Anderson JS, Hara AK, Carezza JW, Menias CO. Volvulus of the gastrointestinal tract: appearances at multimodality imaging. *Radiographics* 2009;29(5):1281-93. doi: 10.1148/rg.295095011.
2. Burrell HC, Baker DM, Wardrop P, Evans AJ. Significant plain film findings in sigmoid volvulus. *Clin Radiol* 1994;49(5):317-9. doi: 10.1016/s0009-9260(05)81795-7.
3. McAlister WH, Kronemer KA. Emergency gastrointestinal radiology of the newborn. *Radiol Clin North Am* 1996;34(4):819-44.
4. Pandey S, Paudel M, Parajuli A, Ghimire R, Neupane A. Mesenteroaxial gastric volvulus: a case report. *JNMA J Nepal Med Assoc* 2021;59(237):506-9. doi: 10.31729/jnma.6519.
5. Hanceriogullari O, Senocak R, Kaymak S, Lapsekili E, Sinan H. An uncommon cause of acute abdomen in an acromegalic patient: colonic volvulus. *Ann Ital Chir* 2018; 89: 572-6.
6. Eisenberg R, Levine M. Miscellaneous abnormalities of the stomach and duodenum. In: Gore RM, Levine MS, eds. *Textbook of Gastrointestinal Radiology*. 2nd ed. Philadelphia, PA: Saunders; 2000. p. 675.
7. Bernstein SM, Russ PD. Midgut volvulus: a rare cause of acute abdomen in an adult patient. *AJR Am J Roentgenol* 1998;171(3):639-41. doi: 10.2214/ajr.171.3.9725289.