Development of Nose and Paranasal Sinuses

Frontonasal Process
- The upper part forms the frontal bone.
- The lower part forms the nasal process.

At the **4th** week, two nasal placodes (two **ectodermal** swellings) develop in the lower border of the nasal process.
Two nasal pits (nostrils) appear in the nasal placodes, dividing the nasal process into:
- Two lateral nasal processes → form the **ala of the nose.**
- Two medial nasal processes → unite with each other in the **midline** forming the **median nasal process.**

Structures Derived from the **Median Nasal Process**
1. Part of the nasal septum.
2. Philtrum (middle part) of the upper lip.
3. Premaxilla (upper jaw that carries the **4 incisor teeth**).
4. Primary palate.

Formation of Nasal and Oral Cavities
- At first, the primitive nasal cavity is continuous with the mouth cavity.
- Later, the nasal cavity is separated from the mouth cavity **by the secondary palate**, forming the definitive nasal cavity.
- The definitive nasal cavity is divided into two cavities by the nasal septum.
- **Nasal conchae (turbinates)** develop as bony projections from the **lateral** wall of the nose.

Development of Paranasal Sinuses
- Develop as outpouchings from the mucous membrane of the **lateral** wall of the nose.
- They extend into the **maxilla**, **ethmoid**, **frontal**, and **sphenoid** bones during childhood and early adult life.

Congenital Anomalies of the Nose
- **A**rhinia: due to bilateral **absence** of nasal placodes. nasal aplasia
- **Half** nose: due to **uni**lateral **absence** of nasal placode.
- **Poly**rhinia: due to **duplication** of the **median** nasal process.
- **Oblique facial cleft**: due to **failure of fusion** of the **maxillary process** with the **lateral nasal process.**

Development of Larynx, Trachea, Bronchi, and Lungs

Formation of Tracheoesophageal Septum
- The tracheoesophageal folds **approximate and fuse** with each other, forming the tracheoesophageal septum.
- This septum divides the tube into:
- Ventral part: **respiratory diverticulum** (**laryngotracheal tube**).
- Dorsal part: **foregut**, **pharynx**, and **esophagus**.

Development of the **Larynx**
- **Mucosa**: from the **cranial part** of the laryngotracheal tube.
- **Cartilages** and **muscles**: from the **mesoderm** of the **4th and 6th** pharyngeal arches.

Development of the **Trachea**
- **Mucosa**: from the **caudal part** of the laryngotracheal tube.
- **Cartilages**: from the **mesoderm** around the laryngotracheal tube.

Development of the **Bronchi**

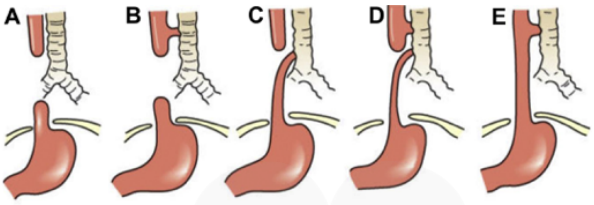
- **The lower end** of the laryngotracheal tube divides into two bronchial buds, forming the **right** and **left bronchi.**
- **Cartilages**: from the **mesoderm** around the buds.

Congenital Anomalies of the **Tracheoesophageal Septum**

An abnormal opening between the esophagus and trachea is caused by **failure of complete closure** of the tracheoesophageal septum.

Types of Fistula:

1. Proximal part of esophagus **ends** as a blind sac, **distal part continues with trachea. (Most common type)**
2. Proximal part of esophagus **continues** with trachea, **distal part ends as a blind sac.**
3. Proximal and distal parts of esophagus continue with trachea separately.
4. Proximal and distal parts continue with trachea by a single tube (**fistula**).

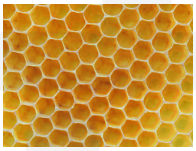


Development of the Lungs

- Each bronchus divides repeatedly forming bronchioles and alveoli.
- **Blood capillaries** and **connective tissue** develop from the **mesoderm**.
- **No** mature alveoli before birth.
- Alveoli are lined by:
- Type I pneumocytes: for gas exchange.
- Type II pneumocytes: secrete surfactant to lower surface tension.
- Macrophages: for the immune system.
- Epithelial barrier cells.
- The amount of **surfactant increases** especially during the **first two weeks after birth.**
- The fluid in the alveoli is absorbed, and alveoli expand with air after birth.

Congenital Anomalies of the Lungs

- **A**genesis of **one or both lungs**: due to **failure** of **bronchial buds to develop** (rare).
- **Abnormal number** of lung lobes: due to **abnormal division of bronchial buds.**
- Congenital **cysts** of the lung: **single or multiple** → honeycomb appearance in X-ray.



- Congenital **collapse** of the lung (**Respiratory Distress Syndrome of the neonate**):
- Due to **absence of surfactant.**
- One of the common causes of **death in premature infants.**

Development of Ribs

Two processes grow **laterally** from each vertebra:

1. Transverse (posterior) process
2. Costal (anterior) process

Fate of the Costal Process:

- **Cervical region**: fuses with the transverse process around the vertebral vessel → **forms foramen transversarium** in each cervical vertebra.
- **Thoracic region**: elongates to **form the ribs and their cartilages.**
- **Lumbar and sacral vertebrae**: fuses with the transverse process.

Cervical Rib

- Continuation of the **costal process** of the **7th cervical vertebra (C7).**
- Found in approximately 0.5% to 1% of the population.
- Most people are asymptomatic.

Possible Effects:

1. **Pressure on subclavian artery** → **ischemia of upper limb.**
2. **Stretch on lower trunk of brachial plexus** → **Klumpke's paralysis**:

- Tingling and numbness along the **ulnar border** of forearm and hand.
- Wasting of small hand muscles, inability to perform fine movements.

Dr . Youssef Hussein
Done by : Raghad Mrayat

لَا حَوْلَ وَلَا قُوَّةَ إِلَّا بِاللَّهِ

"من كنوز الجنة"