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MATRIC NO: 18/MHS01/171

DEPARTMENT: ANATOMY

COURSE: ANA 206

ASSIGNMENT

Write notes on the following:

A. Development of the lungs
B. Rotation of the stomach and the formation of the Omental bursa
C. Development of the esophagus

ANSWER

A. DEVELOPMENT OF THE LUNGS

The respiratory system does not carry out its physiological function (of gas exchange) until after birth. The respiratory tract, diaphragm and lungs do form early in embryonic development. The respiratory tract is divided anatomically into 2 main parts:

- Upper respiratory tract, consisting of the nose, nasal cavity and the pharynx
- Lower respiratory tract consisting of the larynx, trachea, bronchi and the lungs.

Development Overview

Week 4 - laryngotracheal groove forms on floor foregut.

Week 5 - left and right lung buds push into the pericardioperitoneal canals (primordia of pleural cavity)

Week 6 - descent of heart and lungs into thorax. Pleuroperitoneal foramen closes.

Week 7 - enlargement of liver stops descent of heart and lungs.

Month 3-6 - lungs appear glandular, end month 6 alveolar cells type 2 appear and begin to secrete surfactant.

Month 7 - respiratory bronchioles proliferate and end in alveolar ducts and sacs.

Phases of development

- **Embryonic**

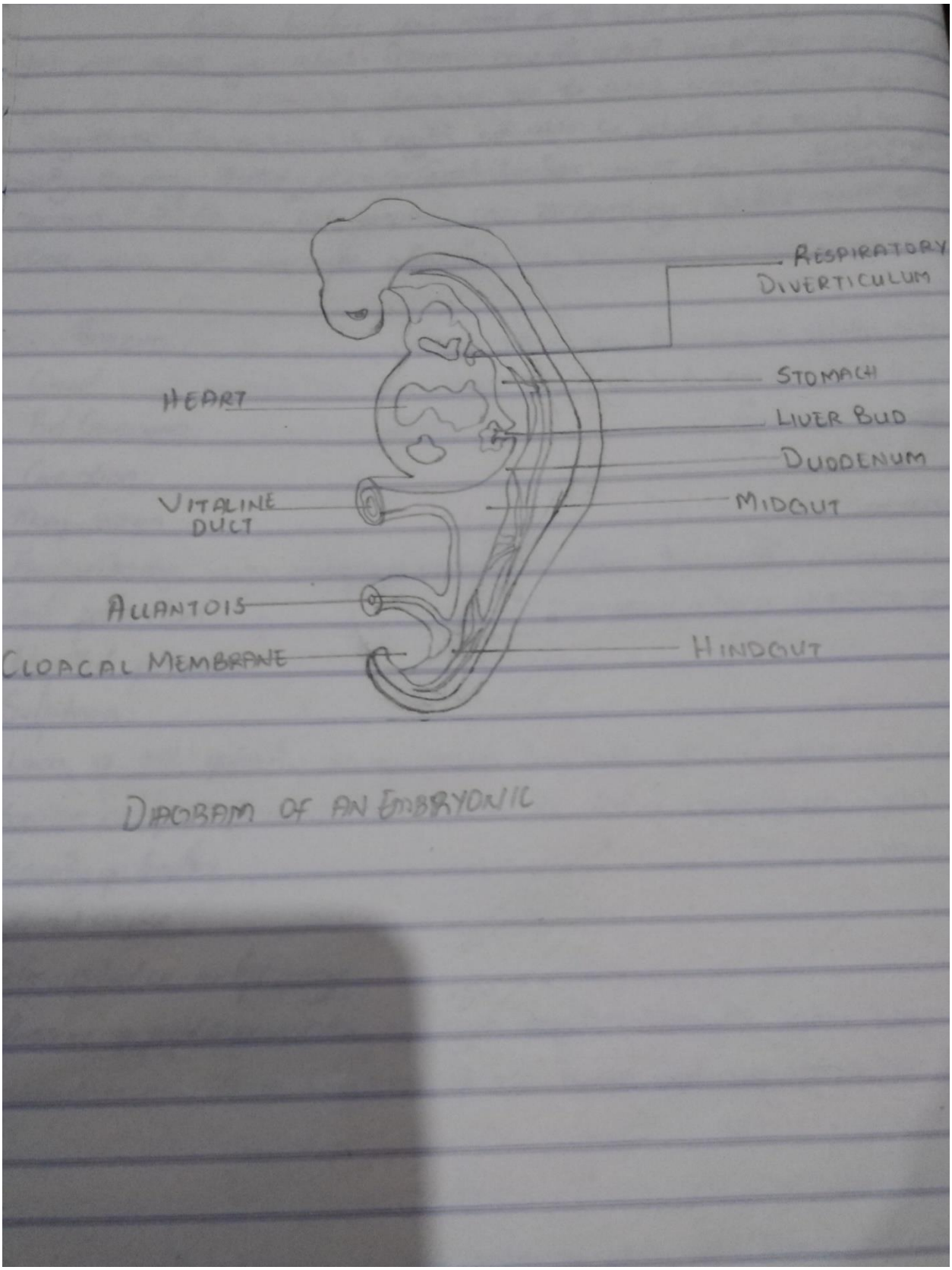


DIAGRAM OF AN EMBRYONIC

The embryonic phase takes place between the third and sixth week of gestation. The development of the lungs begins during the third week, with the appearance of a respiratory diverticulum (lung bud) as an outgrowth from the ventral wall of the foregut. The lung bud expands in a ventral and caudal direction, invading the mesenchyme surrounding the foregut. Soon after, the lung bud being initially in open communication with the foregut, becomes separated from it eventually forms the esophagus.

Concurrently, the distal end of the lung bud bifurcates into the right and left primary bronchial buds, whereas the proximal end (stem) forms the trachea and larynx. By the fifth week of gestation, the primary bronchial buds form three secondary bronchial buds on the right side and two on the left, foreshadowing the primordial lobes of the lungs. Each secondary bronchial bud gives rise to ten tertiary bronchial buds on both sides, demarcating the end of the embryonic phase.

Endoderm - tubular ventral growth from foregut pharynx.

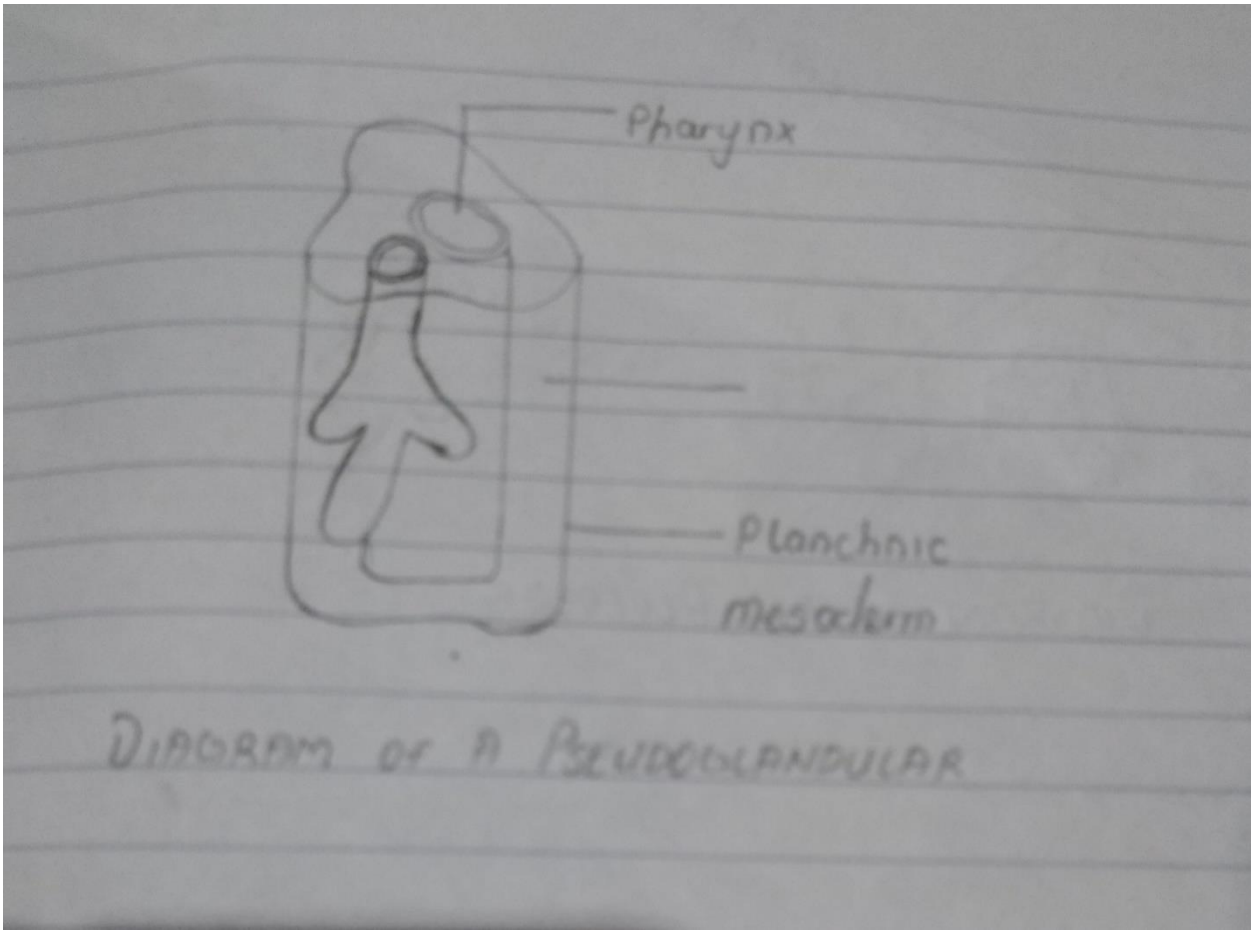
Mesoderm - mesenchyme of lung buds.

Intraembryonic coelom - pleural cavities elongated spaces connecting pericardial and peritoneal spaces.

Vascular - extra pulmonary artery then lobular artery.

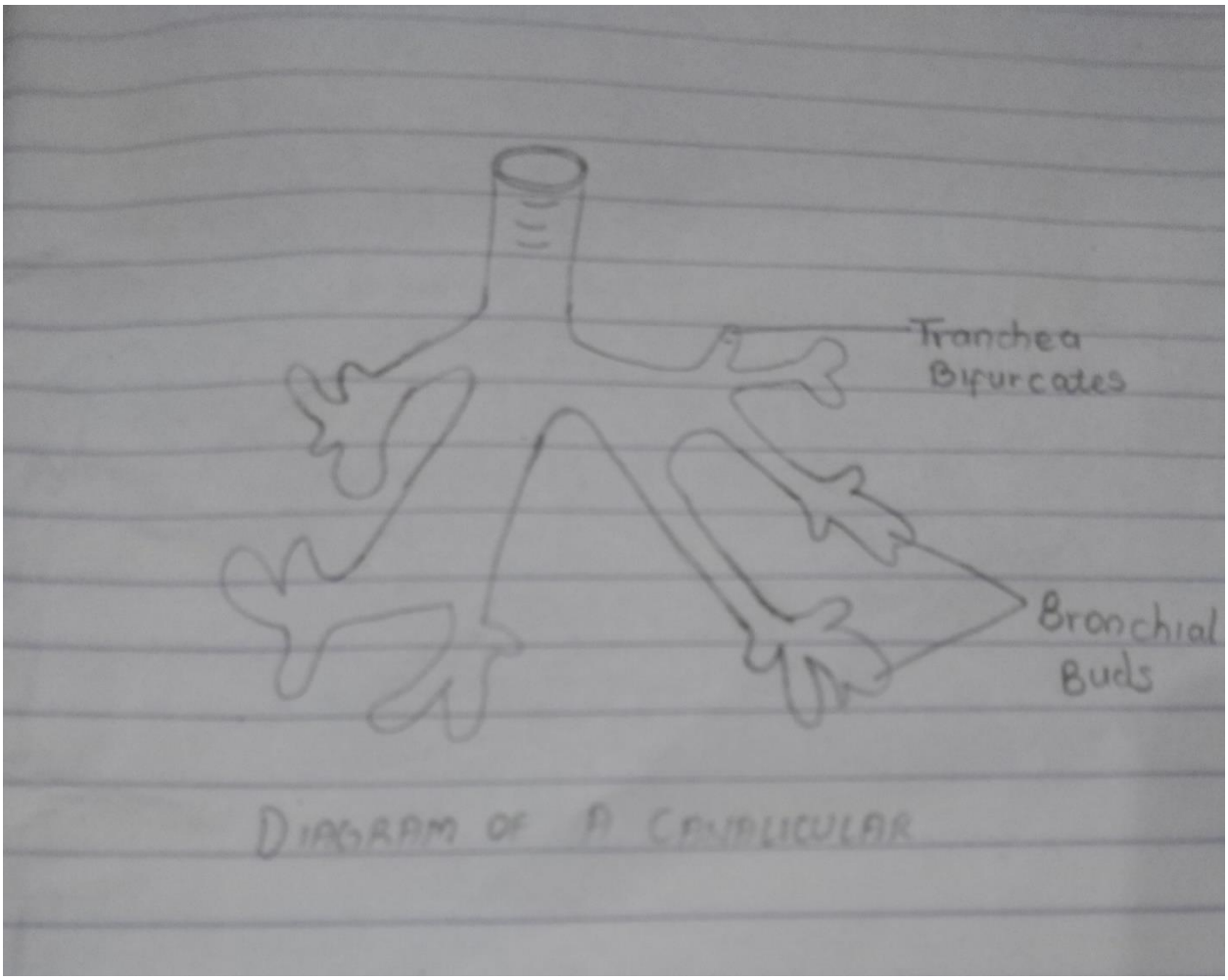
- **Pseudoglandular**

The pseudoglandular phase takes place during between the sixth and sixteenth week of gestation. The respiratory tree undergoes twelve to fourteen more generations of branching, resulting in the formation of terminal bronchioles. This passageway will be lined with a specific type of respiratory epithelium, simple columnar epithelium (ciliated) transitioning to simple cuboidal epithelium (some cilia).

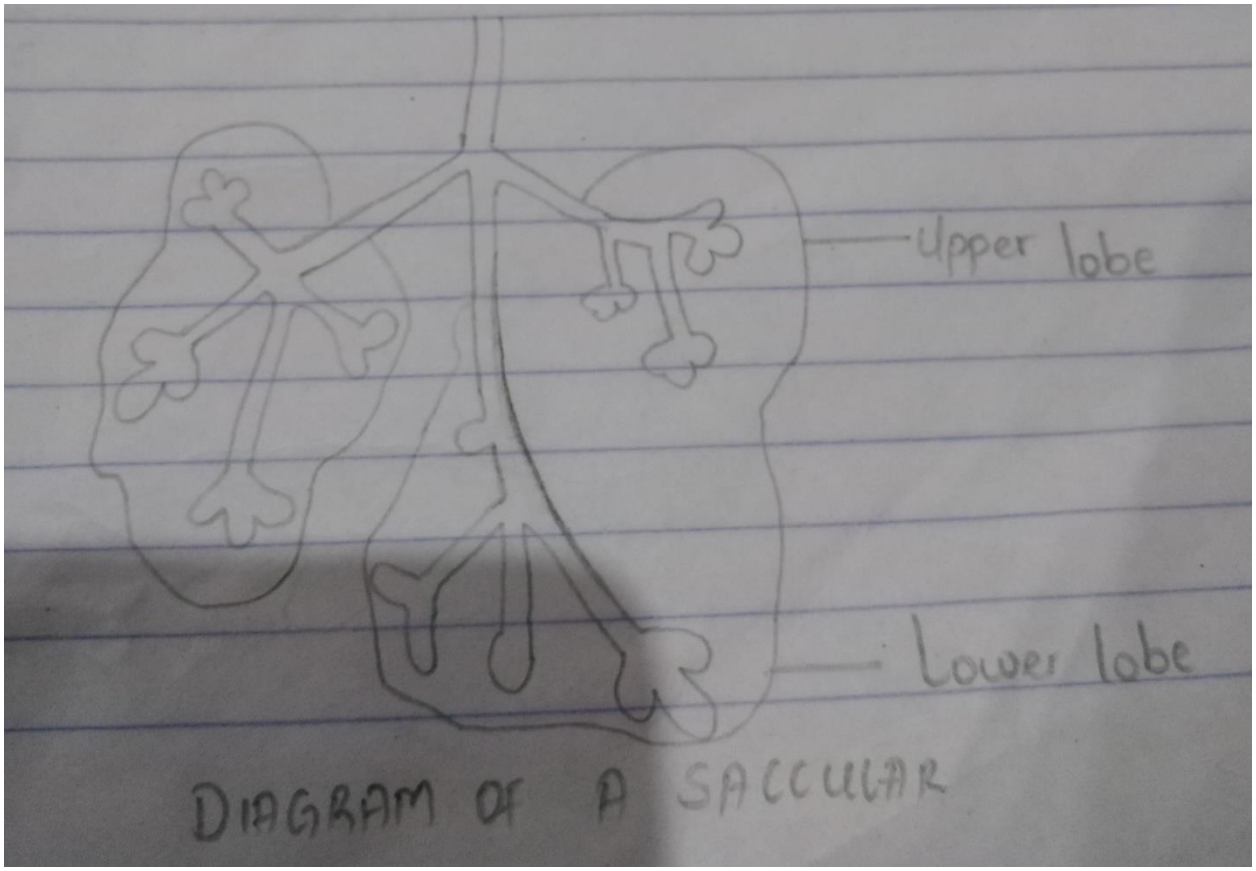


- **Canalicular**

The canalicular phase takes place during the sixteenth and twenty-eighth week of gestation. Each terminal bronchioles further divide into respiratory bronchioles, which become surrounded with an increase in vascularization. Subsequently, the lumens of the respiratory bronchioles become enlarged as a result of the thinning of their epithelial walls. This process sets up the differentiation of specialized cell types associated with the lungs.


Tranchea
Bifurcates
Bronchial
Buds
DIAGRAM OF A CANALICULAR

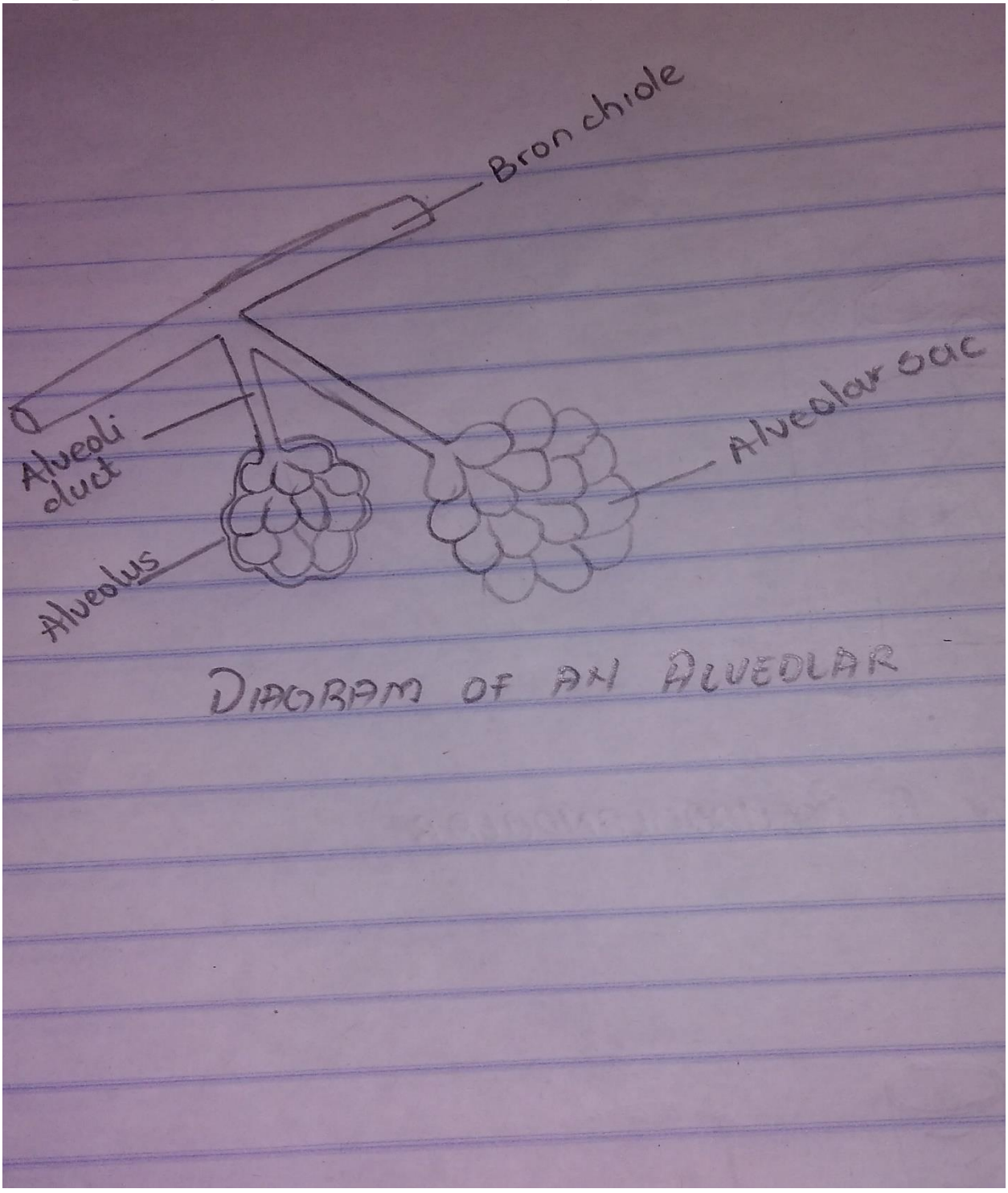
- **Saccular**



The saccular phase takes place between the twenty-eighth and thirty-sixth week of gestation. The respiratory bronchioles give rise to a final generation of terminal branches. These branches become invested in a dense network of capillaries, forming the terminal sacs (primitive alveoli) that are lined with type I and type II alveolar cells. Type I alveolar cells (type I pneumocyte) are branched cells which are the gas exchange surface in the alveolus. Type II alveolar cells act as the 'caretaker' by responding to damage of the type I cells. Type II alveolar cells do this by dividing and acting as a progenitor cell for both type I and type II cells. In addition, they synthesise, store and release pulmonary surfactant into the alveolar hypophase, where it acts to optimise conditions for gas exchange. Although gas exchange is possible at this point, it is very limited as the alveoli are still immature and few in numbers. In fact, the formation of the terminal sacs continues during fetal and postnatal life. Prior to birth, there are approximately twenty million to seventy million terminal sacs, whereas the total number in a mature lung is approximately three-hundred to four-hundred million.

❖ **Alveolar**

The alveolar phase is characterized by the maturation of the alveoli, a process that takes place during the end of fetal life and many years after birth.



LUNG DISEASES

Lung and breathing problems can occur due to such respiratory illnesses and conditions as asthma, pneumonia, collapsed lung and chronic obstructive pulmonary disease.

Collapsed Lung

A collapsed lung, or pneumothorax, occurs when air builds up in the space between the pleura, a two-layer membrane that surrounds the lungs. . The air presses on the lung, causing a collapse. Symptoms include shortness of breath and a sharp pain in the chest that worsens if you cough or take a deep breath. A collapsed lung can occur due to a chest or lung injury or a rib fracture, or may happen after a medical procedure on the lungs. If you have a small pneumothorax, you may not require any treatment, other than rest and oxygen therapy. In some cases, your doctor may remove the extra air in the pleura with a needle. Treatment of a large pneumothorax may require the insertion of a chest tube to remove the air and oxygen treatment. Surgery may be needed in more severe cases

Asthma

Asthma is a chronic lung disease that causes swelling, inflammation and extra mucus in your airways. The swelling narrows the passages in your lungs, making it harder to breathe. In addition to breathing difficulties, asthma can cause wheezing, tightness in the chest and coughing. Doctors treat asthma with daily medication, such as inhaled corticosteroids and quick-relief inhalers to provide immediate relief of symptoms.

Pneumonia

Pneumonia causes a lung inflammation due to a viral, bacterial or fungal infection. Pneumonia can occur as a complication of another illness, such as the flu. Although pneumonia can occur at any age, you may be more likely to develop pneumonia if you have a chronic respiratory illness, are older than age 65, have a disease that compromises your immune system or take medications that suppress the immune system, such as chemotherapy drugs. Doctors treat bacterial pneumonia with antibiotics and recommend drinking clear fluids and resting to treat viral pneumonia. Antifungal medications can help you recover from fungal pneumonia.

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Chronic Obstructive Pulmonary Disease

Both emphysema and chronic bronchitis are part of chronic obstructive pulmonary disease, or COPD.The disease causes inflamed bronchial tubes and, increased mucus production, and results in the stiffening of air sacs in the lung. Symptoms of COPD include shortness of breath that worsens with activity, coughing, wheezing and tightness in the chest. Doctors treat COPD with inhaled medication and antibiotics as needed. If you have a serious case of COPD, you may need to use oxygen or may require lung reduction or lung transplant surgery.

B. ROTATION OF THE STOMACH AND THE FORMATION OF THE 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 bursae in your body are made up of a synovial membrane. This thin membrane of tissue secretes the synovial fluid that is contained within the bursa sac. Synovial fluid is your body’s lubricant, and this viscous fluid

inside the bursa allows structures in your body to glide over one another easily.

Bursae are very small and thin. The average diameter of a bursa in an adult human is about 4 cm, and each bursa is about 2 millimeters thick.1the membrane of the bursa is semi-permeable, allowing some materials to flow across the membrane into and out of the sac. An injury to your bursa may cause it to fill with blood or white blood cells.

Borders

- Anteriorly - quadrate lobe of liver, gastrocolic ligament, lesser omentum
- Left - left kidney, left adrenal gland
- Posteriorly - pancreas
- Right - epiploic foramen, lesser omentum, greater sac

Communications

Superior recess, splenic recess, inferior recess, folds and recesses around the cecum and duodeum

TYPES OF BURSAE

These are the 3 main types of bursa in the body.

1. Synovial- Synovial bursae are most commonly found and lie near the synovial membrane of the joints of your body.

2. Adventitious- The accidental bursa occur only after continued shearing or repeated pressure over a bony prominence. A bunion is an example of an adventitious bursa.

3. Subcutaneous- These bursae lie between your skin and a bony prominence and allow friction-less motion of your skin over the bone. An example of this can be found on the back of the elbow.

There are about 160 bursa in your body, and the main ones can be found in areas of high bony prominence. These bursa include:

The pre-patellar bursa.

There are about five bursae that surround various areas of your knee joint, providing cushioning. They include the pre-patellar bursa, found overlying the kneecap, the suprapatellar bursa, separating the knee-cap from the thigh bone (femoral condyle) and the infrapatellar bursa, found below the kneecap overlying the patellar tendon.

The trochanteric bursa.

There is a large bursa that is located atop the bony prominence of your hip joint. This allows your gluteus medius muscle to glide and slide naturally over the bone.

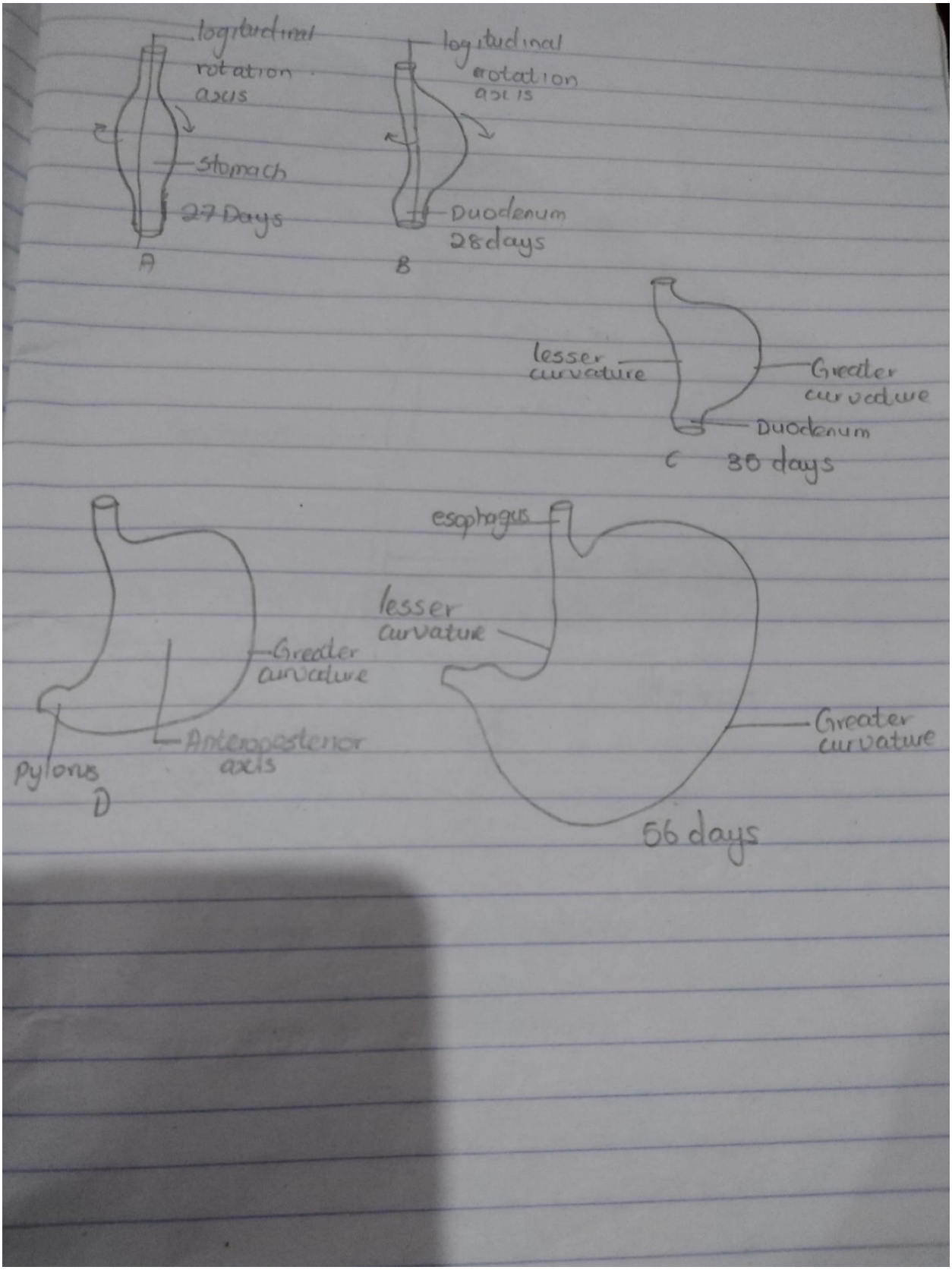
The olecranon bursa.

This bursa lies between your skin and the bony prominence of your elbow.If a bursa is surgically excised from your body, it can grow back over a few weeks' time.

FUNCTIONS

- Your bursae serve to reduce friction between your body's bony prominences and muscles, tendons, and ligaments.
- They help structures glide and slide past one another while movement occurs.

- A bursa may also provide a bit of shock absorption; the olecranon bursa in your elbow or your pre-patellar bursa in your knee may help soften a blow to those joints.


longitudinal rotation axis
stomach
27 Days
A
longitudinal rotation axis
Duodenum
28 days
B
lesser curvature
Greater curvature
Duodenum
C 30 days
esophagus
lesser curvature
Greater curvature
Greater curvature
Anteroposterior axis
pylorus
D
56 days

Associated Conditions

There are several conditions that may affect your bursae, causing pain, limited movement around a joint, or limited function. These may include:

- Bursitis. Bursitis occurs when a bursa becomes inflamed. The hallmarks of inflammation include pain, increased tissue temperature, and swelling. When a bursa becomes irritated due to overuse, repetitive strain, or overloading of the tissues around the bursa, it may become painful and swollen. This may make moving the joint near that bursa difficult. Common areas of your body affected by bursitis include the knee, the hip, and the shoulder.
- Calcification of a bursa. If long-term inflammation and irritation of a bursa occurs, it may cause calcification of that bursa. This most often occurs in the shoulder, and it may lead to calcific bursitis and tendonitis of your shoulder joint.4 This painful condition causes difficulty moving your arm.
- Infection. An infection may cause a bursa to become irritated and inflamed. Infection may be due to some local irritant or due to a rheumatic or systemic disease process.3
- Gout. Deposition of urate crystals in patients with gout can occur with resultant pain or inflammation

Medication

If you have an inflamed bursa due to infection, your doctor may prescribe antibiotic medication to treat the problem. The medicine helps to control the infection, which in turn will relieve the pain and limited motion caused by irritation of the bursa.

If you have bursitis, your doctor may prescribe anti-inflammatory medication. Oral steroids may be used, and over-the-counter nonsteroidal anti-inflammatory drugs (NSAIDS) may be effective.5 If oral steroids and NSAIDS prove ineffective in relieving bursa inflammation, an injection of corticosteroids may be performed, bathing the bursa and surrounding tissue in medicine that fights inflammation.

Physical Therapy

If you have bursitis or limited use of a joint due to a suspected bursa problem, your physician may prescribe physical therapy. Your physical therapist will assess your condition and use various treatment techniques to decrease pain and improve your ability to function.

Treatments that may be used by your physical therapist may include:

- Exercise. Your therapist may identify impairments that may be leading to an irritated bursa. This may be tight muscles, weakness, or abnormal movement patterns that are placing your bursa in a compromised position. Exercise to improve range of motion (ROM), strength, and functional mobility may be effective in relieving your current problem and preventing future problems with your bursa.3
- Joint mobilization. If tightness around your joint is causing your bursa to become pinched and inflamed, your physical therapist may perform joint mobilizations. These specialized manual movement techniques can help improve the way you move and keep pressure off your inflamed bursa.
- Ice. If your bursa is inflamed, your therapist may apply ice to your body. The ice has been shown to decrease localized blood flow, helping to calm down the painful inflammation of your bursa. Keep in mind that although ice may feel good and help soothe your pain, it has not been shown to lead to improved outcomes when compared to people who do not use ice for bursitis.
- Heat. For chronic pain caused by irritation of a bursa, heat may be applied. Heat increases circulation and can bring much-needed oxygen and blood to injured bursa tissues. Use caution; heat may burn your skin, so follow your physical therapist's directions when using heat. As with ice, using heat for bursitis may feel good, but it has not been shown to offer superior outcomes when compared to people who do not use heat for bursa problems.
- Ultrasound. Ultrasound is a deep heating treatment occasionally used in physical therapy. When ultrasound is applied to your inflamed bursa, it heats

it, leading to increased blood flow which brings in oxygen and washes away inflammatory cells. Keep in mind that ultrasound has not been proven to be more effective than placebo for the treatment of inflammation in the body. Still, you may encounter it in the physical therapy clinic.

- Electrical stimulation. Your physical therapist may use a modality called electrical stimulation to help treat your bursitis. E-stim, as it is commonly called, may be used to decrease pain and improve muscle function. Another form of e-stim called iontophoresis uses electricity to introduce anti-inflammatory medication into your body.
- Massage. If tight tissues are causing your bursa to become pinched and inflamed, your physical therapist may use massage techniques to help relieve the tension. Massage can improve blood flow, decrease pain, and improve the way your body moves.

Most problems with a bursa can be successfully treated with conservative measures. Bursitis and other related conditions typically last for four to six weeks. If your condition lasts longer, you may need to follow up with your doctor to discuss more invasive treatments.

Surgery

For the most severe cases of bursitis and conditions affecting your bursa, surgery may be performed. During the surgery, called a bursectomy, the injured or inflamed bursa may be surgically excised from the area around your joint. This removal of the damaged and inflamed bursa helps to decrease pain and relieve compression of the bursa. Keep in mind that a new bursa will grow back within a few weeks. This new bursa will not be inflamed or calcified. Working with a physical therapist and performing exercises to minimize stress on your bursa after surgery may be effective in preventing future problems with your bursa.

C. DEVELOPMENT OF THE ESOPHAGUS

The esophagus also known as the food pipe or gullet, is an organ in vertebrates through which food passes, aided by peristaltic contractions, from the pharynx to the stomach. It begins at the back of the mouth, passing downwards through the rear part of the mediastinum, through the diaphragm, and into the stomach. In humans, the esophagus generally starts around the level of the sixth cervical vertebra behind the cricoid cartilage of the trachea, enters the diaphragm at about the level of the tenth thoracic vertebra, and ends at the cardia of the stomach, at the level of the eleventh thoracic vertebra. The upper parts of the esophagus and the upper esophageal sphincter receive blood from the inferior thyroid artery, the parts of the esophagus in the thorax from the bronchial arteries and branches directly from the thoracic aorta, and the lower parts of the esophagus and the lower esophageal sphincter receive blood from the left gastric artery and the left inferior phrenic artery. The venous drainage also differs along the course of the esophagus. The upper and middle parts of the esophagus drain into the azygos and hemiazygos veins, and blood from the lower part drains into the left gastric vein. All these veins drain into the superior vena cava, with the exception of the left gastric vein, which is a branch of the portal vein. Lymphatically, the upper third of the esophagus drains into the deep cervical lymph nodes, the middle into the superior and posterior mediastinal lymph nodes, and the lower esophagus into the gastric and celiac lymph nodes. This is similar to the lymphatic drainage of the abdominal structures that arise from the foregut, which all drain into the celiac nodes.

Position

The esophagus (yellow) passes behind the trachea and the heart.The position and relation of the esophagus in the cervical region and in the posterior mediastinum. The upper esophagus lies at the back of the mediastinum behind the trachea, adjoining along the tracheoesophageal stripe, and in front of the erector spinae muscles and the vertebral column. The lower esophagus lies behind the heart and curves in front of the thoracic aorta. From the bifurcation of the trachea downwards, the esophagus passes behind the right pulmonary artery, left main bronchus, and left atrium. At this point it passes through the diaphragm.

The thoracic duct, which drains the majority of the body's lymph, passes behind the esophagus, curving from lying behind the esophagus on the right in the lower part of the esophagus, to lying behind the esophagus on the left in the upper esophagus. The esophagus also lies in front of parts of the hemiazygos veins and the intercostal veins on the right side. The vagus nerve divides and covers the esophagus in a plexus.

Constrictions

The esophagus has four points of constriction. When a corrosive substance, or a solid object is swallowed, it is most likely to lodge and damage one of these four points. These constrictions arise from particular structures that compress the esophagus. These constrictions are:

1. At the start of the esophagus, where the laryngopharynx joins the esophagus, behind the cricoid cartilage
2. Where it is crossed on the front by the aortic arch in the superior mediastinum
3. Where the esophagus is compressed by the left main bronchus in the posterior mediastinum
4. The esophageal hiatus where it passes through the diaphragm in the posterior mediastinum

As early as the fourth week in development, the esophagus of the human embryo is merely a sphincter or constricted part of the primitive foregut, between the pharynx and stomach. During the sixth and seventh weeks of gestation, the esophagus undergoes rapid elongation as cephalic development separates the head and neck from the thorax. The elongation is facilitated by development of the lungs and pleural cavities, which push the stomach dorsally and inferiorly. During the sixth week of development, the esophagus is only 2 mm long, but at birth it extends to 100 mm. Its superior limit is marked by the inferior cricopharyngeal portion of the inferior pharyngeal constrictor. The cricopharyngeal part of the inferior pharyngeal constrictor relaxes suddenly during swallowing and simultaneously lengthens the vocal folds of the larynx. The lower limit of the esophagus is marked by its entrance to the stomach, in a region that constitutes a barrier to reflux of gastric contents, but it is not marked by an anatomically recognizable sphincter. It was indicated that at lower thoracic levels, the esophagus is supported away from the aorta, azygos vein, and body of the vertebra, which permits advancement of the esophagus away from the vertebral column. As the

lungs approach each other in inspiration of an erect subject, a retroesophageal window is presented in radiographs. Between 8.4 and 16 mm (fifth to seventh weeks), the esophagus is crescentic, with the concavity of the crescent directed toward the trachea. Its upper part is round, but as it descends, it appears transversely elliptic. Near the level of tracheal bifurcation, it becomes round again, and finally it assumes an elliptic shape in the dorsoventral direction. The esophagus remains patent during this early period, save for a

nonspecific reticular coagulum.

PROBLEMS IN THE ESOPHAGUS

There are a host of different problems with the esophagus which mainly affect the inner lining and middle muscular layer. The term 'esophageal problems' does not indicate a specific condition affecting the esophagus. Problems with the inner lining are mainly due to inflammation and growths. Deeper lying problems most commonly affects the muscles in the esophageal wall upsetting normal esophageal motility and opening or closing of the upper or lower esophageal sphincters. Esophageal problems are not a single entity and therefore there is no specific treatment unless the underlying disease is identified.

Symptoms

The signs and symptoms of esophageal problems depends on the underlying condition.

- Esophageal pain
- Painful swallowing (odynophagia)
- Difficulty swallowing (dysphagia)
- Regurgitation
- Nausea
- Changes in appetite
- Heavy sensation in the chest

Esophageal pain includes heartburn which varies from a burning sensation or discomfort to intense burning pain. This is one of the most common and prominent symptoms of esophagus problems. However, it is important to ensure that esophageal pain – most commonly experienced as central chest pain – is

emanating from the esophagus and none of the surrounding vitals organs in the chest cavity such as the heart.

Causes

Common Causes

The most common esophagus problems includes :

1. Esophagitis which is the inflammation of the esophagus usually limited to the inner lining. There are several different causes including infections, medication and autoimmune factors. However, a common cause is acid reflux which is known as reflux esophagitis.
2. Injury to the esophagus may be due to a number of causes. A foreign body that enters the esophagus (like a fish bone or small sharp toys ingested by infants) can lodge in the esophageal lining or cause tears. Very hot foods or drink may also cause trauma to the esophageal lining.
3. Esophageal ulcers are the formation of open sores in the wall of the esophagus. It is mainly due to the same causes as stomach ulcers and duodenal ulcers (peptic ulcer disease). Acid reflux is the main cause and ulcers tend to follow prolonged or severe esophagitis.
4. Gastroesophageal reflux disease (GERD) is mainly a problem with lower esophageal sphincter (LES) dysfunction thereby allowing stomach acid to flow backwards into the esophagus. It causes esophagitis and esophageal ulcers.

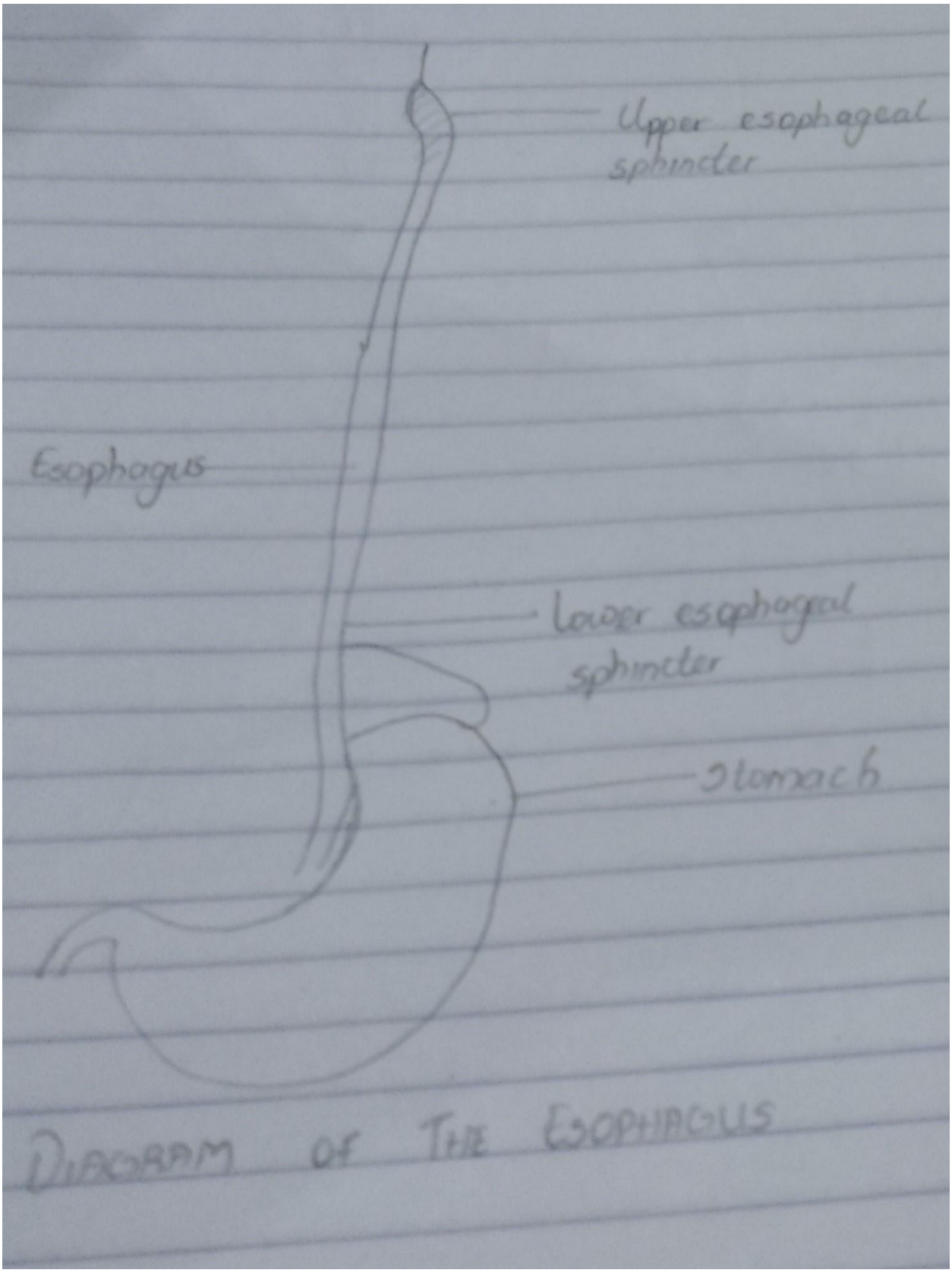


DIAGRAM OF THE ESOPHAGUS