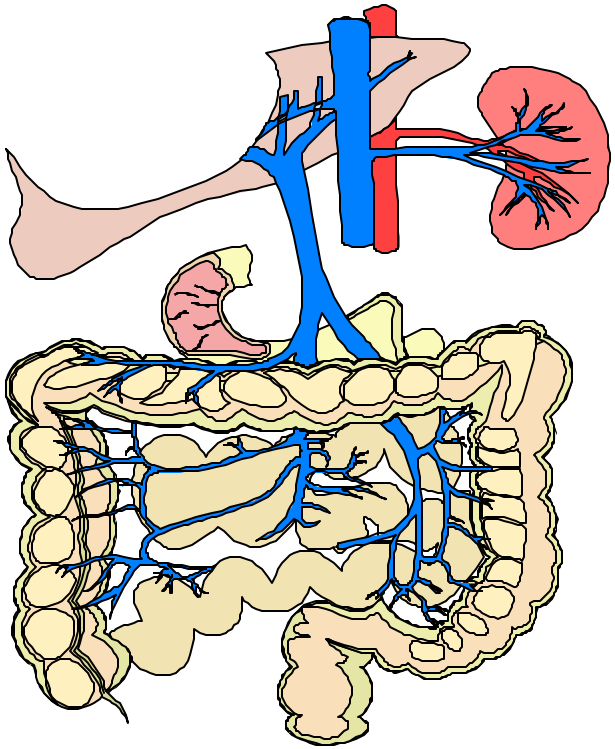


Embryological Anatomy of the Gastrointestinal Tract and Related Birth Defects

Handout download:
http://www.oucom.ohiou.edu/dbms-witmer/peds-rpac.htm

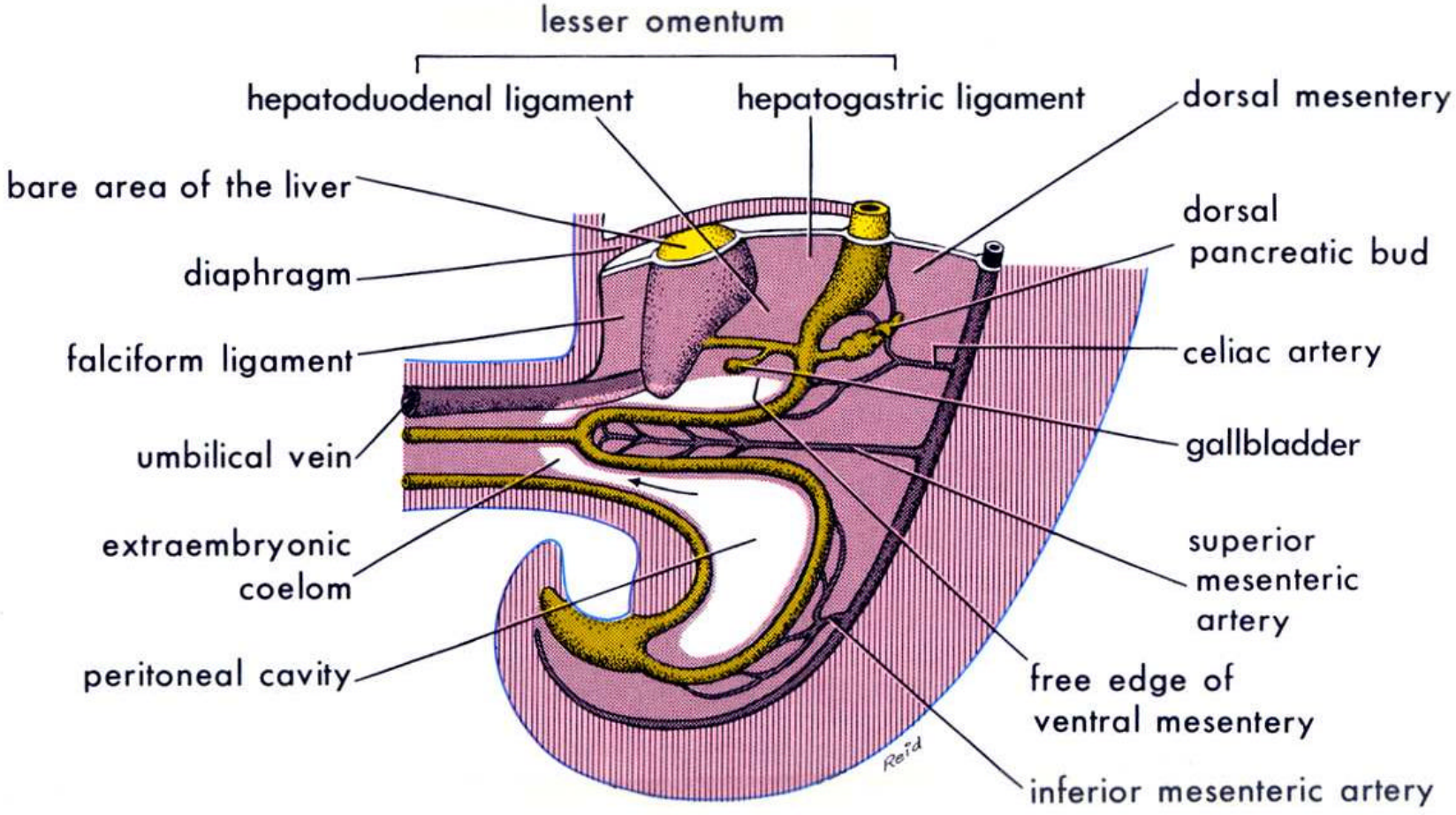
15 January 2003

Lawrence M. Witmer, PhD
Department of Biomedical Sciences
College of Osteopathic Medicine
Ohio University
Athens, Ohio 45701
witmer@exchange.oucom.ohiou.edu

CORE
CENTERS FOR OSTEOPATHIC RESEARCH & EDUCATION

Overview

- Digestive tract divided into segments based on vascular supply
  - Foregut (esophagus, stomach, part of duodenum, biliary apparatus): celiac artery
  - Midgut (rest of small & large bowel up almost to splenic flexure): superior mesenteric artery
  - Hindgut (rest of large bowel to superior part of anal canal): inferior mesenteric artery
- Dorsal and ventral mesenteries and their fates
  - Ventral mesentery: mostly breaks down, except lesser omentum & falciform ligament
  - Dorsal mesentery: mostly retained, forming greater omentum & other named mesenteries



Case Presentation

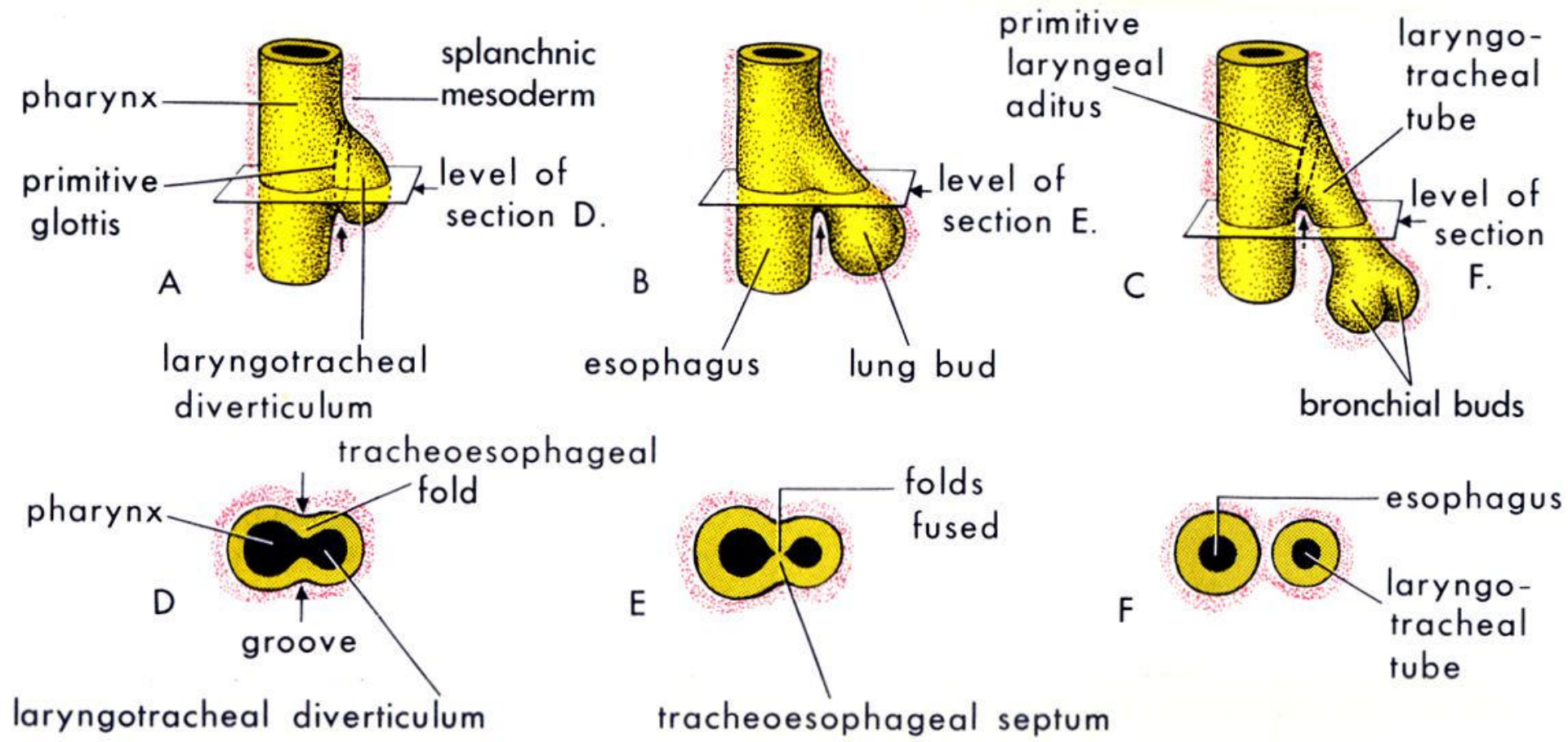
Choking and continuous coughing were observed in a newborn infant. There was an excessive amount of mucous secretion and saliva in the infant's mouth, who experienced considerable difficulty in breathing. The pediatrician was unable to pass a catheter through the esophagus into the stomach. Radiography demonstrated air in the infant's stomach.

Case Presentation

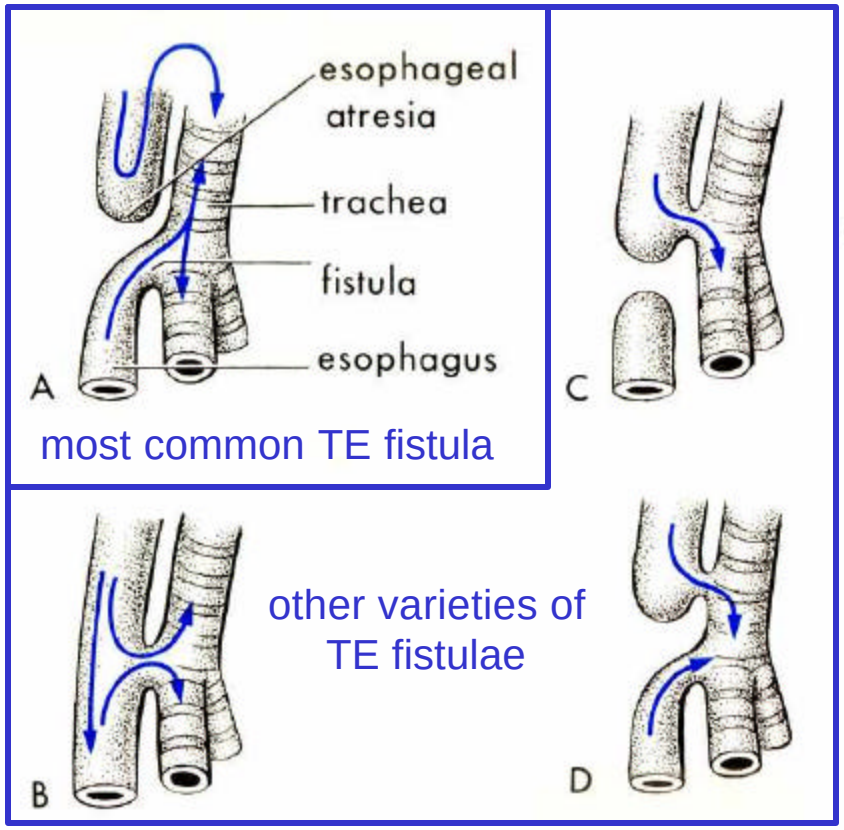
Choking and continuous coughing were observed in a newborn infant. There was an excessive amount of mucous secretion and saliva in the infant's mouth, who experienced considerable difficulty in breathing. The pediatrician was unable to pass a catheter through the esophagus into the stomach. Radiography demonstrated air in the infant's stomach.

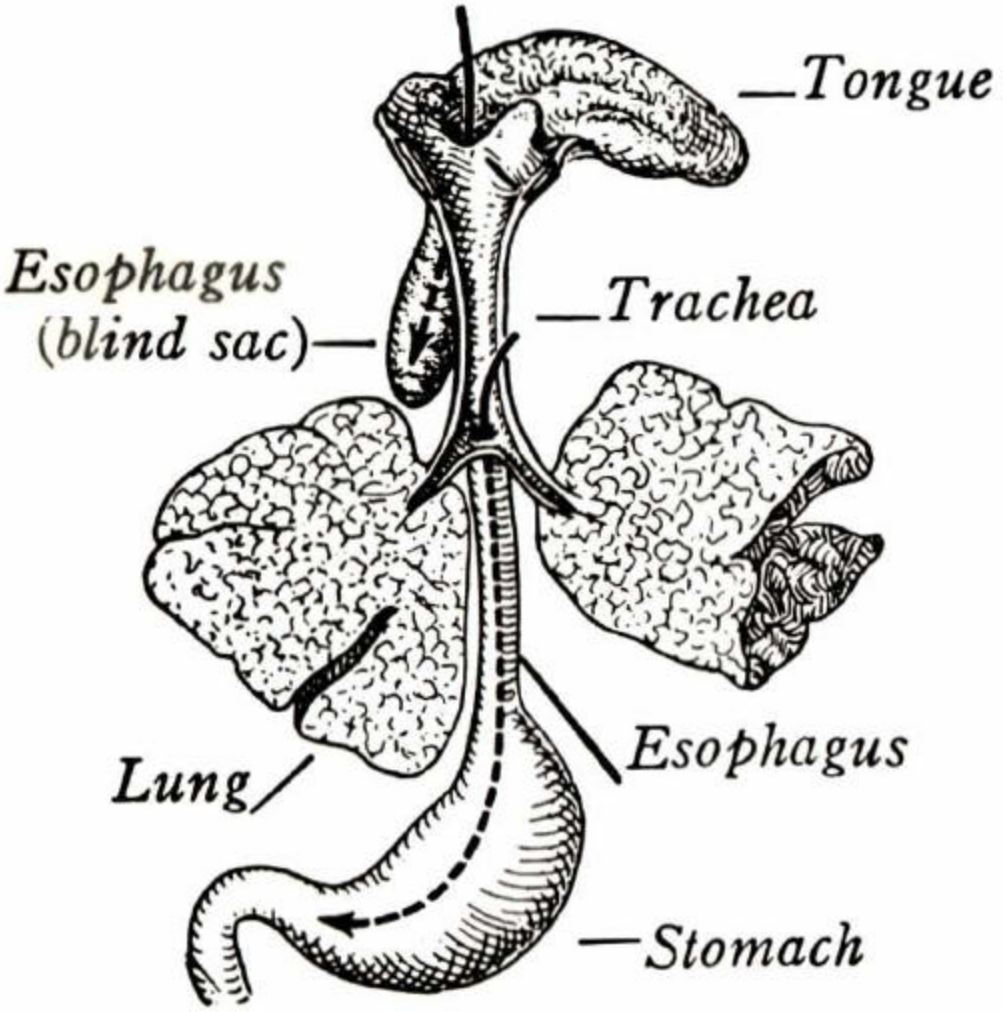
→ Esophageal atresia with tracheoesophageal fistula

Development of Esophagus



Esophageal Atresia with Tracheoesophageal (TE) Fistula





Case Presentation

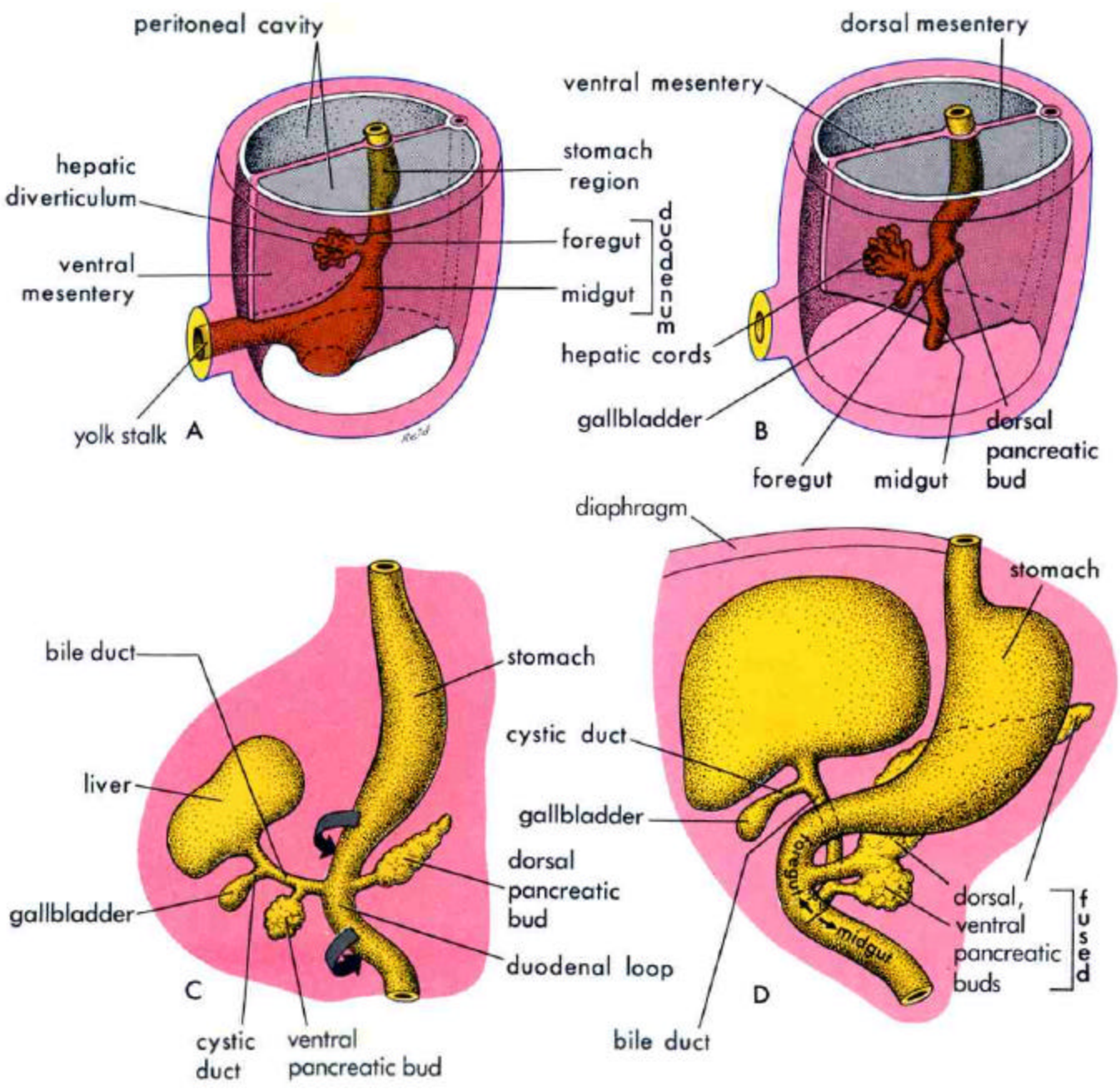
A female infant was born prematurely at 32 weeks' gestation to a 39-year-old woman whose pregnancy was complicated by polyhydramnios. Amniocentesis at 16 weeks showed that the infant had trisomy 21. The baby began to vomit within a few hours after birth; the vomitus contained bile. Marked dilation of the epigastrium also was noted. Radiographs of the stomach showed gas in the stomach and the superior part of the duodenum, but no other intestinal gas was observed.

Case Presentation

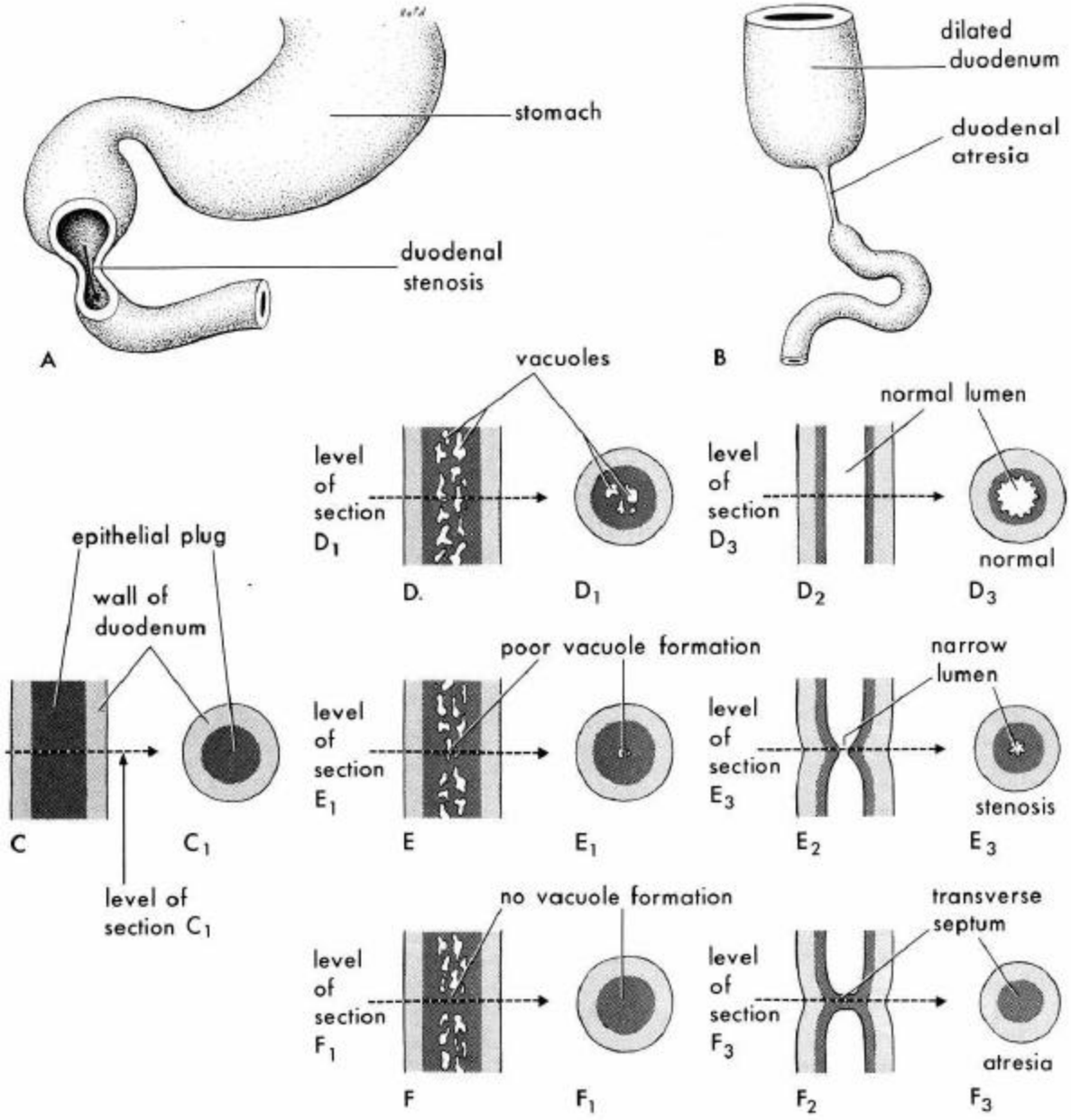
A female infant was born prematurely at 32 weeks' gestation to a 39-year-old woman whose pregnancy was complicated by polyhydramnios. Amniocentesis at 16 weeks showed that the infant had trisomy 21. The baby began to vomit within a few hours after birth; the vomitus contained bile. Marked dilation of the epigastrium also was noted. Radiographs of the stomach showed gas in the stomach and the superior part of the duodenum, but no other intestinal gas was observed.

→ Duodenal atresia

Development of the Duodenum I

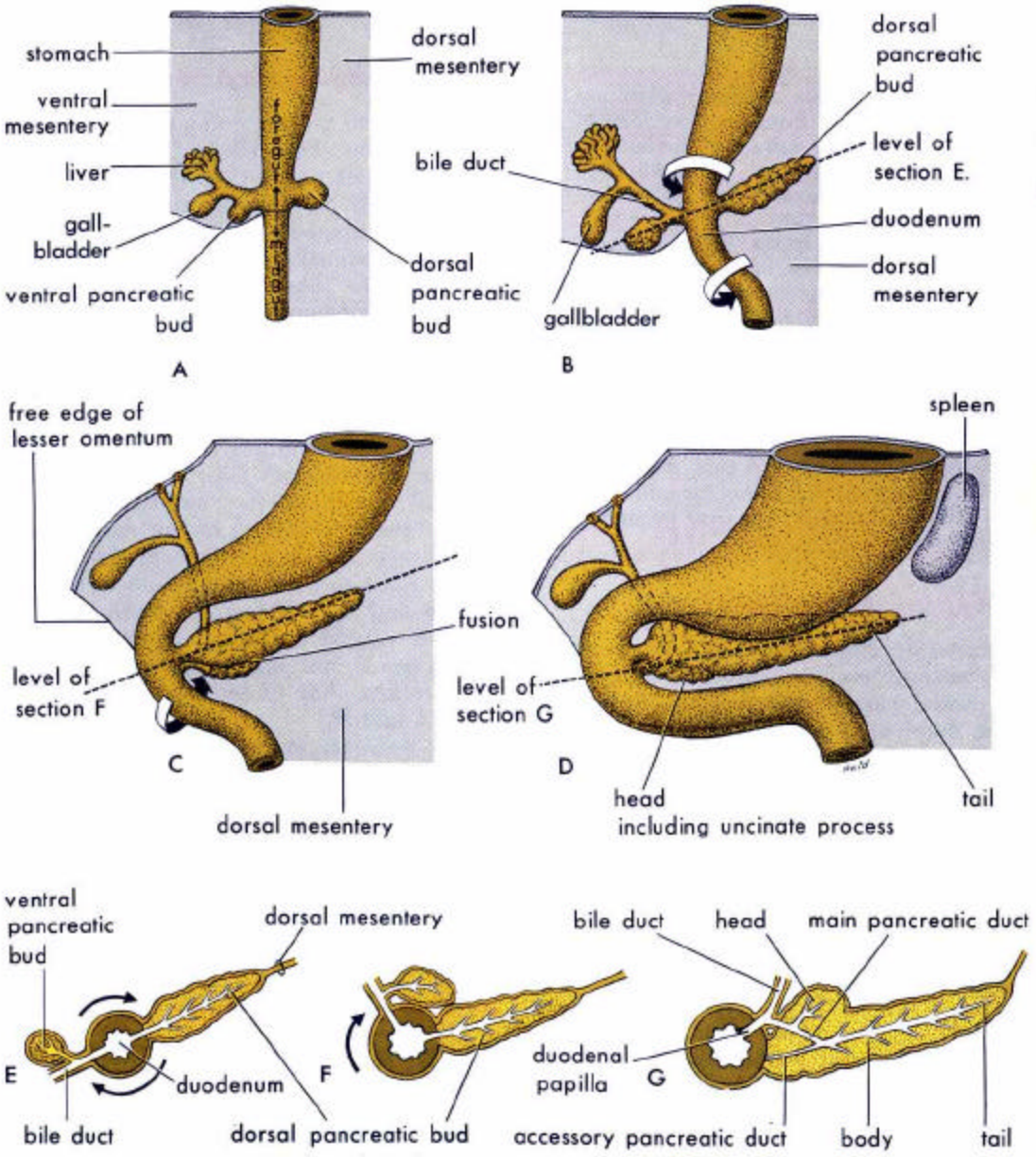


Development of the Duodenum II: Stenosis & Atresia



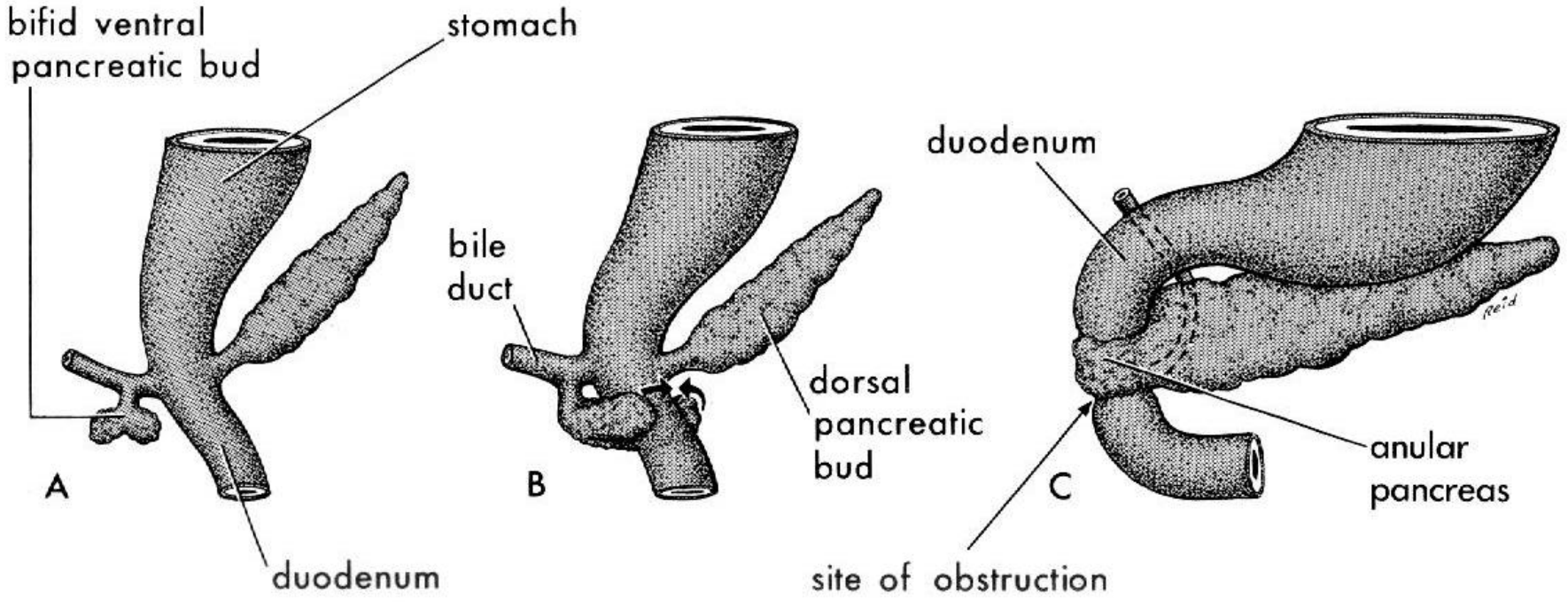
- Proliferation of epithelium
- Recanalization of lumen
- Defective vacuolization
  - Duodenal stenosis
    - small lumen
    - usually 3rd or 4th part
  - Duodenal atresia
    - occluded lumen
    - usually 2nd or 3rd part
    - 1/4 also have Down's
    - Familial Duodenal Atresia: autosomal recessive

Development of the Pancreas



Development of the Pancreas: Anular Pancreas

- Bifid ventral pancreatic bud
- One part rotates normally with bile duct, the other part remains ventral
- Dorsal and ventral parts fuse, forming a ring around descending (2nd) part of duodenum
- Can cause obstruction, but can also be asymptomatic



Case Presentation

A newborn infant was born with a light gray, shiny mass measuring the size of an orange and protruding from the umbilical region. It was covered with a thin transparent membrane.

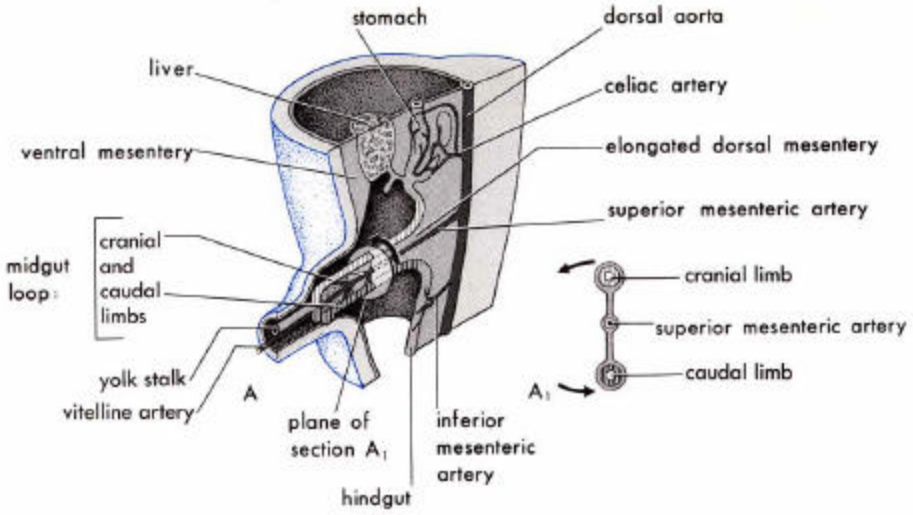
Case Presentation

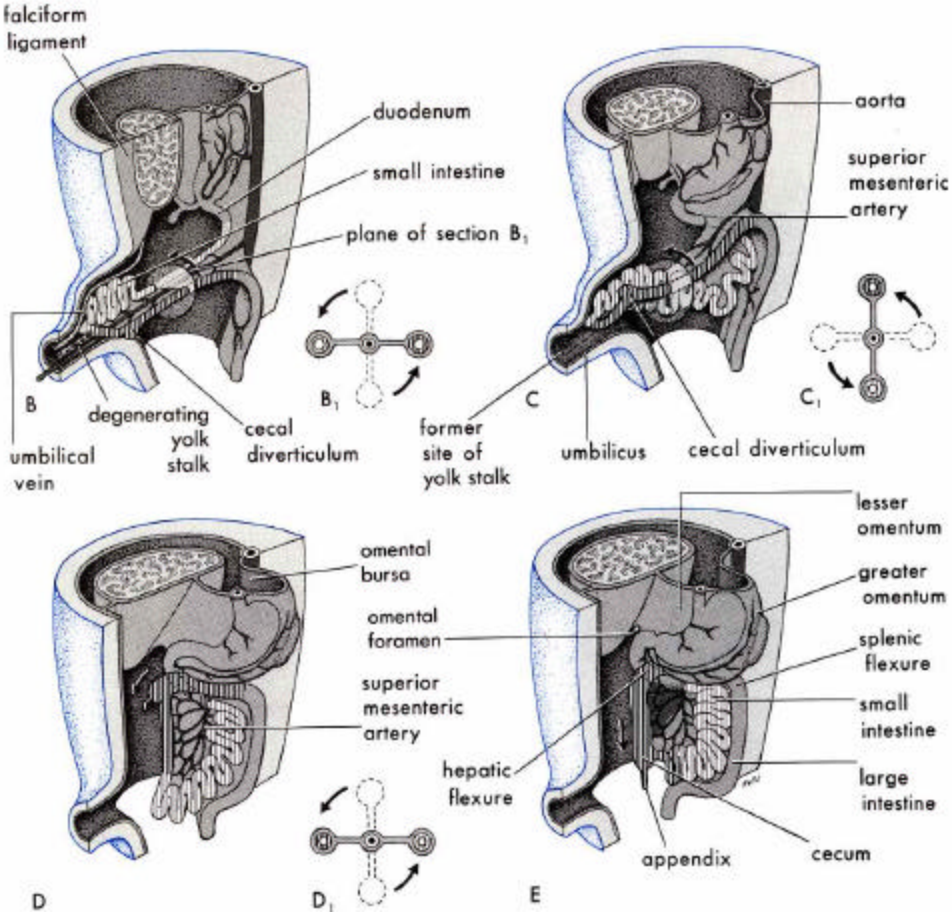
A newborn infant was born with a light gray, shiny mass measuring the size of an orange and protruding from the umbilical region. It was covered with a thin transparent membrane.

→ Omphalocele

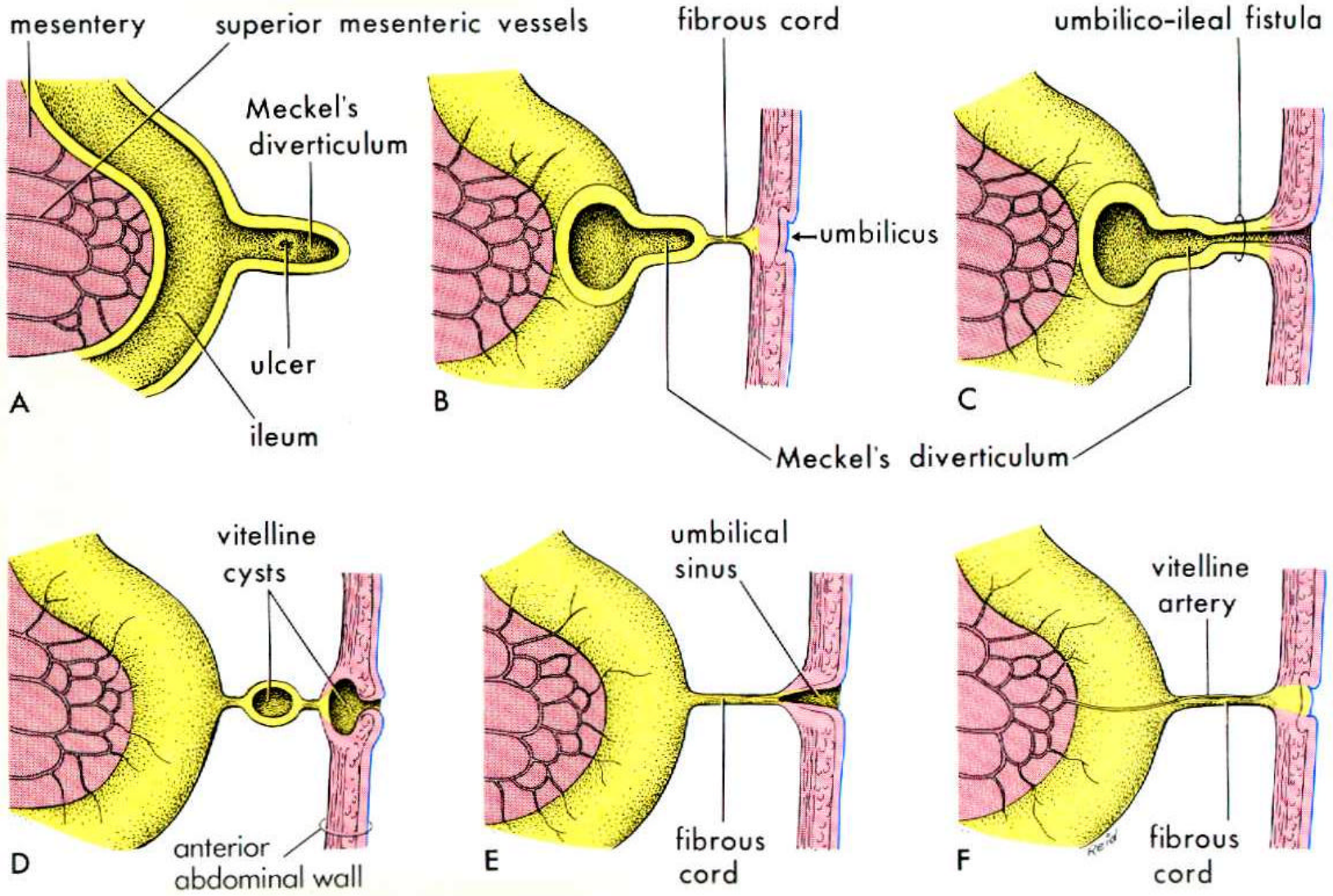
Gut Rotation

- Midgut elongates faster than trunk: herniates into umbilical cord in 6th week
- Midgut loop connected to yolk sac via a yolk stalk
- Cranial limb of loop: jejunum and most of ileum
- Caudal limb: distal ileum, cecum, ascending colon, proximal part of transverse colon
- Series of three 90º counterclockwise rotations around the superior mesenteric artery
- Sequential return of the gut to the trunk

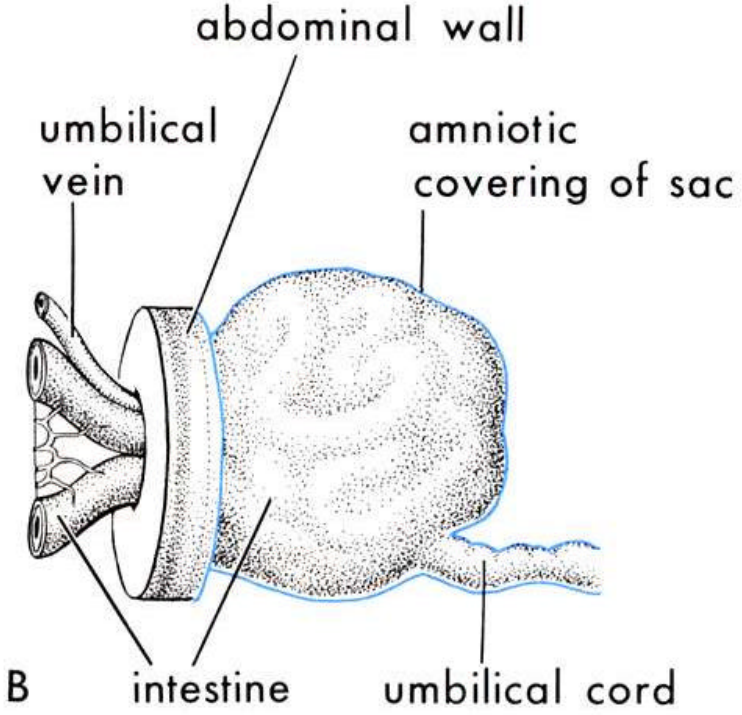




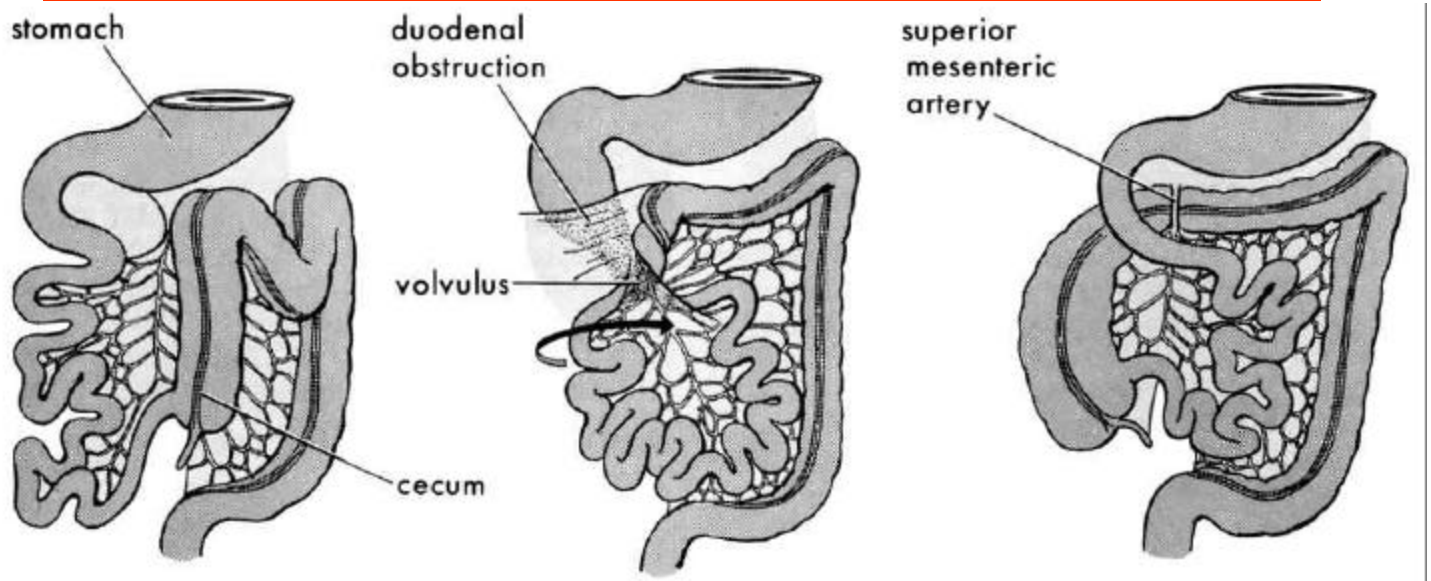
Meckel's (Ileal) Diverticulum



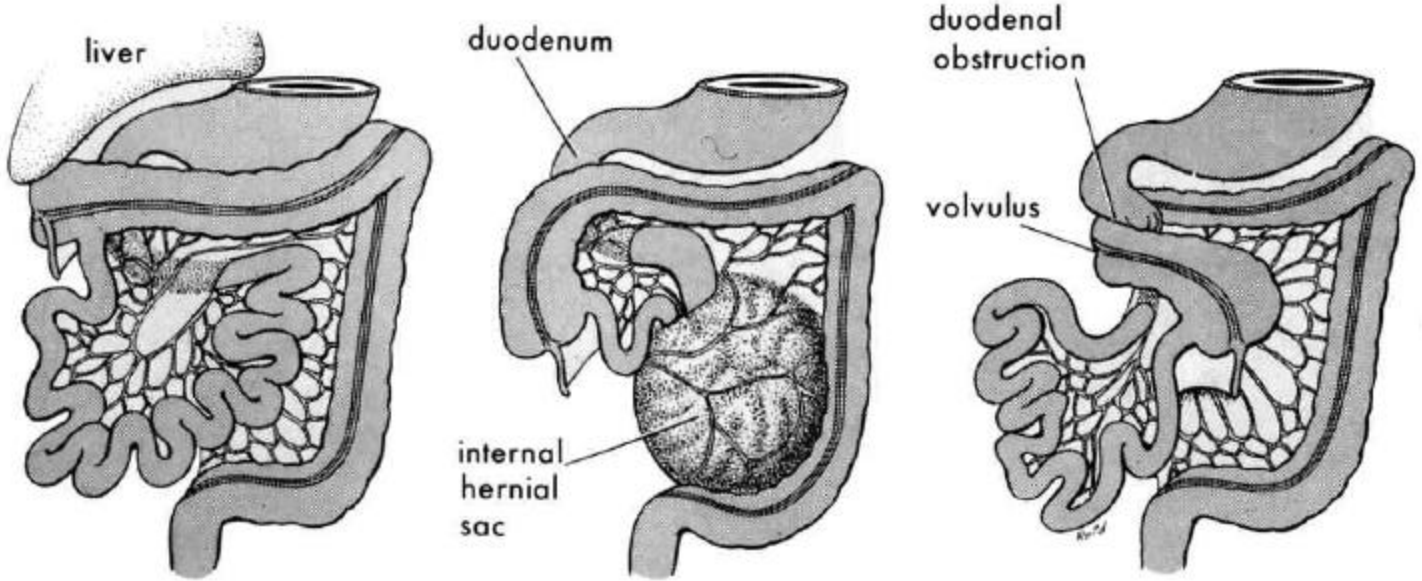
Congenital Omphalocele



Anomalies Associated with Malrotation



nonrotation | mixed rotation w/ volvulus | reversed rotation



subhepatic cecum & appendix | internal hernia | midgut volvulus

References

- Moore, K. L. 1988. *The Developing Human. Clinically Oriented Embryology, 4th Ed.* Lippincott, Williams & Wilkins, Baltimore.
- Moore, K. L. and A. F. Dalley. 1999. *Clinically Oriented Anatomy, 6th Ed.* Lippincott, Williams & Wilkins, Baltimore.