Midgut Nonrotation
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Section: Abdominal imaging
Case Type: Clinical Cases
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Patient: 31 years, male

Clinical History:
Patient was involved in a motor vehicle accident and sustained a pelvic fracture.

Imaging Findings:
Patient was involved in a motor vehicle accident and sustained a pelvic fracture. A CT of the abdomen and pelvis was ordered to rule out intra-abdominal injury. Portal venous phase imaging was obtained through the abdomen and pelvis. No bowel injury was identified, however, incidental note was made of a left sided colon and a right sided small bowel location which does not appear to cross the midline. Subhepatic small bowel is also documented. The superior mesenteric vessels are inverted in their position with the superior mesenteric vein (SMV) located to the left ventral aspect of the superior mesenteric artery (SMA) at the level of the pancreatic uncinate process.

Discussion:
Normally, the midgut undergoes 270 degrees of rotation around the axis of the SMA in between the fourth and eighth week of the developing embryo. Intestinal malrotation is defined as an anomaly of this rotation leading to anomalous fixation of the midgut [1]. This has been estimated to occur at a frequency of 1/200 to 1/500 of live births. It is often an isolated and asymptomatic finding discovered incidentally in adulthood but can exist as a component in a constellation of visceral anomalies. Examples include congenital diaphragmatic hernia, abdominal wall defects, duodenal atresia, situs inversus, left or right isomerism syndromes, cardiac anomalies [2]. Symptomatic cases are estimated to occur in only 1/6000 cases.

The most common abnormality is nonrotation of the colon and duodenum and is estimated to be an incidental finding in 0.2% of adults [2]. The primary loop of the midgut returns to the abdomen with no further rotation resulting in the duodenum and jejunum remaining to the right of the spine and a left sided colon. This is associated with a low risk of volvulus. Another type that occurs in much less frequency is that of malrotation where the midgut only undergoes a partial rotation of approximately 90 degrees. This results in the caecum in the mid-upper abdomen and fixated by Ladd bands of peritoneum which can cause duodenal obstruction.

Currently, upper gastrointestinal barium series are the study of choice in suspected cases, especially in the paediatric population. Radiologic evaluation should be initiated in cases of bilious emesis, acute duodenal obstruction, chronic abdominal pain, intermittent vomiting. Most intestinal malrotation cases are asymptomatic and are incidental findings on CT. Signs of intestinal malrotation on CT include right-sided small bowel, left-sided colon, abnormal relationship between the superior mesenteric vessels, and aplasia of the uncinate process [1]. Small bowel volvulus may also be present and is secondary to the malrotation or Ladd bands. The SMV rotation sign is a useful finding in cases of midgut malrotation [3]. The SMA runs through the centre of the midgut mesentery and is a very constant structure. The SMV lies on the side of the midgut mesentery and normally, the 270 degree rotation
results in a right ventral aspect in relation to the SMA. However, the absence of the rotation places the SMV to the left side of the SMA.

Other less common CT findings include hypoplasia or aplasia of the uncinate process. This may be caused by malpositioning of pancreatic buds or interruption of the normal rotation of the pancreatic primordium. Polyspenia, interrupted IVC with hemi/azygos continuation, preduodenal portal vein, and other pancreatic anomalies have been reported [2].

The Ladd procedure remains the cornerstone of surgical treatment for malrotation in symptomatic cases without signs of bowel ischemia. Classically, this involves reduction of the volvulus if present, division of Ladd bands, placement of small bowel on the right and large bowel on the left of the abdomen (nonrotation position), and appendectomy [4].

**Differential Diagnosis List:** Midgut nonrotation

**Final Diagnosis:** Midgut nonrotation

**References:**


Description: Coronal CT image shows the small bowel in the right side of the abdomen which does not cross the midline. The large bowels are predominantly left sided. Origin:
Description: Axial CT obtained through upper abdomen, shows superior mesenteric vein (white arrow) to the left of the superior mesenteric artery (black arrow) at the level of the pancreas. Origin: