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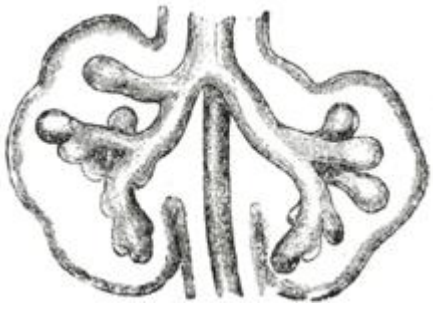
ANA 206

Anatomy

QUESTION 1: DEVELOPMENT OF THE LUNGS

The lung bud sometimes referred to as the respiratory bud forms from the respiratory diverticulum, an embryological endodermal structure that develops into the respiratory tract organs such as the larynx, trachea, bronchi and lungs. It arises from part of the laryngotracheal tube.

In the fourth week of development, the respiratory diverticulum, starts to grow from the ventral (front) side of the foregut into the mesoderm that surrounds it, forming the lung bud. Around the 28th day, during the separation of the lung bud from the fore gut it forms the trachea and splits into two bronchial buds, one on each side.



Lungs Of a Human Embryo At About Six Weeks

Separation Of Trachea And Esophagus

At first, the posterior part of the trachea is open to the esophagus, but as the bud elongates two longitudinal mesodermal ridges known as the laryngotracheal folds, begin to form and grow until they join, forming a wall between the two organs. An incomplete separation of the organs leads to a congenital abnormality known as a tracheoesophageal fistula.

The Development Of The Larynx

The epithelium of the larynx is of endodermal origin, but the laryngeal cartilages, unlike the rest of the respiratory bud connective tissue, come from the mesenchyme of the fourth and sixth pharyngeal arches. The fourth pharyngeal arch, adjacent to what will be the root of the tongue, will become the epiglottis. The sixth pharyngeal arch, located around the laryngeal orifice, will become the thyroid, cricoid and arytenoid cartilages. These structures are formed in a process in which the lining cells of the primitive larynx proliferate and occlude it. Later, it recanalizes leaving two membrane-like structures: the vocal folds and the vestibular folds. In between, an enlarged space, the ventricle, remains.Failure in this process leads to a serious but rare condition called congenital atresia of the larynx.

Later Development

After the lung buds have formed, they begin to grow and branch forming a primitive version of the bronchial tree, determining how the lobes of the lung will be arranged in the mature organ.[2] The first stage of alveolar development, spanning between the fifth and the 16th week of development, is called the pseudoglandular stage.It is so called because of the histological appearance of the primitive alveoli, which resemble glandular tissue. After the pseudoglandular stage, the lung enters the canalicular and saccular phases. During these stages, the terminal tubes narrow and give rise to small saccules, which become increasingly associated with capillaries as to make gas exchange possible. The alveolar epithelium begins to differentiate into two distinct

types of cells: type I pneumocytes and type II pneumocytes, as well as the respiratory epithelium of the trachea and bronchial tree.

After Birth

At birth, the baby's lungs are filled with fluid secreted by the lungs and are not inflated. After birth the infant's central nervous system reacts to the sudden change in temperature and environment. This triggers the first breath, within about 10 seconds after delivery. Before birth, the lungs are filled with foetal lung fluid. After the first breath, the fluid is quickly absorbed into the body or exhaled. The resistance in the lung's blood vessels decreases giving an increased surface area for gas exchange, and the lungs begin to breathe spontaneously. This accompanies other changes which result in an increased amount of blood entering the lung tissues. At birth the lungs are very undeveloped with only around one sixth of the alveoli of the adult lung present. The alveoli continue to form into early adulthood, and their ability to form when necessary is seen in the regeneration of the lung. Alveolar septa have a double capillary network instead of the single network of the developed lung. Only after the maturation of the capillary network can the lung enter a normal phase of growth. Following the early growth in numbers of alveoli there is another stage of the alveoli being enlarged.

QUESTION 2: THE ROTATION OF THE STOMACH AND THE FORMATION OF OMENTAL BURSA

Rotation Of The Stomach

During week 4 at the level where the stomach will form the tube begins to dilate, forming an enlarged lumen. The dorsal border grows more rapidly than ventral, which establishes the greater curvature of the stomach. A second rotation (of 90 degrees) occurs on the longitudinal axis establishing the adult orientation of the stomach.

Formation Of Omental Bursa

The omental bursa or lesser sac is a hollow space that is formed by the greater and lesser omentum and its adjacent organs. It communicates with the greater sac via the epiploic foramen of winslow, which is known as the general cavity of the abdomen that sits within the peritoneum, but outside the lesser sac. This space has well-defined borders which are represented by certain organs or their parts, so they are quite easy to spot and form a mental image of the omental bursa. In addition, like anything in anatomy, the omental bursa doesn't just exist as a standalone and isolated entity, but rather it communicates with several other spaces and recesses found throughout the body.

The borders of the omental bursa are are formed:

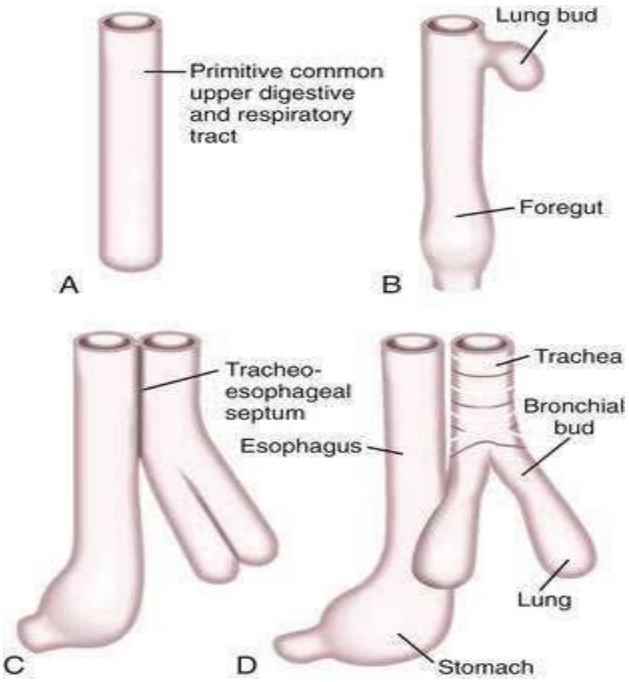
- Anteriorly by the quadrate lobe of the liver, the gastrocolic ligament and the lesser omentum
- to the left it is limited by the left kidney and the left adrenal gland
- Posteriorly it is walled off by the pancreas
- to the right, the epiploic foramen and lesser omentum can be found and the greater sac beyond that.

The cavity itself is almost completely closed, save its communication with the greater sac and the entrance through the omental foramen and is filled with a capillary film. The greater part of the omental bursa consists of its superior recess which extends cranially between the esophagus and the inferior vena cava.

QUESTION 3: DEVELOPMENT OF THE ESOPHAGUS

The esophagus is a fibromuscular tube, about 25 centimetres long in adults, which travels behind the trachea and heart, passes through the diaphragm and empties into the uppermost region of the stomach. During swallowing, the epiglottis tilts backwards to prevent food from going down the larynx and lungs.

The wall of the esophagus from the lumen outwards consists of mucosa, submucosa (connective tissue), layers of muscle fibers between layers of fibrous tissue, and an outer layer of connective tissue. The mucosa is a stratified squamous epithelium of around three layers of squamous cells, which contrasts to the single layer of columnar cells of the stomach. The transition between these two types of epithelium is visible as a zig-zag line. Most of the muscle is smooth muscle although striated muscle predominates in its upper third. It has two muscular rings or sphincters in its wall, one at the top and one at the bottom. The lower sphincter helps to prevent reflux of acidic stomach content. The esophagus has a rich blood supply and venous drainage. Its smooth muscle is innervated by involuntary nerves (sympathetic nerves via the sympathetic trunk and parasympathetic nerves via the vagus nerve) and in addition voluntary nerves (lower motor neurons) which are carried in the vagus nerve to innervate its striated muscle.



DEVELOPMENT

In early embryogenesis, 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.