



Malrotation and Volvulus

Due to the risk for loss of bowel, any infant with bilious emesis must be evaluated for malrotation and volvulus. Malrotation is in itself harmless, and an infant can have malrotation without a volvulus. However, because having malrotation places the infant at an increased risk for a midgut volvulus, surgical correction will be needed at some point.

Embryology

Normal Intestinal Rotation

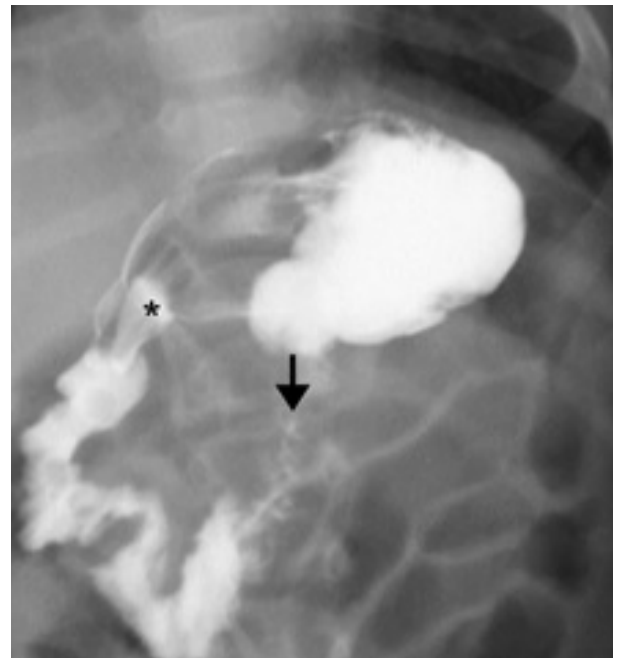
The duodenum makes a C-loop to the infant's left, and the third portion of the duodenum—at the ligament of Treitz—is to the left of the spine. The superior mesenteric artery (SMA) then runs in front of the third portion of the duodenum, and the mesentery attaches posteriorly from the left upper quadrant by the ligament of Treitz to the right lower quadrant by the cecum. This prevents the mesentery from twisting on itself. In the fourth week of gestation, the intestinal tract rapidly elongates, leaves the abdominal cavity, and undergoes rotational changes. The duodenum and colon both have to rotate 270 degrees counterclockwise, and the midgut needs to return to the abdominal cavity by the 12th week of gestation. If these events do not occur, malrotation or an incomplete rotation will result.

Abnormal Intestinal Rotation

When normal intestinal rotation fails to happen, the third portion of the duodenum lies to the right of the spine and the SMA never crosses it. There is a narrow mesenteric base that then connects the duodenojejunal junction with the cecum. The bands between the duodenum and cecum place the mesentery at risk for complete volvulus, because it cuts off the vascular supply to the SMA. This results in ischemic necrosis of the entire midgut from the duodenum to the proximal transverse colon.

Diagnosis

An upper gastrointestinal (GI) series is the gold standard for the diagnosis of malrotation and volvulus. Upon evaluation, contrast will leave the stomach and enter the duodenum. The duodenum will be to the right of the spine, the small intestine will be on the right side of the abdomen, and the colon will be on the left side of

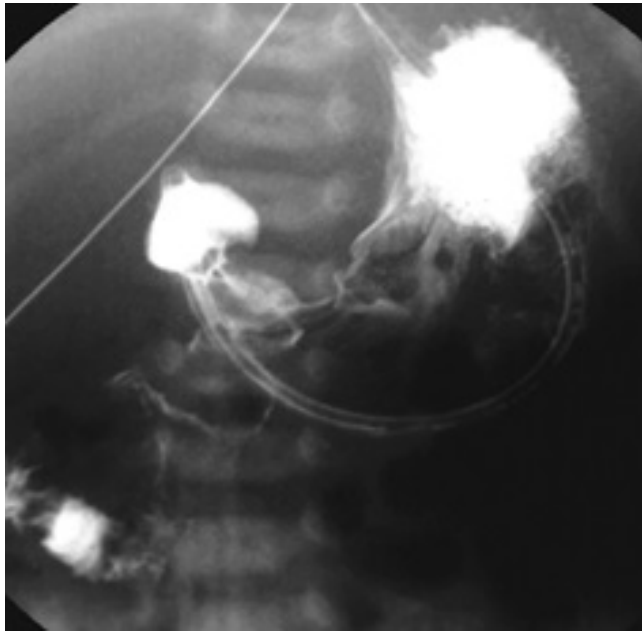


Malrotation. Arrow = inferior position of the duodenojejunal junction; * = duodenal bulb

From Applegate, K.E., Anderson, J.M., & Klatte, E.C. (2006). Intestinal malrotation in children: A problem-solving approach to the upper gastrointestinal series. RadioGraphics, 26, 1485–1500. Used with permission.

the abdomen. In an infant with a volvulus you will see a “corkscrew” or “beaking” appearance of the duodenum and proximal jejunum.

Other diagnostic tools that can be used are plain abdominal X rays and ultrasound. With abdominal X ray, when Ladd's bands are present a “double bubble” may be seen, or if a midgut volvulus is present, radiographic signs and symptoms similar to necrotizing enterocolitis may be seen. Ultrasound has been used to visualize a swirl or whirlpool pattern on Doppler of the SMA—which is useful in detecting volvulus—as well as free peritoneal fluid, portal venous gas, pneumatosis, and intestinal wall edema.



Malrotation with volvulus. "Corkscrew" appearance of duodenum to right of the spine

From Applegate, K. E., Anderson, J. M., & Klatte, E. C. (2006). *Intestinal malrotation in children: A problem-solving approach to the upper gastrointestinal series*. *RadioGraphics*, 26, 1485–1500. Reprinted with permission.

Treatment

Infants with suspected malrotation or volvulus will be given nothing by mouth (NPO) and have a Replogle tube placed to low intermittent wall suction. A peripheral intravenous (PIV) line will be placed and intravenous fluids will be started. Laboratory studies will be collected, especially a Type and Screen so the patient can go to the operating room, followed by complete blood count with differential and electrolytes. Additional fluids will be given to correct any fluid deficits. Prophylactic antibiotics also will be administered.

As initially stated, an infant presenting with bilious emesis must have a volvulus ruled out. If the patient is stable, an upper GI series should be performed immediately. If a volvulus is revealed, the patient is either immediately taken to the operating room for emergency surgery or bedside surgery is performed. As a bedside nurse, expect hypovolemia due to vomiting and third spacing of fluid.

Once in the operating room, the volvulus is addressed first by untwisting the intestine in a counterclockwise fashion that allows blood flow to be restored to the intestines. One must then assess the viability of the intestine. Only intestine that is necrotic should be resected; over-resection will lead to short bowel syndrome. If necessary, the surgeon will re-explore the abdomen at 24–48 hours to check the viability of the remaining intestine. Depending on the remaining bowel, an ostomy may need to be created.

After the volvulus has been corrected, the malrotation must be addressed to prevent reoccurrence. A Ladd's procedure is performed by widening the mesenteric base; any bands that cross anteriorly to the duodenojejunal junction are divided. The duodenum is then placed on the right side of the abdomen, and the cecum and ascending colon are placed on the left side of the abdomen. An appendectomy completes the Ladd's procedure. A laparoscopic approach also may be used, but it is not advised for patients with volvulus or at risk for volvulus, considering the time-sensitive nature of treatment. Advantages of a laparoscopic approach include less postoperative pain and quicker return to normal bowel function; however, its use and capability of avoiding recurrent volvulus is still controversial.

Postoperative Care

In the immediate postoperative period, routine postoperative nursing care is provided. A salem sump or Replogle is inserted and placed to low intermittent wall suction to maintain abdominal decompression. Pain is assessed at least every 4 hours using the appropriate pain assessment tool; appropriate analgesic therapy is then administered.

Many patients have a prolonged ileus, especially if a volvulus or bowel ischemia was present. Some will even have symptoms of duodenal dysmotility or a pseudo-obstruction. There is the possibility that a volvulus will occur again, so the infant should be monitored for several weeks after repair for the symptoms characteristic of a volvulus. A central line will be needed to provide adequate nutrition via parenteral nutrition and intralipids. Those who lost a



significant portion of bowel and are considered to have short bowel syndrome are faced with malabsorption and failure to thrive.

Once the return of bowel function has been achieved, enteral feedings will be initiated. The extent of the injury will determine how quickly feedings will be advanced. During this time, the bedside nurse will observe signs and symptoms of feeding intolerance. As the patient advances on enteral feedings, parenteral nutrition is titrated to meet total fluid needs and is eventually discontinued.

Bibliography

- Applegate, K. E., Anderson, J. M., & Klatte, E. C. (2006). Intestinal malrotation in children: A problem-solving approach to the upper gastrointestinal series. *RadioGraphics*, 26, 1485–1500. doi: 10.1148/rg.265055167
- Carroll, A. G., Kavanagh, R. G., Ni Leidhin, C., Cullinan, N. M., Lavelle, L. P., & Malone, D. E. (2016). Comparative effectiveness of imaging modalities for the diagnosis of intestinal obstruction in neonates and infants: A critically appraised topic. *Academic Radiology*, 23(5), 559–568.
- Langer, J. C. (2017). Intestinal rotation abnormalities and midgut volvulus. *Surgical Clinics of North America*, 97(1), 147–159.
- Luks, F. I. (2011). Fundamentals of pediatric surgery. In P. Mattei (Ed.), *Anomalies of intestinal rotation* (pp. 373–380). New York, NY: Springer Science+Business Media, LLC.



Malrotation and Volvulus: Information for Parents

What is malrotation?

It is when the intestines do not sit in the belly the right way.

What is volvulus?

When the intestines do not sit in the belly the right way (malrotation), the intestines can twist around one of the big arteries that supplies blood to the intestine and cut off the blood supply to part of the intestines. The twist is known as the volvulus.

What causes malrotation and volvulus?

Both malrotation and volvulus are problems that happened when your baby was developing. They are not caused by anything you did or did not do. The intestines did not rotate and move around inside the amniotic sac like they should have.

What is the treatment for malrotation?

Malrotation by itself is harmless and your baby can have malrotation without a volvulus. However, having malrotation places your baby at an increased risk for a volvulus; therefore, surgery will be needed at some point to correct this.

What is the treatment for a volvulus?

Immediate surgery is needed for any baby who has a volvulus, because the blood supply to the intestines is being cut off.

More Information

Some babies with a volvulus may have a lot of intestine that has to be removed because there was not enough blood flow to it for a long period of time. If this is the case for your baby, the surgeon will have to create an ostomy (an intestine loop that sits on the outside of the abdomen, as pictured below). This is not usually permanent, but your baby may go home with an ostomy.



Babies with a volvulus will need to receive intravenous (IV) nutrition through a special IV called a peripheral inserted central catheter line. This will allow your baby to grow while the intestines heal.

Your baby's providers will be waiting for your baby to have a bowel movement before feedings are restarted. Breast milk feedings are preferred and will be given in small amounts in the beginning. As feedings are advanced, the IV nutrition will be decreased.

Your baby may have a recurrent volvulus after surgery. It is important to watch for symptoms for several weeks after surgery.