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Course Code: ANA 206

Course Title: Systemic Embryology

Assignment Title: Development of the lungs and stomach

Question

Write notes on the following:

1. Development of the lungs
2. Rotation of the stomach and the formation of the omental bura
3. Development of the esophagus

Development of the Lungs

Development of the lung can be divided into two phases, lung growth (structural development) and lung maturation (functional development). Lung growth can be influenced by a host of physical factors. Lung maturation and the achievement of functionality is primarily a biochemical process and are under the control of a number of different hormones. Lung growth proceeds through gestation. There is progressive branching of the airways and finally development of alveolar spaces capable of gas exchange in the last trimester. The surfactant system, composed of phospholipids that decrease surface tension within the alveoli and prevent alveolar collapse during exhalation, develops in the last trimester, and reaches maturity by approximately 36weeks. Lung growth continues after birth as alveolar number continues to increase. The end result of the development of the lung is an organ with a tremendously large surface area that is approximately 50-100m^2, capable of exchanging oxygen and carbon dioxide across a very thin membrane.

Maturation of the lungs

- The Pseudoglandular period is from the 5^{th} to 16^{th} week. Here branching has continued to form terminal bronchioles. No respiratory bronchioles or alveoli are present.
- The Canalicular period is from the 16^{th} to 26^{th} week. Each terminal bronchile divides into 2 or more respiratory bronchioles, which in turn divides into 3-6 alveolar ducts.
- Terminal sac period is from 26weeks to birth. Terminal sacs (primitive alveoli) form, capillaries establish close contact.

- Alveolar period, 8 months to childhood. Mature alveoli have well developed epithelial endothelial (capillary) contacts.

There are five phases of structural lung development that occur at progressive times during gestation.

- The Embryonic stage is apparent in the 3 week old embryo. When the embryo is 5 weeks old, two lung buds are identifiable.
- The Pseudoglandular stage takes between the 7^{th} and 16^{th} week of embryonic development. Conducting airways are formed by progressive branching. During this stage, the first differentiation of lung epithelium occurs. Mesenchyme is necessary for this epithelial differentiation to occur.
- The Terminal sac or Sacclar stage encompasses the period from, 26week until term. During this stage there is a decrease in interstitial tissue, and a thinning of the airspace walls.

The terminal sac period begins at the end of the sixth and beginning of the seventh prenatal month. Cuboidal cells become very thin and intimately associated birth in the ***Postnatal or Alveolar stage.***

The development of the **pulmonary arterial system** follows a similar progression to that of the developing airways,

Rotation of the Stomach and the Formation of the Omental Bursa.

It begins at the 5th week of an infant. Starts as a spindle-shaped tube ventral and dorsal mesenteries attach the tube to the body walls. The portion of the dorsal mesentery that anchors the stomach can be more specifically referred to as the dorsal mesogastrium. Branches of the left and right vagus nerves lie on ventral and dorsal surfaces.

Differential growth of the stomach and clockwise rotation along the longitudinal axis alters the course of the vagus nerve branches, which are the right vagus nerve now innervates the anterior or ventral surface of the stomach, the left vagus nerve lies on the posterior aspect, and notice that the cephalic and caudal ends remain in the midline.

As the stomach rotates along the ventral-dorsal (also known as antero-posterior) axis, the caudal end is displaced towards the right, as the cephalic end towards the left. The ventral and dorsal mesenteries are also displaced to the right and left respectively.

Lesser curvature (Ventral mesentery attachment)

Greater curvature (Dorsal mesentery attachment)

During embryologic development, the rotation of the stomach relative to the liver causes a redundancy in the mesentery about the stomach. As the greater curvature of the stomach rotates anterolaterally, a recess is formed between the redundant dorsal peritoneal ligaments connecting greater curvature of stomach to the dorsal abdominal wall. Simultaneously, the lesser curvature of the stomach rotates posteromedially, and the ventral peritoneal ligament between stomach and liver becomes the lesser omentum, an incomplete boundary separating the main peritoneal cavity (greater sac) from the posterior recess (lesser sac).

Development of the Esophagus

The esophagus develops from the endodermal primitive gut tube. The ventral part of the embryo abuts the yolk sac. During the second week of embryological development, as the embryo grows, it begins to surround parts of the sac. The enveloped portions form the basis for the adult gastrointestinal tract. The sac is surrounded by a network of vitelline arteries. Over time, these arteries consolidate into the three main arteries that supply the developing gastrointestinal tract: the celiac artery, superior mesenteric artery, and inferior mesenteric artery. The areas supplied by these arteries are used to define the midgut, hindgut and foregut.

The surrounded sac becomes the primitive gut. Sections of this gut begin to differentiate into the organs of the gastrointestinal tract, such as the esophagus, stomach, and intestines. The esophagus develops as part of the foregut tube. The innervation of the esophagus develops from the pharyngeal arches.