Embryology of the Lungs, Trachea, & Esophagus

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The lower respiratory tract develops from the foregut.
Ridges eventually separate the foregut into 2 separate tubes
The lungs develop by successive branching

Respiratory bud off of foregut

2 primary bronchial buds (left and right)

2 secondary (lobar) bronchial buds on the left, 3 on the right

8 tertiary (segmental) bronchial buds on the left, 10 on the right
The surface area of a human lung is about equal to that of a tennis court. Roughly 750 sq ft.
Amniotic Fluid

- Amniotic fluid is necessary for proper fetal development
- It serves as a protective cushion for the fetus
- The swallowing of amniotic fluid helps the GI tract develop
The breathing of amniotic fluid helps the lungs develop
Potter sequence

- **Oligohydramnios**: too little amniotic fluid, can be from leakage or lack of production (e.g. kidney anomalies)

- **Potter sequence** refers to the subsequent musculoskeletal & craniofacial malformation, smaller fetal size, and *underdeveloped lungs* (aka *pulmonary hypoplasia*) in the setting of oligohydramnios
Ridges eventually separate the foregut into 2 separate tubes
Tracheo-esophageal fistula

Proximal esophagus ending in a blind pouch

Abnormal connection between distal esophagus and trachea

Distal esophagus

Stomach

Normal - Posterior view

Trachea

Bronchus
Tracheo-esophageal fistula

Normal Anatomy

Atresia with distal Fistula

Atresia with double Fistula

Atresia with proximal Fistula

Atresia

Fistula

Atresia
Tracheo-esophageal fistula

• Several types, but the majority of cases (~85%) involve proximal esophageal atresia and distal fistula
• Complications: drooling, immediate regurgitation after feeding, gastric reflux into lungs, air diverting into stomach
• ~85% survival rates with surgical repair
Summary

• The lower respiratory tract develops from the foregut and undergoes successive branching
• The presence of amniotic fluid is important for fetal lung development
  – If there isn’t enough amniotic fluid, the lungs don’t develop properly (pulmonary hypoplasia)
• The trachea shares a close embryologic relationship with the esophagus
  – The most common congenital abnormality of this region involves atresia of the esophagus proximally and a fistula with the trachea distally