

COMMON MESENTERY : DIAGNOSIS, COMPLICATIONS AND PITFALLS

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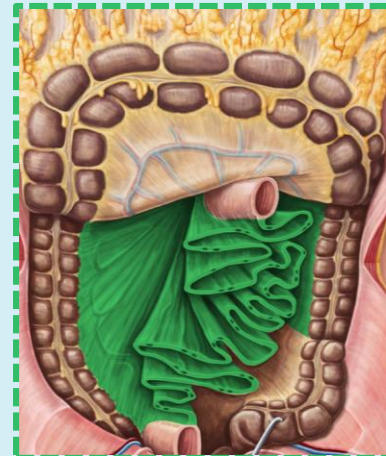
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ANATOMY AND EMBRYOLOGY :

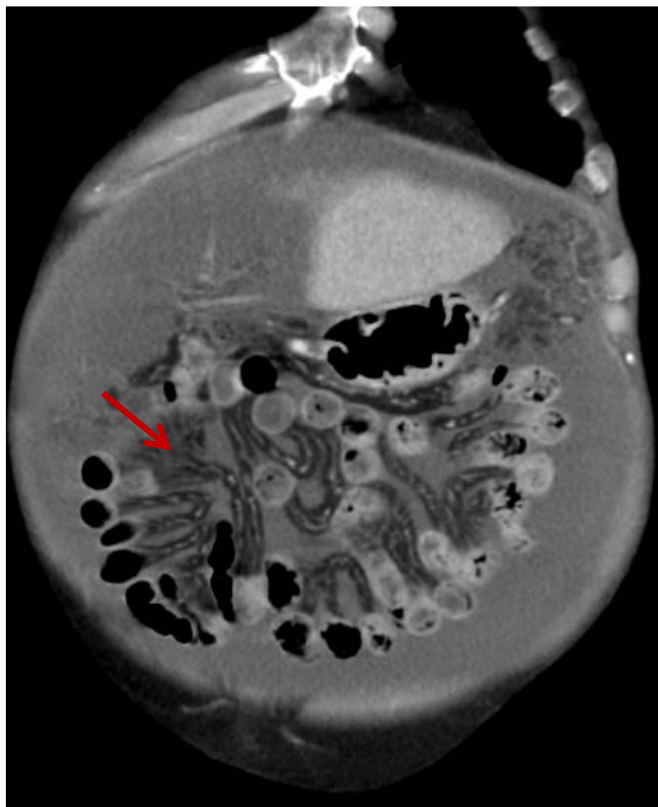
DEFINITION

- ✧ The mesentery is a double layer of peritoneum that encloses the intestines and attaches them to the posterior abdominal wall
- ✧ The term was originally used to refer to the supporting tissue suspending the jejunum and ileum, but its **meaning has been widened** :
- Anatomically, the mesentery is considered as one and the same continuous entity that includes :
 - ❖ **Small bowel mesentery** (mesentery proper): suspends the jejunum & ileum
 - ❖ Mesoappendix: peritoneum of the vermiform appendix
 - ❖ Transverse mesocolon: peritoneum of the transverse colon
 - ❖ Sigmoid mesocolon: peritoneum of the sigmoid colon



SMALL BOWEL MESENTERY

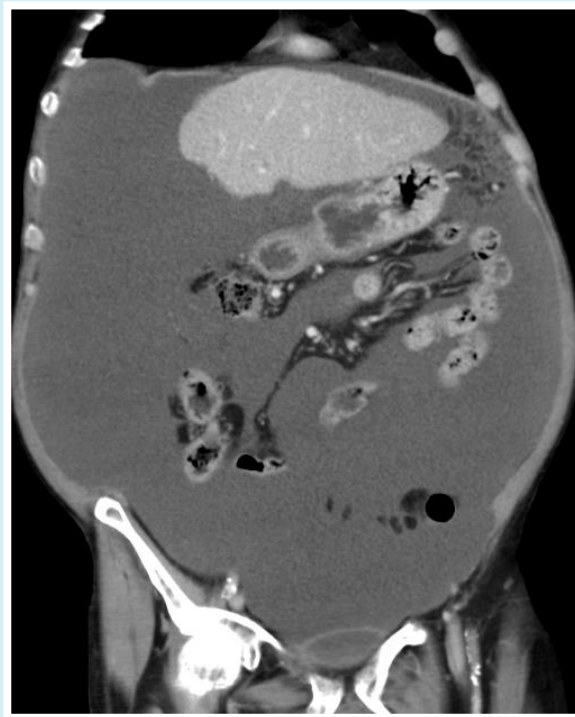
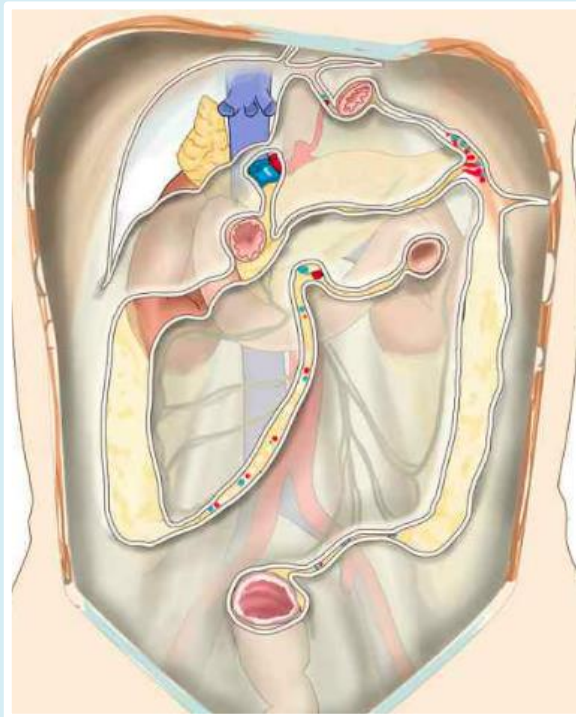
- ✧ Supplying **blood vessels**, lymphatics, nerves and storing fat



Small bowel mesentery presents as a **fan-shaped fatty structure** traveled by blood vessels

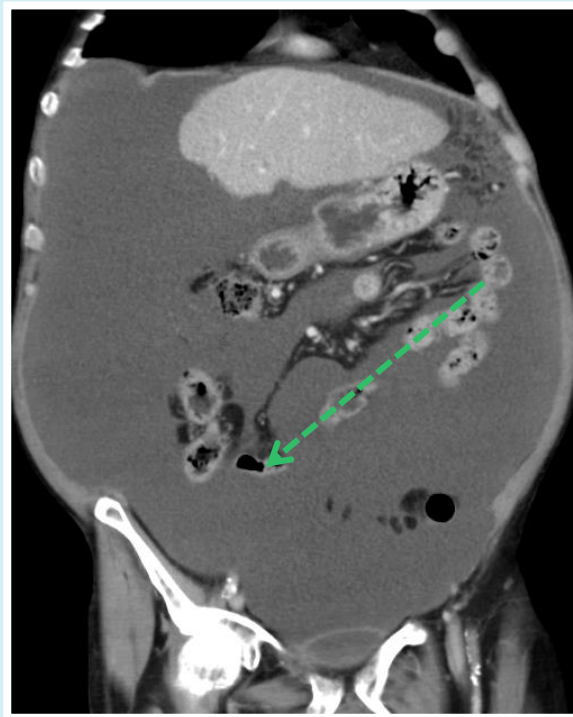
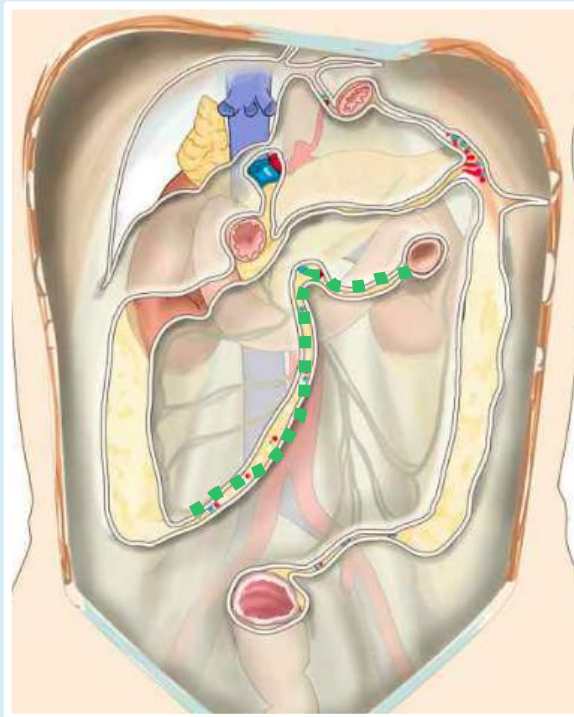
SMALL BOWEL MESENTERY

- ✧ Arises from the mesentery root which attaches the intestines to the posterior abdominal wall :
 - Average length : 15-20cm
 - Directed **obliquely downward and rightward** from the duodenojejunal flexure to the ileocaecal junction



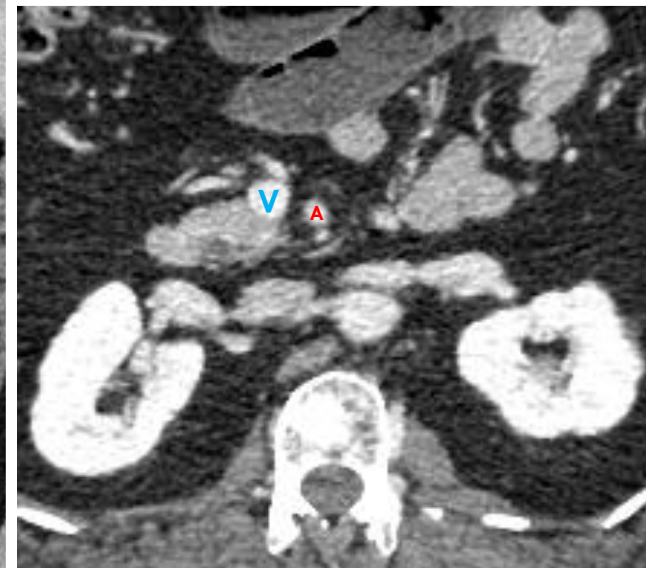
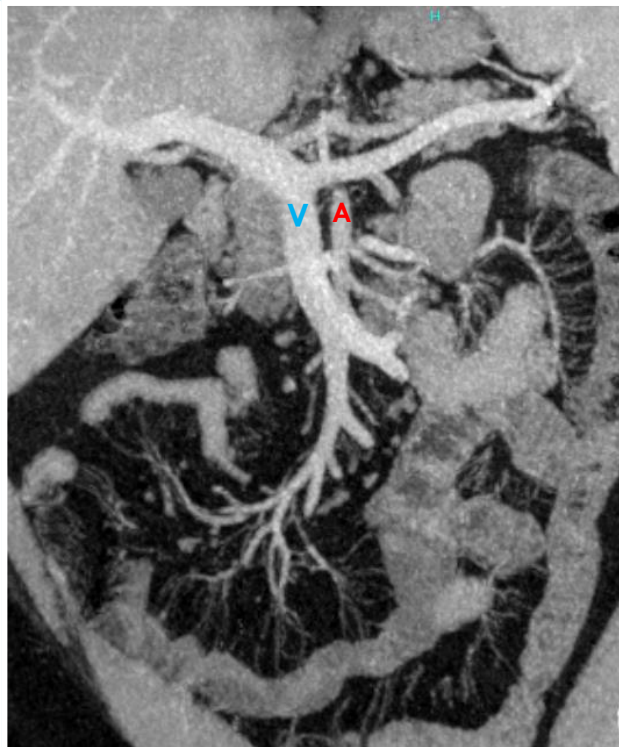
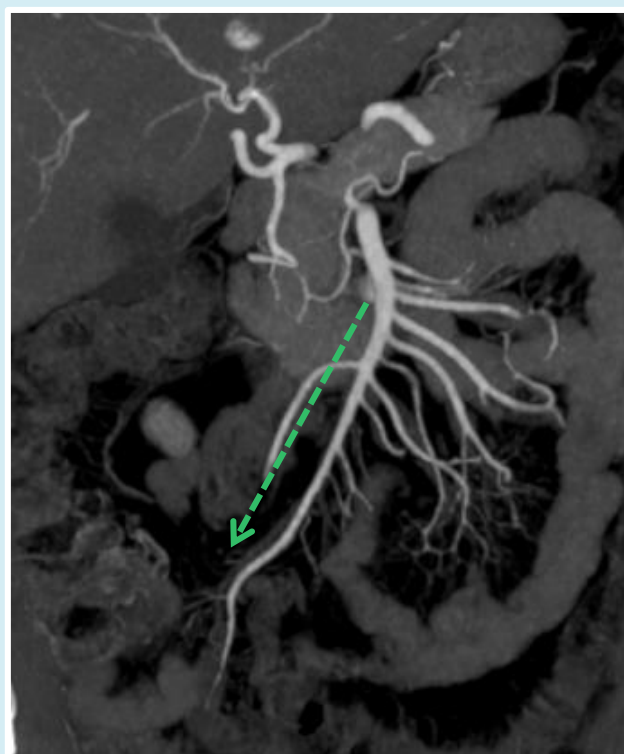
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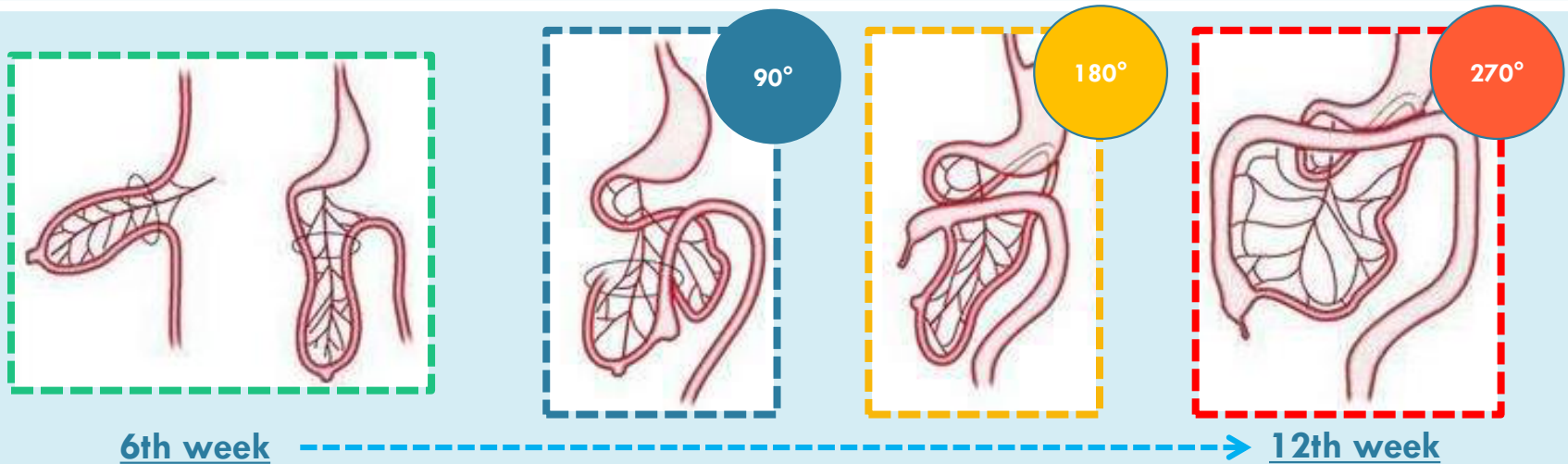


SMALL BOWEL MESENTERY

- ✧ Axed on superior mesenteric artery
- ✧ Modal SMA/SMV relationship :
 - Superior mesenteric artery (SMA) oblique downward and rightward, **to the left of the vein**
 - Superior mesenteric vein (SMV) located **on the right side of the SMA**



EMBRYOLOGY



6th week

12th week

- ✧ The primitive gut grows outside the abdominal cavity
- ✧ Then **3 successive 90° counterclockwise rotations** occur, axed on the SMA :
 - With **concomitant reintegration** inside the abdominal cavity
 - Traversing of the **duodenum to the left side of the abdomen** (forming the ligament of Treitz)
 - Migration of the **ileo-caecal junction to the lower right** abdominal quadrant
 - The fixation of the full-length bowel is complete during the twelfth week

COMMON MESENTERY :

EPIDEMIOLOGY

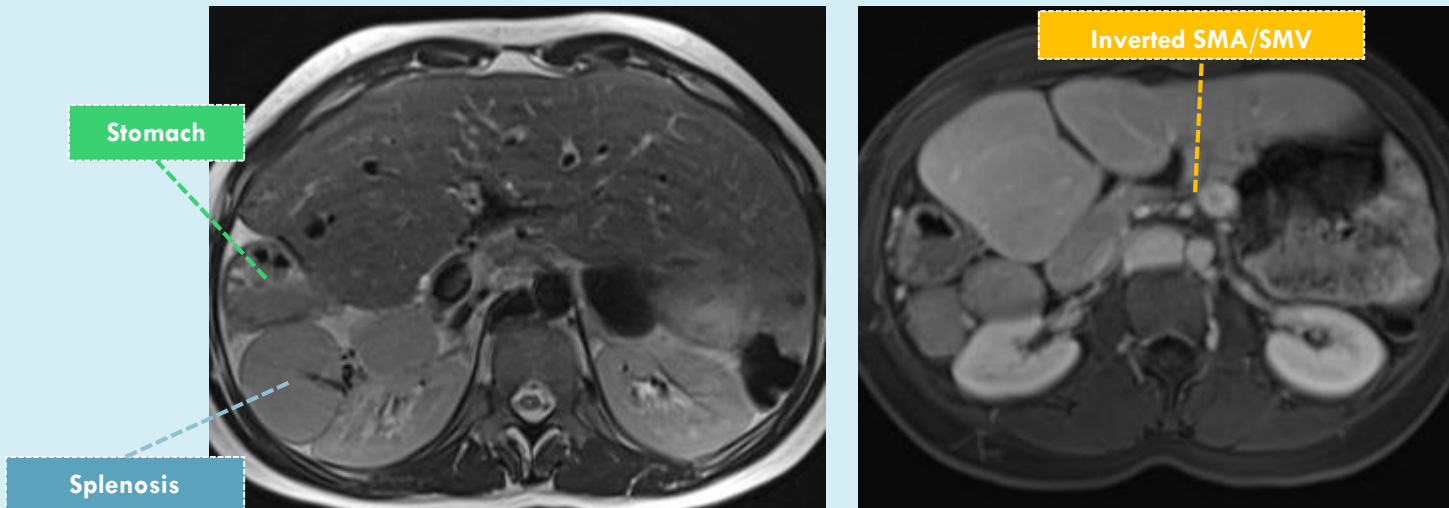
- ✧ Midgut rotation anomalies are frequent
- ✧ Estimated prevalence of malrotation ranges from 1 in 200 to 1 in 500 live births
- ✧ Improved radiological facilities, including multi-detector CT-scans, provide new possibilities with increasing anatomical aberrations identification

MIDGUT ROTATION ANOMALIES

- ✧ Impaired embryological development of the gut, incomplete rotation and/or failure of fixation may cause abnormalities in its location and arrangement
- ✧ Depending on the **stage during which failure occurs**, a spectrum of various congenital midgut rotation anomalies may happen :
 - **Premature stop** of the rotation :
 - ❖ **Complete** common mesentery at **90°** : called “intestinal nonrotation”
 - ❖ **Incomplete** common mesentery at **180°** : called “intestinal malrotation”
 - **Reverse** rotations : 90° or 180° **clockwise** intestinal rotation

MIDGUT ROTATION ANOMALIES

- ❖ Other abdominal anomalies are frequent (~50% of cases), causative and/or merely associated :
 - **Gastroschisis & omphalocele** (always associated with a rotation anomaly)
 - **Heterotaxy** (malrotation associated in 70% of cases)
 - Duodenal atresia, stenosis or web
 - Congenital diaphragmatic herniation, choanal atresia ...

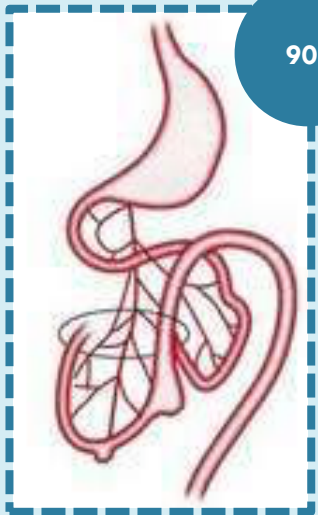


Situs inversus associated with common mesentery

COMPLETE COMMON MESENTERY AT 90°

✧ Embryological gut rotation stops after a single 90° counterclockwise rotation :

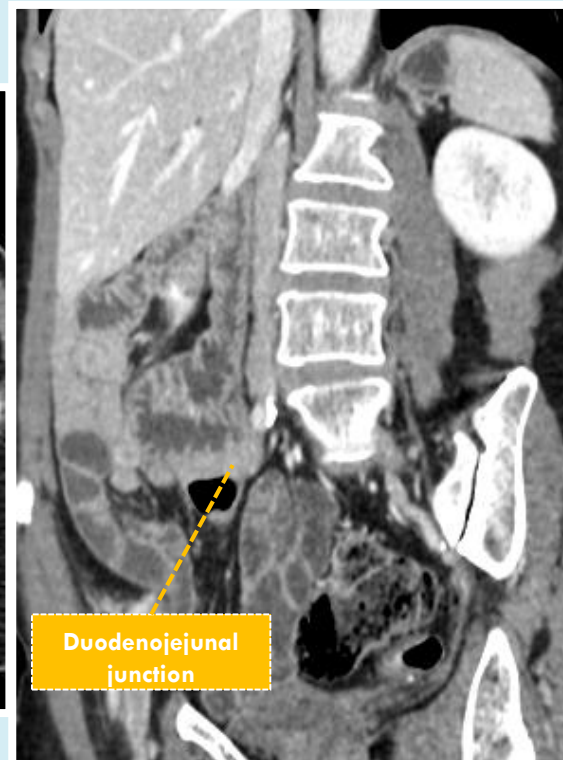
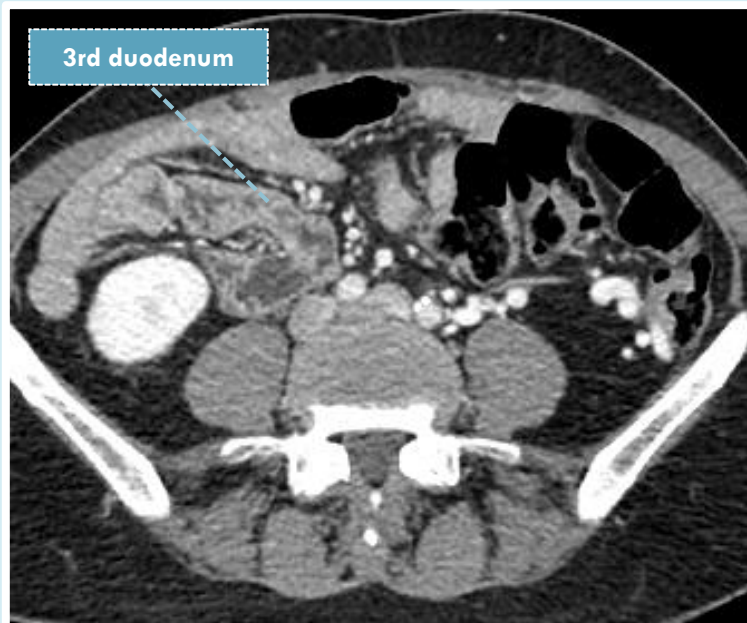
- Small bowel is found exclusively on the right side of the abdomen
- The whole colon is located on the left side of the abdomen
- Cecum is displaced in the lower left quadrant



Note : The term “nonrotation” employed in the literature is therefore inappropriate

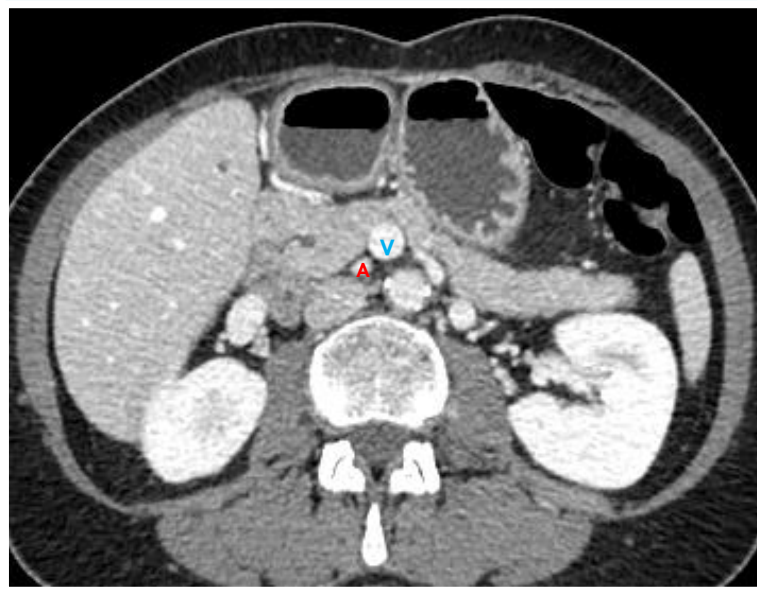
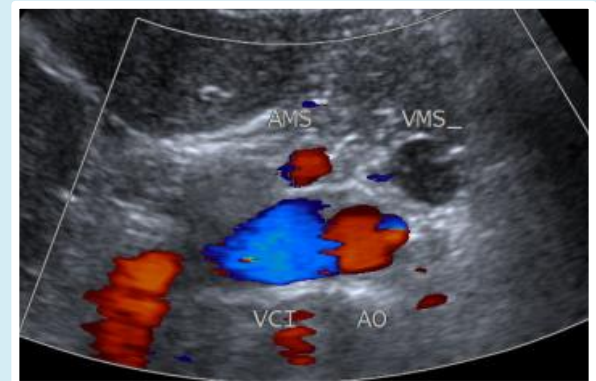
COMPLETE COMMON MESENTERY AT 90°

- The ligament of Treitz is displaced inferiorly and rightward
- Duodenojejunal junction located to the right of the rachis
- Absence of 3rd portion of the duodenum in the aortomesenteric compass



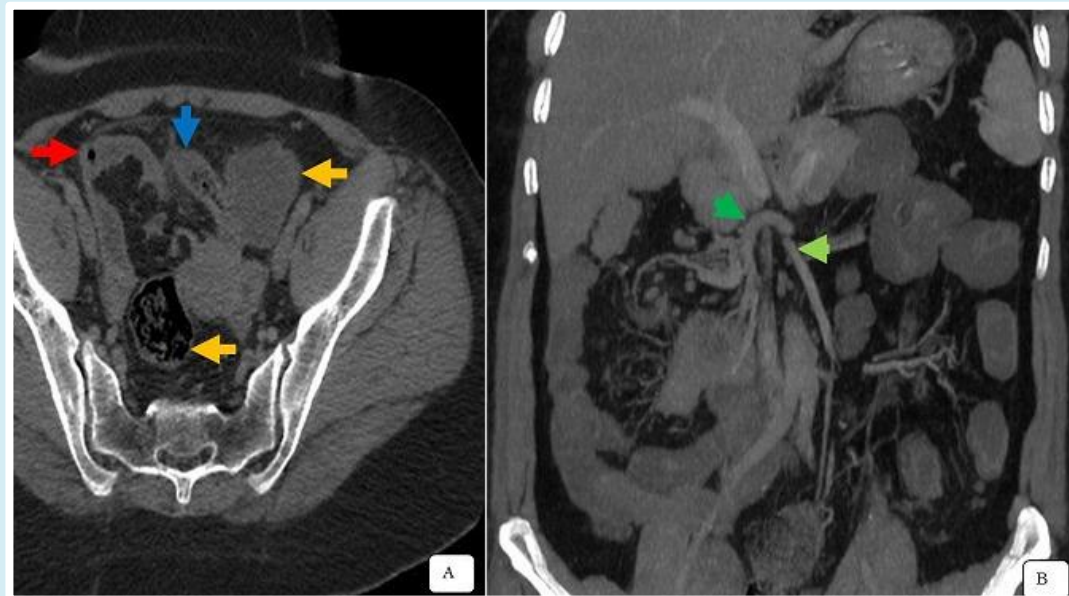
COMPLETE COMMON MESENTERY AT 90°

- Inverted superior mesenteric vessels relationship :
 - ❖ Superior mesenteric **artery positioned on the right**
 - ❖ Superior mesenteric **vein positioned on the left**



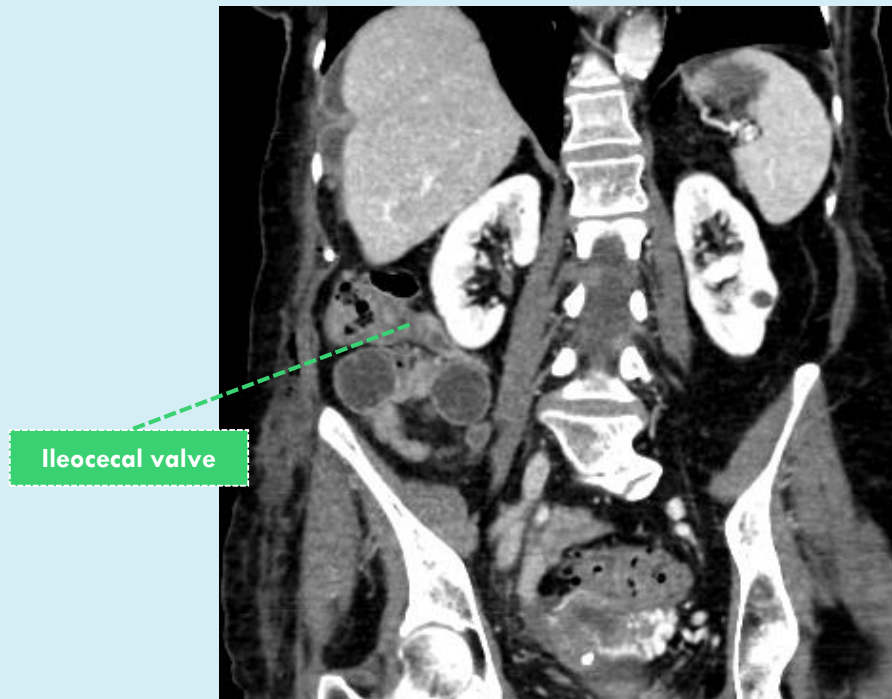
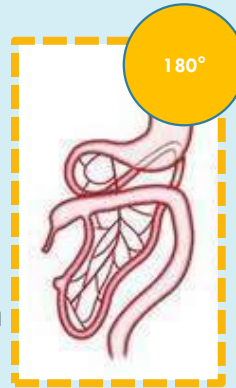
COMPLETE COMMON MESENTERY AT 90°

- ✧ Insignificant rate of complication : **do not require preventive surgery**
- ✧ May be discovered incidentally in patients with ectopic appendicular syndrome :



INCOMPLETE COMMON MESENTERY AT 180°

- ✧ Embryological gut rotation stops after **2x90° counterclockwise rotations** :
 - Absence of 3rd portion of the duodenum in the aortomesenteric compass
 - Small bowel mesentery has an unusually **narrow base**, favoring midgut volvulus
 - Small bowel found predominantly on the right side of the abdomen
 - Absence of cecum in the right iliac fossa : displaced to epigastrium / right hypochondrium



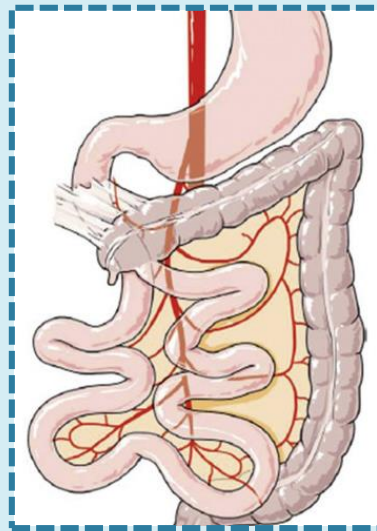
INCOMPLETE COMMON MESENTERY AT 180°

- Inverted superior mesenteric vessels relationship :
 - ❖ Superior mesenteric **artery positioned on the right**
 - ❖ Superior mesenteric **vein positioned on the left**



INCOMPLETE COMMON MESENTERY AT 180°

- **Ladd's bands** : fibrous stalks of peritoneal tissue attaching the cecum to the posterior abdominal wall, coursing **over the 2nd portion of the duodenum**
- Their relevance lies in predisposition to :
 - ❖ Small bowel obstruction by **volvulus** or internal hernias
 - ❖ Extrinsic compression and obstruction of 2nd portion of the duodenum



They are usually not visualized directly in imaging

COMMON MESENTERY DIAGNOSIS

APPEALING SIGNS :

- Absence of cecum in the right iliac fossa
- Small bowel predominant on the right side of the abdomen
- Malposition of superior mesenteric vessels

SPECIFIC SIGNS :

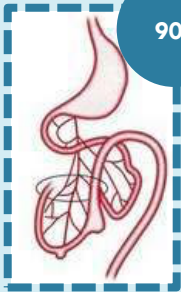
- Absence of 3rd portion of the duodenum in the aortomesenteric compass
- Right-sided duodenojejunal junction

THE CECUM POSITION DETERMINES THE TYPE :

- Lower left quadrant = complete common mesentery at 90° (*nonrotation*)
- Epigastrium / right hypochondrium = incomplete common mesentery at 180° (*malrotation*)

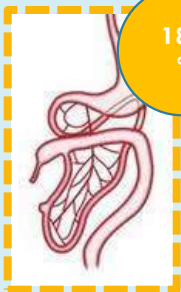
COMPLICATIONS

EPIDEMIOLOGY



✧ Complete common mesentery at 90° (*nonrotation*) :

- Considered as a **non pathologic condition**
- Insignificant rate of complication : **no preventive surgery**



✧ Incomplete common mesentery at 180° (*malrotation*) :

- In most of cases : remains entirely **asymptomatic over a lifetime**
- Complications are rare : symptomatic in only 1 in 6000
- Male predominance is observed in neonatal presentation (M/F ratio 2:1)
- No sexual predominance is observed in patients older than 1 year
- Traditional teaching suggests that up to 90% of symptomatic cases occur within the 1st year of life
- **But several recent studies report that over 40% of patients with a symptomatic malrotation were adults at the time of diagnosis**

CLINICAL MANIFESTATIONS OF MALROTATION

- ✧ They are related to **Ladd's bands**
- ✧ And favored by an exceptionally **short mesentery**
- ✧ The clinical presentation **correlates with the age** of onset

IN THE INFANTS

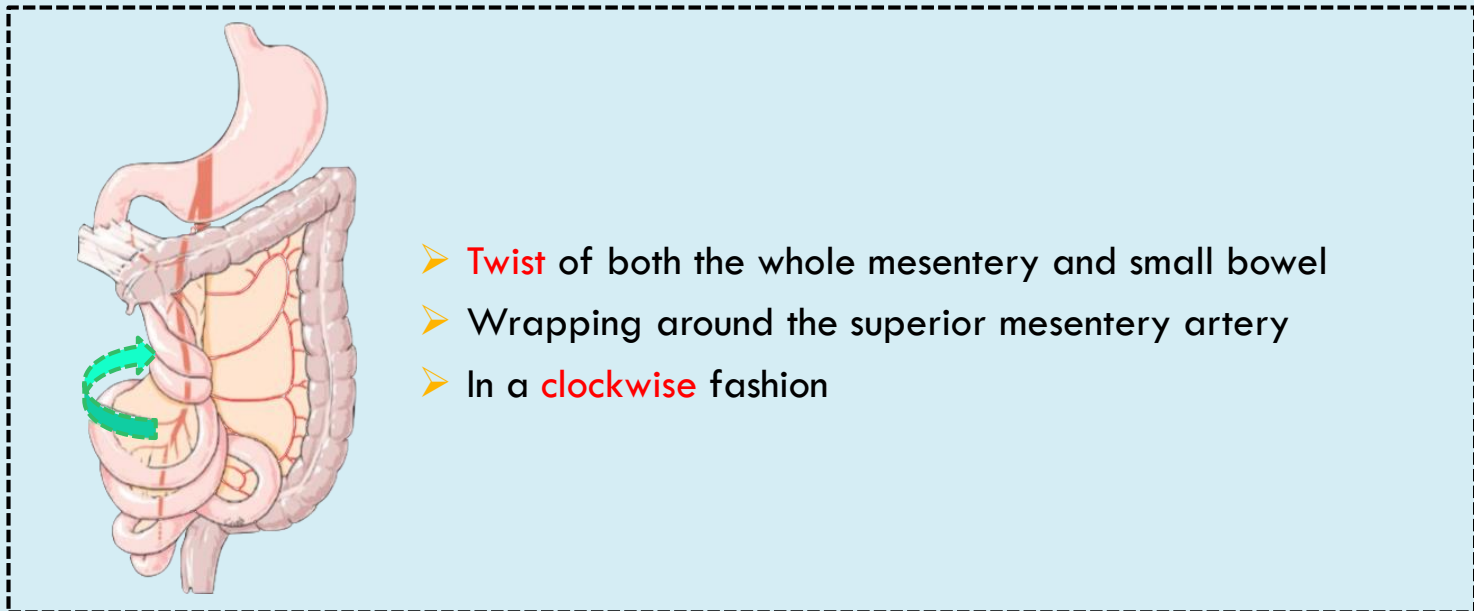
- The major complication is **small bowel volvulus**

IN THE OLDER PATIENTS

- Internal hernias
- Extrinsic compression of the 2nd duodenum
- Often less straightforward : intermittent episodes of intestinal obstruction or non-specific symptoms (episodes of abdominal pain, melaena, diarrhea, nutrition/thrive difficulties, weight loss, chylous ascites, mesenteric lymphocele...)
- Malrotation may also be an **incidental imaging finding**

SMALL BOWEL VOLVULUS

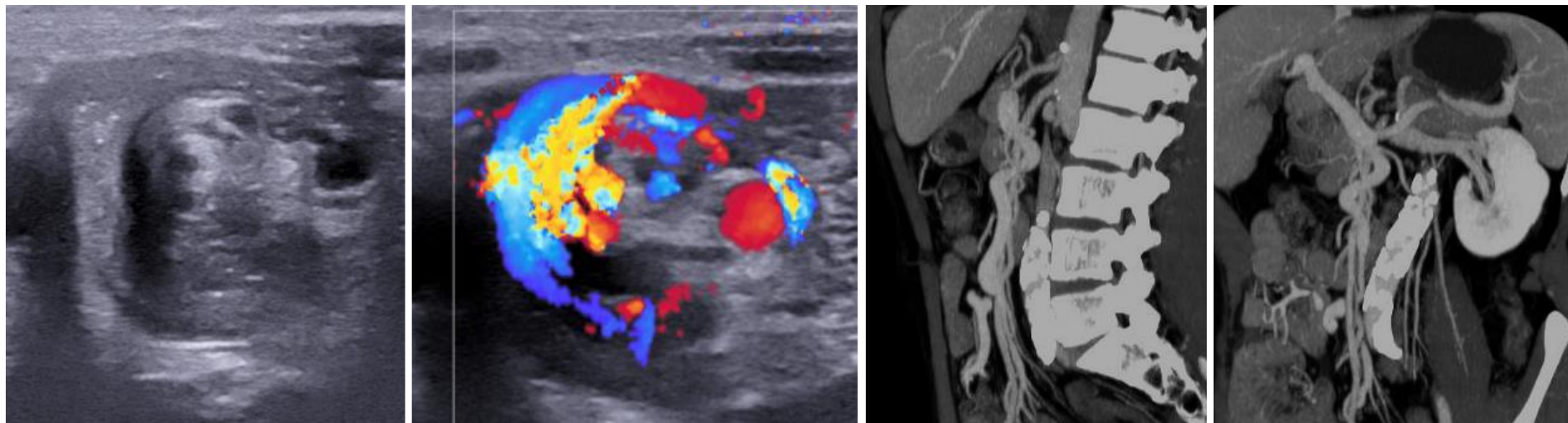
✧ Mechanism :



SMALL BOWEL VOLVULUS

✧ Imaging finding :

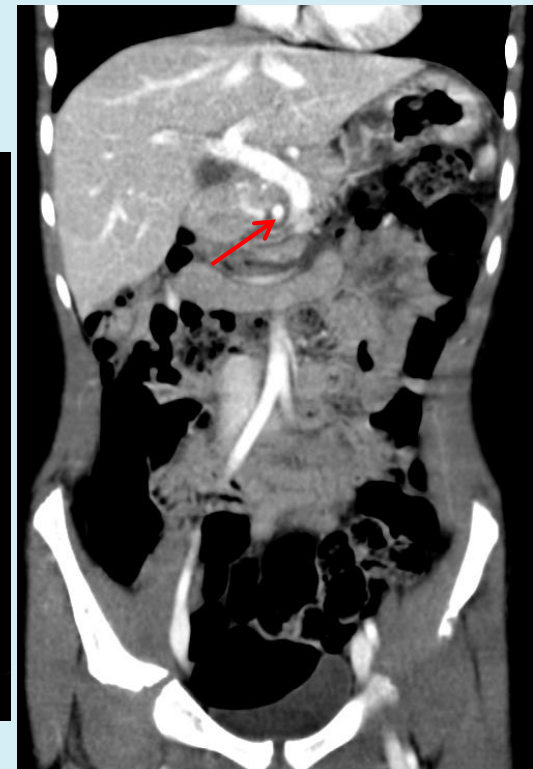
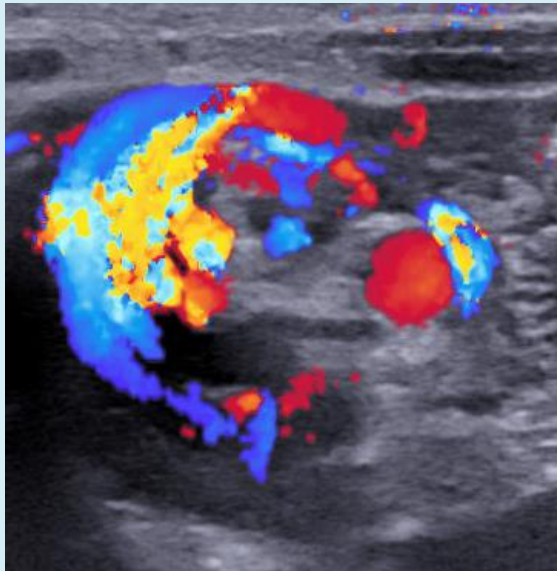
- Dilatation of bowel loops can be absent : brutal «flat abdomen» occlusion
- **Closed-loop** features : double beak sign with radial configuration of bowel loops
- Strangulation signs : venous engorgement and mesenteric edema
- Specific sign : **the whirl sign**



Clockwise swirl around arterial axis formed by bowel, mesentery and veins

SMALL BOWEL VOLVULUS

✧ 7 years old femal admitted for severe and brutal abdominal pain and vomiting :



- US and CT scan demonstrate a **clockwise whirl sign** corresponding to complete **small bowel volvulus** with mesentery wrapped around superior mesenteric vessels
- Absence of bowel loops dilatation is common in «flat abdomen» occlusion
- Right-sided SMA is evocative of underlying **incomplete common mesentery at 180°**

MANAGEMENT OF SMALL BOWEL VOLVULUS

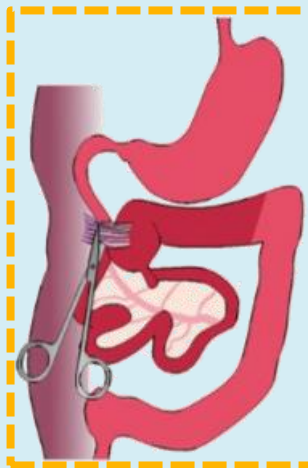
- ✧ **Strangulation** of mesenteric vessel and intestinal loops
- ✧ High risk of rapid **intestinal ischemic necrosis**
- ✧ **Life-threatening** surgical emergency : mortality ranges from 0-14%

➤ Ladd's procedure :



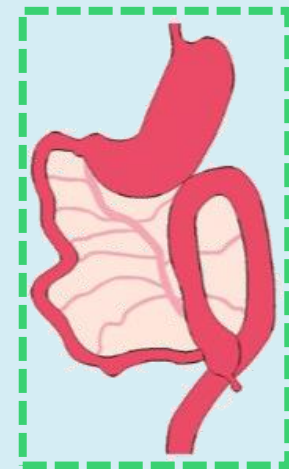
1

Manual devolvulation



2

Ladd's bands section



3

Arrangement in complete common mesentery configuration

MANAGEMENT OF ASYMPTOMATIC MALROTATION

- ✧ When **incidental recognition** of malrotation occurs, the need for prophylactic surgery might be in question
 - ✧ Intestinal malrotation may sometimes remain entirely asymptomatic for life
 - ✧ The risk for volvulus decreases with age
 - ✧ **No method for predicting which patients will develop volvulus**
- Consequently, a **conservative attitude** towards surgery is more reasonable in older child and adults

PITFALLS

RADIOLOGICAL FINDINGS MIMICKING COMMON MESENTERY

- ✧ Other midgut rotation anomalies :
 - Reverse rotations

- ✧ Non pathologic anatomic variations :
 - Ectopic cecum
 - Unusual SMA/SMV relationship without rotation anomalies

- ✧ Other cause of bowel obstruction :
 - Internal hernias

REVERSE ROTATIONS

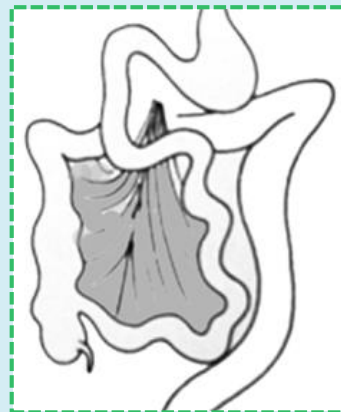
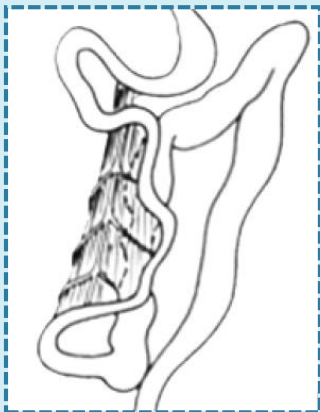
✧ Exceptional

✧ Embryology :

- First 90° counterclockwise rotation (normal)
- Then, instead of a further 90° counterclockwise rotation of the midgut, a series of reverse rotation occurs in a **clockwise direction**

✧ 2 different types :

- Reverse rotation at 90° - Reverse rotation at 180°

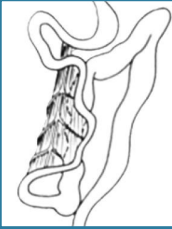


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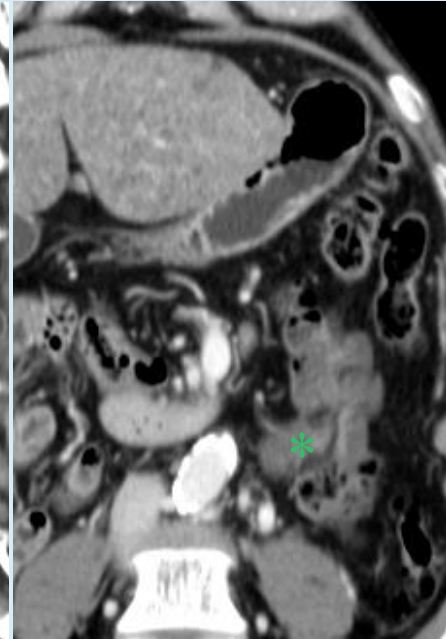
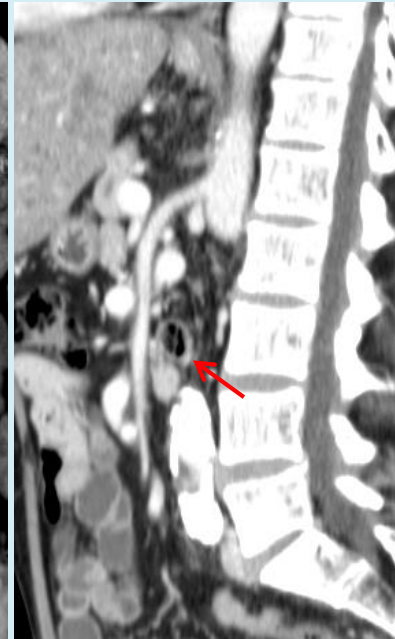
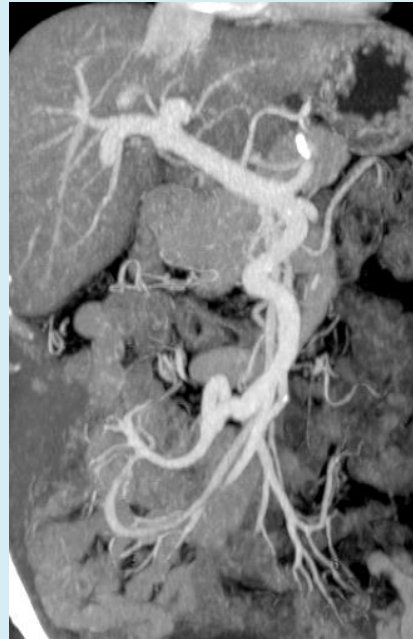
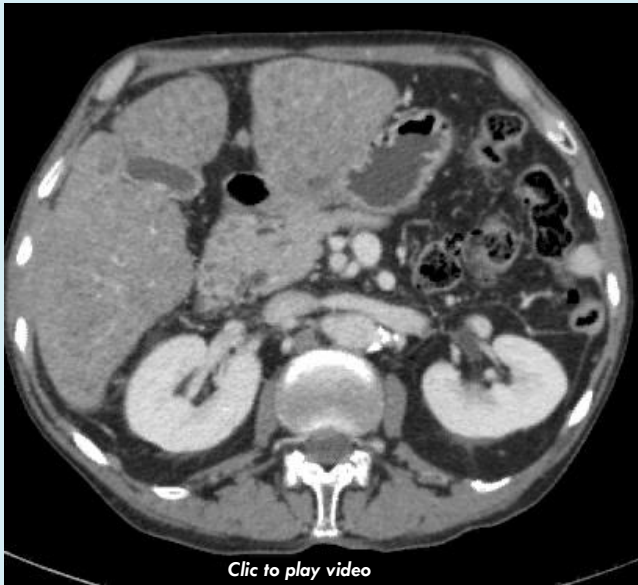
✧ Imaging findings

- Absence of 3rd portion of the duodenum in the aortomesenteric compass
- Duodenum passes forwards superior mesenteric vessels
- Transverse colon passes behind the superior mesenteric vessels
- Position of the cecum depends on the degree of reverse rotation

REVERSE ROTATIONS



✧ Reverse rotation at 90° :

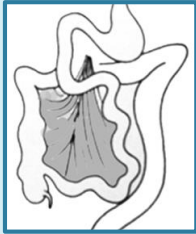


➤ 60 years old male : incidental detection of mesentery reverse rotation at 90°

- Duodenum is placed forwards superior mesenteric vessels
- Transverse colon passes backwards the mesentery (↑)
- Caecum is located to the left iliac fossa (*)
- Clockwise rotation of the mesentery

REVERSE ROTATIONS

✧ Reverse rotation at 180° :

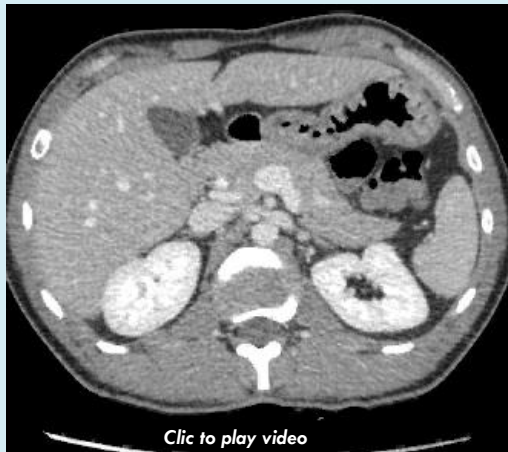


➤ 45 years old male : incidental detection of mesentery reverse rotation at 90°

- Duodenum is placed forwards superior mesenteric vessels (*)
- Transverse colon crosses behind the mesentery (↑)
- Caecum is located to the right iliac fossa (*)
- Clockwise rotation of the mesentery

REVERSE ROTATIONS

✧ Reverse rotation at 180° :



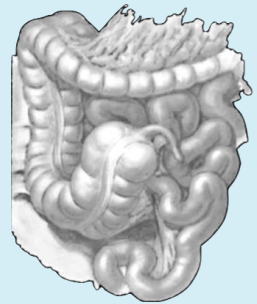
➤ 36 years old male with massive upper GI bleeding :

- 180° mesentery reverse rotation
- **Active bleeding at the venous phase (*)** in the duodenum lumen related to large varices upstream SMV stenosis
- Combined treatment by simultaneous percutaneous and endoscopic glue embolization

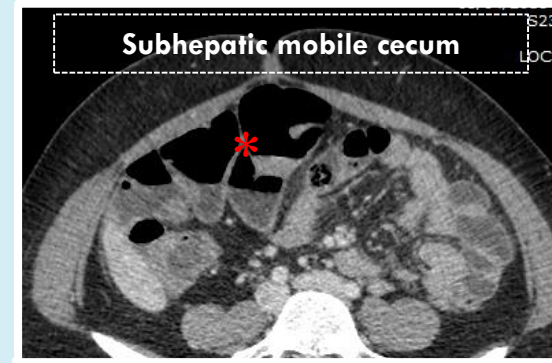
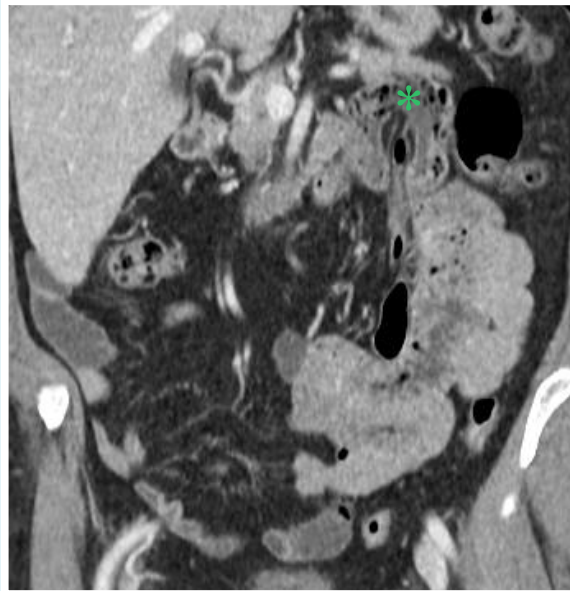
ECTOPIC CAECUM

- ✧ Default of attachment of Told's fascia involves **abnormal mobility** of the cecum
- ✧ Cecum can be ascended in the right hypochondrium or displaced to the left quadrants of the abdomen
- ✧ Mimicking anomaly of midgut rotation as common mesentery

- ✧ BUT :
 - Duodenum passes in the usual way through aortomesenteric space
 - Normal repartition of jejunum and ileum
 - Superior mesenteric vessels present with normal relationship



ECTOPIC CAECUM



- Mobile caecum mimicking anomaly of intestinal rotation
- Mesenteric vessels, 3rd duodenum and transverse colon present with anatomical disposition

INTERNAL HERNIA

✧ Right anterior paraduodenal hernia :

- Incarceration into the aortomesenteric space
- SMA is displaced
- Spheric repartition of bowel loops, with strangulation features
- May mimick a small bowel volvulus

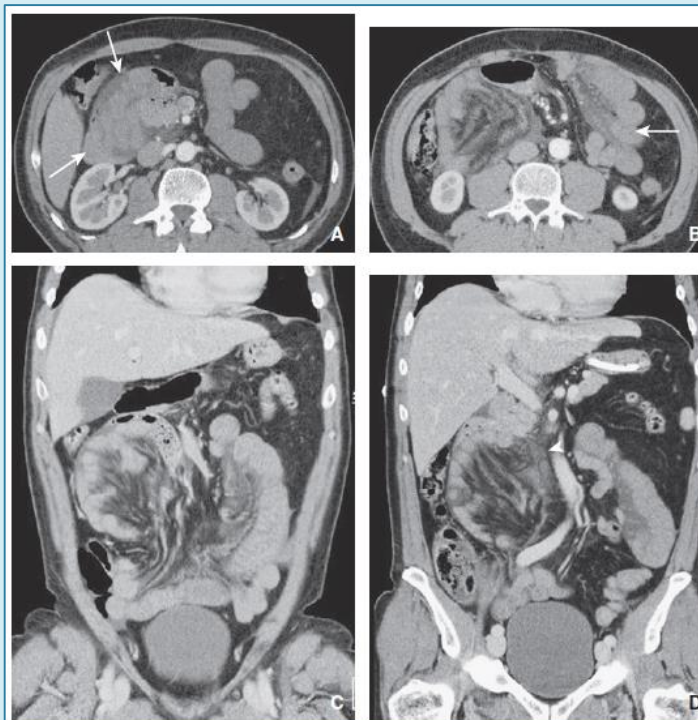
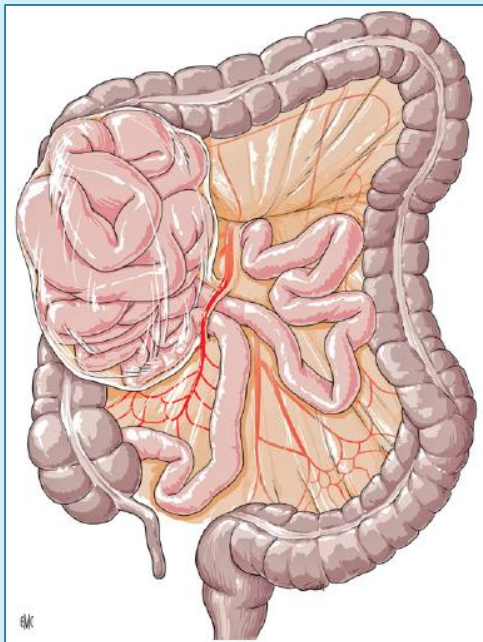


Figure 14. Hernie paraduodénale droite. Exploration scanographique. Le sac herniaire renfermant des anses en disposition « sac-like » (A) (flèches) se développe vers la droite à partir de la pince aortomésentérique élargie notamment dans sa partie distale (A, B). On observe des signes de congestion importante des anses afférentes (B) (flèche), bien visibles sur les reformations frontales (C, D) ; le siège de la convergence des veines des plis mésentériques est bien objectivé à la partie moyenne du tronc de l'artère mésentérique supérieure (D) (tête de flèche).

CONCLUSION

TAKE HOME MESSAGES

- ✧ Intestinal rotation anomalies are a frequent condition with increasing identification due to improved radiological facilities
- ✧ Diagnosis requires a step-by-step anatomic analysis :
 - 1 Absence of 3rd duodenum in the aortomesenteric compass is the pathognomonic sign common to all types of rotation anomalies
 - 2 The cecum position determines the type of common mesentery
 - 3 The transverse colon position differentiates common mesentery and reverse rotation
- ✧ Isolated ectopic cecum or unusual SMA/SMV relationship may be misleading
- ✧ Small bowel volvulus is the main complication of malrotation, featuring specific whirl sign

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