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Discuss the rotation of the intestine

ROTATION OF INTESTINE

During normal abdominal development, the 3 divisions of the GI tract (ie, foregut, midgut, hindgut) herniate out from the abdominal cavity, where they then undergo a 270º counterclockwise rotation around the superior mesenteric vessels. Following this rotation, the bowels return to the abdominal cavity, with fixation of the duodenojejunal loop to the left of the midline and the cecum in the right lower quadrant.

Intestinal malrotation, also known as intestinal nonrotation or incomplete rotation, refers to any variation in this rotation and fixation of the GI tract during development. Interruption of typical intestinal rotation and fixation during fetal development can occur at a wide range of locations; this leads to various acute and chronic presentations of disease. The most common type found in pediatric patients is incomplete rotation predisposing to midgut volvulus, requiring emergent operative intervention. Intestinal malrotation occurs due to disruption of the normal embryologic development of the bowel. Understanding of normal abdominal development aids in the understanding of the etiology of the clinical findings seen with malrotation.

Normal embryologic development of the alimentary tract:

The alimentary tract develops from the embryologic foregut, midgut, and hindgut. Normal rotation takes place around the superior mesenteric artery (SMA) as the axis. It is described by referring to 2 ends of the alimentary canal, the proximal duodenojejunal loop and the distal cecocolic loop, and is usually divided into 3 stages. Both loops make a total of 270° in rotation during normal development. Both loops start in a vertical plane parallel to the SMA and end in a horizontal plane.

The list below:

* Stage I occurs between 5-10 weeks' gestation. It is the period of physiologic herniation of the bowel into the base of the umbilical cord. The duodenojejunal loop begins superior to the SMA at a 90° position and rotates 180° in a counterclockwise direction. At 180°, the loop is to the anatomical right of the SMA, and by 270°, it is beneath the SMA. The cecocolic loop begins beneath the SMA at 270°. It rotates 90° in a counterclockwise manner and ends at the anatomical left of the SMA at a 0° position. Both loops maintain these positions until the bowel returns to the abdominal cavity. Also during this period, the midgut lengthens along the SMA, and, as rotation continues, a broad pedicle is formed at the base of the mesentery. This broad base protects against midgut volvulus.
* Stage II occurs at 10 weeks' gestation, the period when the bowel returns to the abdominal cavity. As it return s, the duodenojejunal loop rotates an additional 90° to end at the anatomical left of the SMA, the 0° position. The cecocolic loop turns 180° more as it reenters the abdominal cavity. This turn places it to the anatomical right of the SMA, a 180° position.
* Stage III lasts from 11 weeks' gestation until term. It involves the descent of the cecum to the right lower quadrant and fixation of the mesenteries.

Nonrotation:

* Arrest in development at stage I results in nonrotation. Subsequently, the duodenojejunal junction does not lie inferior and to the left of the SMA, and the cecum does not lie in the right lower quadrant. The mesentery in turn forms a narrow base as the gut lengthens on the SMA without rotation, and this narrow base is prone to clockwise twisting leading to midgut volvulus. The width of the base of the mesentery is different in each patient, and not every patient with nonrotation develops midgut volvulus.

Incomplete rotation:

* Stage II arrest results in incomplete rotation and is most likely to result in duodenal obstruction. Typically, peritoneal bands running from the misplaced cecum to the mesentery compress the third portion of the duodenum. Depending on how much rotation was completed prior to arrest, the mesenteric base may be narrow and, again, midgut volvulus can occur. Internal herniations may also occur with incomplete rotation if the duodenojejunal loop does not rotate but the cecocolic loop does rotate. This may trap most of the small bowel in the mesentery of the large bowel, creating a right mesocolic (paraduodenal) hernia.

Incomplete fixation:

* Potential hernia pouches form when the mesentery of the right and left colon and the duodenum do not become fixed to the retroperitoneum. If the descending mesocolon between the inferior mesenteric vein and the posterior parietal attachment remains unfixed, the small intestine may push out through the unsupported area as it migrates to the left upper quadrant. This creates a left mesocolic hernia with possible entrapment and strangulation of the bowel. If the cecum remains unfixed, volvulus of the terminal ileum, cecum, and proximal ascending colon may occur.