* Lecture 21Development of respiratory system
* Dr. Rehan Asad
* At the end of session students should able to
* Describe formation of lung buds
* Describe development of larynx, trachea and bronchi.
* Describe the development of lungs.
* Describe the maturation of lungs.
* Correlate this knowledge to clinical conditions.
* DEVELOPMENT OF THE LUNG BUD
* Around 4 weeks of gestation
* **Respiratory diverticulum (lung bud)** appears as an outgrowth from the ventral wall of the foregut
* Retinoic acid produced by mesoderm controls its appearance
* Development of lung Bud
* In early stages, the lung bud is in communication with the foregut.
* On further growth, two longitudinal ridges termed as **tracheoesophageal ridges** appears
* It separate trachea from the foregut
* In later stages, when these ridges fuse to form the **tracheoesophageal septum**, the foregut is divided into a dorsal portion **esophagus** and a ventral portion, the **trachea** and **lung buds.**
* Development of lung buds
* Lung bud forms trachea
* Its lateral out pockets, known as bronchial buds.
* Primary bronchi start forming at beginning of fifth week.
* Lobar bronchi appears at sixth week.
* Development of lungs
* During further development, lung buds expand in body cavity.
* Cavity is known as **pericardioperitoneal** canal.
* Mesoderm of lung form visceral pleura
* Space between somatic and visceral pleura forms pleural cavity.
* Development of lungs
* Divided in **four** phases:
* pseudoglandular
* Canalicular
* Terminal sac
* Alveolar
* ***Pseudoglandular phase***
* Absence of respiratory bronchioles
* 5 to 16 wks
* Branching continues to form terminal bronchiole.
* Canalicular phase
* 16-26 weeks
* Terminal bronchiole divide in respiratory bronchiole and formation of alveolar ducts.
* *Increase in vascularity*
* Terminal sac phase
* 26 weeks to birth.
* Formation of primitive alveoli.
* Close contact of capillaries.
* Formation of blood air barrier.
* Alveolar phase
* Eight months to childhood
* Complete development of epithelium
* Maturation of endothelial cells of capillaries
* ***Lungs before and after birth***
* **Before birth, lungs half-filled with fluid, little protein, mucus and surfactant**
* **Aeration of lungs at birth is replacement of intra-alveolar fluid by air**
* **During delivery, some fluid expelled via bronchi and trachea**
* **When respiration begins at birth, most of lung fluid absorbed by blood and lymphatic capillaries**
* **surfactant remains deposited as a thin, phospholipid, coating on alveoli**
* Clinical correlations
* Esophageal atresia with tracheo-esophageal fistula
* 90% present with upper esophageal blind pouch.
* 33% of the cases are involved with **VACTERL** association (**V**ertebral anomalies, **A**nal atresia, **C**ardiac defects, **T**racheoesophageal fistula, **E**sophageal atresia, **R**enal anomalies, and **L**imb defect).
* Complications: Polyhydramnios.

* Clinical correlations
* At birth, babies having trachesophageal defect need to be carefully monitored for VACTREL defects.
* ***HYALINE MEMBRANE DISEASE  
  Respiratory Distress Syndrome***
* Most common in premature babies.
* Due to immature type II alveoli
* Deficiency of surfactant
* Congenital anomalies
* Agenesis of lungs
* Hypoplasia of lungs
* Ectopic lung lobes
* Congenital lung cysts due to dilation of terminal bronchi
* Summary
* References
* **Langman's Medical Embryology: T.W. Sadler, 12th ed., CH. 14, P. 201-206**