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Course Title: Systematic Embryology

Question: Write notes on the following:

I) Development of the lungs

II) Rotation of the stomach and the formation of the Omental bursa

III) Development of the esophagus

Development of the Lungs

Development of the respiratory system begins early in the fetus. many structures arise from the endoderm. Until birth, the mother provides all of the oxygen to the fetus as well as removes all of the fetal carbon dioxide via the placenta. The development of the respiratory system begins at about week 4 of gestation. By week 28, enough alveoli have matured that a baby born prematurely at this time can usually breathe on its own. The respiratory system, however, is not fully developed until early childhood, when a full complement of mature alveoli is present.

Respiratory development in the embryo begins around week 4. Ectodermal tissue from the anterior head region invaginates posteriorly to form olfactory pits, which fuse with endodermal tissue of the developing pharynx. An olfactory pit is one of a pair of structures that will enlarge to become the nasal cavity. At about this same time, the lung bud forms. The lung bud is a dome-shaped structure composed of tissue that bulges from the foregut. The foregut is endoderm just inferior to the pharyngeal pouches. The laryngotracheal bud is a structure that forms from the longitudinal extension of the lung bud as development progresses. The portion of this structure nearest the pharynx becomes the trachea, whereas the distal end becomes more bulbous, forming bronchial buds. A bronchial bud is one of a pair of structures that will eventually become the bronchi and all other lower respiratory structures.

Bronchial buds continue to branch as development progresses until all of the segmental bronchi have been formed. Beginning around week 13, the lumens of the bronchi begin to expand in diameter. By week 16, respiratory bronchioles form. The fetus now has all major lung structures involved in the airway. Once the respiratory bronchioles form, further development includes extensive vascularization, as well as the formation of alveolar ducts and alveolar precursors. At about week 19, the respiratory bronchioles have formed.

Rotation of the Stomach and the Formation of the Omental Bursa

It occurs during week 4-5 of embryonic development. During embryonic development, the peritoneum is anchored to the gut in the midline of the abdomen anteriorly, with the dorsal mesentery securing it posteriorly. The mesenteric layers develop in an anterior direction around the upper alimentary canal, carrying the blood supply and creating the ventral mesentery.

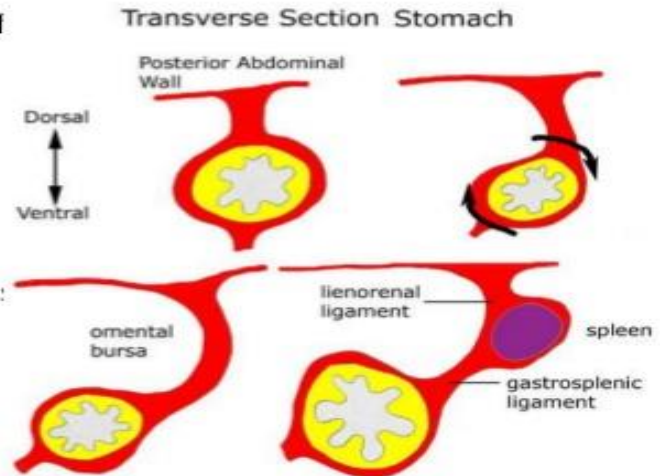
Due to the growth of the organs, they gradually become larger and have to shift in order to fit into the abdominal cavity. The stomach rotates 90 degrees, the spleen is displaced to the left and the liver moves to the right. The peritoneum twists with these movements which lead to the formation of the falciform ligament, the lesser omentum and the coronary ligaments of the liver. Throughout this entire process, the cavity of the lesser sac is created. After rotation of the stomach is complete, the dorsal mesogastrium continues to grow and forms a double-leaved apron which extends in front of the transverse colon and small loops of the intestine as the greater omentum. Its leaves fuse to form a single sheet that hangs over the greater curvature of the stomach, with the upper portion of the posterior leaf fusing to the mesentery of the transverse colon.

With formation of the omental bursa, a part of the dorsal mesogastrium, between the spleen and the dorsal midline, fuses with the posterior abdominal wall, while the remainder remains and connects the spleen to the kidney as the lienorenal ligament. The connection of the spleen to the stomach forms the gastrosplenic ligament therefore the spleen always keeps an intraperitoneal position.

The formation of the omental bursa also influences the position of the pancreas which initially grows into the dorsal mesoduodenum, but in time, its tail portion expands into the dorsal mesogastrium.

Formation of the Lesser sac/Omental Bursa

- During its development, the stomach is suspended in the midline with the help of double-layered mesenteries (mesogastrium),
- the Dorsal mesogastrium connects it to the posterior/dorsal body wall.
- The Ventral mesogastrium attaches the gut tube to the anterior abdominal wall
- Rotation around the longitudinal axis pull: the 'dorsal mesogastrium' to the left.
- This move leads to the formation of 'Omental Bursa' (a pouch of peritoneal cavity located behind the stomach).



Development of the Esophagus

When the embryo is approximately 4 weeks old, the respiratory diverticulum (lung bud) appears at the ventral wall of the foregut at the border with the pharyngeal gut. The tracheoesophageal septum gradually partitions this diverticulum from the dorsal part of the foregut. In this manner, the foregut divides into a ventral portion, the respiratory primordium, and a dorsal portion, the esophagus.

At first, the esophagus is short, but with descent of the heart and lungs, it lengthens rapidly. The muscular coat, which is formed by surrounding visceral mesenchyme, is striated in its upper two-thirds and innervated by the vagus; the muscle coat is smooth in the lower third and is innervated by the splanchnic plexus.

DEVELOPMENT OF THE ESOPHAGUS

1. Division of the cranial part of the foregut immediately caudal to the primitive pharynx to: **Trachea** (anterior) & **Esophagus** (posterior).
2. Initially, the esophagus is short.
3. Due to the growth and descent of the heart and lungs it elongates.
4. Temporary obliteration of the lumen occurs due to proliferation of the epithelium.
5. Recanalization of the lumen occurs by the end of the embryonic period.



Dr M Eladi

Congenital malformations of Esophagus

Atresia of Esophagus & Esophageal Fistula:

- Mostly is the result of a spontaneous deviation of Tracheoesophageal septum in the posterior direction
- As a result the proximal part of the esophagus ends as a blind sac, and the distal part is connected to the trachea by a narrow canal just at the point of tracheal bifurcation.
- Atresia of Esophagus prevents the normal passage of amniotic fluid into the intestinal tract leading to the accumulation of excess fluid in the amniotic sac (Polyhydroamnios)

