• In the last lecture, we were talking about the peritoneum. Today we will finish it up

• **Ligaments of the peritonum:**
  - Ligament: thickening in a part of the peritoneum
  ✓ Suspensory ligament of the duodenum (treitz ligament): it is an important landmark at the end of the duodenum and the beginning of the jejunum (very important for surgeons, points the beginning of the jejunum)
  - This ligament is attached to the right crus of the diaphragm
  ✓ Phrenicocolic ligament
  - Phrenico: diaphragm  colic: colon
  - Fold of the peritoneum from the left colic flexure to diaphragm, important because it fixes the spleen in its location above it, also it separates the spaces above and below it from each other.

• **Peritoneal recesses and fossa**
  - At the junction between intraperitoneal and retroperitoneal organs, we have excess or folding in the peritoneum which is called recess or fossa.
  - It's disadvantage is that part of the small intestine can enter the recess or fossa, high pressure will be exerted on it and this can lead to cut in the blood supply→ strangulated or internal hernia
  - This means that the tissue of the small intestine will be degenerated (because of the cut of the blood supply) so the patient will have severe pain in that place, this case is an urgent operation. When a patient is diagnosed with strangulated hernia, he must have a surgery immediately.
  - If they found that part of the intestine is gangrened, because of the cut of blood supply, they will cut the affected place and make end to end anastomosis of the small intestine.
  ✓ The places that have recesses fossae in our bodies:

  *around the duodenum: the end of the duodenum is retroperitoneal then the jejunum is covered with mesentry “intraperitoneal”. Duodenal recesses:

    1. Superior duodenal recesses
    2. Inferior duodenal
    3. Paraduodenal
    4. Duodenojejunal recess or fossa

  * Around the cecum

    1. Superior ileocecal
    2. Inferior ileocecal
3. Retrocecal recess: behind the cecum, sometimes the appendix will be found there. What leads us to it is the tinea coli→ if we follow the tinea coli, it will reach the cecum and the base of the appendix.

4. Rectocolic recess

* Intersigmoid recess

*hepatorenal recess: between the liver, the right kidney and the right colic flexure (a place for internal hernia also)

- **pouches:**
  - depressions in the lower part of the peritoneum in the abdominal cavity
  - In females:

*uterovesical “vesicouterine”: between the fundus of the uterus and the gall bladder

*rectouterine pouch (Douglas pouch): between the uterus and the rectum, commonly involved in abdominal ectopic pregnancy, when an ectopic pregnancy happens in the abdomen, the baby will be found in the douglas pouch because it is the most dependent part of the entire peritoneal cavity (when the patient is in the standing position)

  - In males:

* Rectovesical: between the rectum and the gall bladder.

- **Peritoneal subdivisions:**
  - The transverse colon and its mesentry that is attached to the posterior abdominal wall divide the greater sac to:

A.supracolic part: above the transverse colon and the mesocolon.

B.infracolic part: below the transverse colon and the mesocolon.

  - The supracolic part involves:

1. **Subphrenic space**: below the diaphragm, divided by the falciform ligament to:
   - Right
   - left
- the falciform ligament is a ligament that attaches the anterior surface of the liver with the anterior abdominal wall.

2. Subhepatic space: (subhepatic= below liver)

- Below the liver: the right kidney and the right colic flexure.
- The Subhepatic space is divided into:
  A. Right subhepatic space (Morison’s pouch):
     - Clinically Important, because sometimes an infection in the lower abdomen can move to morison's pouch, especially appendicitis; when the appendix is inflamed and left untreated, pus gathers around the appendix, and the patient always lays on his side (right side), so the pus will move upwards to morison's pouch resulting in abscess. (Diagnosis is very hard; the doctor must consider the history of the patient to diagnose this abscess as an untreated appendicitis.)
     - The abscess can be:
       - Subphreric (below diaphragm)
       - Or subhepatic (below the liver) ➔ in morison's pouch

This abscess has a certain characteristic, which is a sudden frequent increase in the body temperature, so the patient is sometimes cold and sometimes hot. (To diagnose it you have to know that the patient has untreated appendicitis).

[Diagram of a patient lying on their back showing the pelvic and thoracic cavity filled with fluids.]

As you can see in this picture, when the patient lies on his back, the pelvis and the lower part of the thoracic cavity are the most common sites to be filled with fluids.

B. Left subhepatic space (lesser sac)

- **Gutter**: (infracolic compartment)
  - Is a groove around the ascending and descending colon
  - The ascending and descending colon are retroperitoneal (i.e. peritoneum is on the anterior surface only, while the lateral sides are fixed in the posterior abdominal wall), surrounding each one is a groove. (We'll see them in the lab).
  - Lies below the transverse colon and transverse mesocolon
  - Divided by root of the mesentery of the small intestine into:
A. Right infracolic compartment (right paracolic gutter)
B. Left infracolic compartment (left paracolic gutter)
- Notice on the picture (in the next page) the phrenicocolic ligament \(\rightarrow\) which divides the space above and below, and the spleen is above it.

- **Right paracolic sulcus** (gutter)
  - Subdivide into:
    - Rt.medial.paracolic
    - Rt.Lateral.paracolic

Rt.Lateral.paracolic communicates with the hepatorenal recess and the pelvic cavity.

It provides a route for the spread of infection between the pelvis and the upper abdominal region. \(\rightarrow\) As we said before: in cases of appendicitis the pus can move from the right side upwards, either below the liver or below the diaphragm.

So there is connection between the pelvis and the diaphragm on the right side.

- **Left paracolic** (gutter)
  - Subdivide into:
    - Lt.medial.paracolic
    - Lt.Lateral.paracolic

Lt.medial.paracolic opens into the outside through the pelvis

Lt. Lateral paracolic is separated from the area around the spleen by the phrenicocolic ligament (a fold of peritoneum that passes from the colic flexure to the diaphragm).

So there is no connection between the pelvis and the diaphragm in the left side.

- If there is an infection in the left or the right side, it can move to the pelvis.
- If the infection spreads upwards, it will definitely be from the right side (because it’s opened, whereas the left side is closed by the phrenicocolic ligament)
Esophagus

- The esophagus is a tubular structure (muscular, collapsible tube) about 10 in. (25 cm) long that is continuous above with the laryngeal part of the pharynx opposite the sixth cervical vertebra.
- The esophagus conducts food from the pharynx into the stomach. Wavelike contractions of the muscular coat, called peristalsis, propel the food onward.
- It passes through the diaphragm at the level of the 10th thoracic vertebra to join the stomach.
- In the neck, the esophagus lies in front of the vertebral column; laterally, it is related to the lobes of the thyroid gland; and anteriorly, it is in contact with the trachea and the recurrent laryngeal nerves.
- In the thorax, it passes downward and to the left through the superior and then the posterior mediastinum.
- At the level of the sternal angle, the aortic arch pushes the esophagus over to the midline.

- The relations of the thoracic part of the esophagus:
  - Anteriorly: The trachea and the left recurrent laryngeal nerve (it extends to the thorax while the right one remains in the neck); the left principal bronchus, which constricts it; and the pericardium, which separates the esophagus from the left atrium.
  - Posteriorly: The bodies of the thoracic vertebrae; the thoracic duct; the azygos veins; the right posterior intercostal arteries; and, at its lower end, the descending thoracic aorta (In the lower part, before opening into the esophageal orifice, it crosses the descending thoracic aorta).
  - Right side: The mediastinal pleura (right pleura), right lung and the terminal part of the azygos vein.
  - Left side: The left subclavian artery, the aortic arch (anterior to the left side), the thoracic duct, the mediastinal pleura (left pleura) and the left lung.
- Inferiorly to the level of the roots of the lungs, the vagus nerves leave the pulmonary plexus and join with sympathetic nerves to form the esophageal plexus.

- The left vagus lies anterior to the esophagus and the right vagus lies posterior.

- At the opening in the diaphragm, the esophagus is accompanied by the two vagi, branches of the left gastric blood vessels, and lymphatic vessels.

- Fibers from the right crus of the diaphragm pass around the esophagus in the form of a sling (مقلاع).

- In the abdomen, the esophagus descends for about 0.5 in. (1.3 cm) and then enters the stomach through the esophagus orifice (1 inch to the left at the level of T10) in the diaphragm.

- It is related to the left lobe of the liver anteriorly and to the left crus of the diaphragm posteriorly.
- **Blood Supply of the Esophagus**
  - The upper third of the esophagus is supplied by the inferior thyroid artery,
  - the middle third by branches from the descending thoracic aorta,
  - and the lower third by branches from the left gastric artery
  - The veins from the upper third drain into the inferior thyroid veins, from the middle third into the azygos veins (systemic, towards the heart), and from the lower third into the left gastric vein (portal, towards the liver), a tributary of the portal vein.
  - anastomosis between the 2 systems (the systemic and the portal) could occur if there is a portal hypertension due to liver cirrhosis or fibrosis (esophageal varices)

- Lymph vessels from the upper third of the esophagus drain into the deep cervical nodes,
- from the middle third into the superior and posterior mediastinal nodes,
- and from the lower third into nodes along the left gastric blood vessels and the celiac nodes
- The esophagus is supplied by parasympathetic and sympathetic efferent and afferent fibers via the vagi and sympathetic trunks
- In the lower part of its thoracic course, the esophagus is surrounded by the esophageal nerve plexus (sympathetic and parasympathetic)

- **Gastroesophageal Sphincter**
- No anatomic sphincter exists at the lower end of the esophagus
- However, the circular layer of smooth muscle in this region serves as a physiologic sphincter
- As the food descends through the esophagus, relaxation of the muscle at the lower end occurs ahead of the peristaltic wave so that the food enters the stomach
- The tonic contraction of this sphincter prevents the stomach contents from regurgitating into the esophagus.
- (Sometimes if regurgitating happens due to a problem in cardia, the patient will feel acidity in the thorax and this might cause irritation and inflammation to the mucosa of the lower third of the esophagus)
- The closure of the sphincter is under vagal control, and this can be augmented by the hormone gastrin and reduced in response to secretin, cholecystokinin, and glucagon.

**Stomach**

- The stomach is a dilated part of the alimentary canal
- Between the esophagus and the small intestine

**Stomach site**
- It occupies the left upper quadrant mainly in the epigastric region

- **Shape of stomach**
  - It is roughly J-shaped
  - Steer horn in obese person
  - has two openings, the cardiac and pyloric orifices
  - Two curvatures, the greater and lesser curvatures
  - Two surfaces, an anterior and a posterior surface
  - Its shape undergoes considerable variation in the same person and depends on:
    - The volume of its contents
    - The position of the body
    - The phase of respiration.

- **Function OF stomach**
  - Has three main functions:
  - It stores food (in the adult it has a capacity of about 1500 mL)
  - It mixes the food with gastric secretions to form a semifluid chyme
  - It controls the rate of delivery of the chyme to the small intestine so that efficient digestion and absorption can take place.
  - (food stayes in the stomach almost 2-4 hours before being evacuated into the dudenum)

- **Parts of stomach**

  The stomach is divided into the following parts:

  **1- Fundus:**
  - Dome-shaped
  - Projects upward and to the left of the cardiac orifice
  - It is usually full of gas, although at the end of the pharynx there is a cricopharyngeal muscle which prevents the passage of air

  The x ray will show a dark spot in the fundus because of the air
The line from the incisure to the most dependent part of the stomach separates the body from the pylorus

2- Body:
   - Extends from the level of the cardiac orifice to the level of the incisura angularis (a constant notch in the lower part of the lesser curvature)

3- Pyloric region
   Divided into:
   a- Pyloric antrum:
      - This extends from the incisura angularis to the pylorus
   b. Pyloric canal
   C. Pyloric sphincter
      - The most tubular part of the stomach
      - The thick muscular wall is called the pyloric sphincter


The most dependent part of the stomach (it’s location and direction depend on whether the stomach is distended or empty)
Orifices of the stomach

- **Cardiac orifice**
  - The cardiac orifice is where the esophagus enters the stomach
  - No anatomic sphincter can be demonstrated here
  - A physiological sphincter → physiological mechanism exists that prevents regurgitation of stomach contents into the esophagus

- **The site of Cardiac orifice**
  - 7th Lt. costal cartilage
  - 1 inch to Lt. of midline
  - 45 cm from incisors in the oral cavity.
  - 10 cm from ant. abdominal wall

- **pyloric orifice**
  - Present at end of the pyloric canal
  - On the level of L1
  - 1” to the Rt. of the midline.
  - The circular muscle coat of the stomach is much thicker here and forms the anatomic and physiologic pyloric sphincter
  - Its position can be recognized by a slight constriction on the surface of the stomach (The pylorus lies on the transpyloric plane).
  - -the trans pyloric plane: horizontal plane half way between the superior margin of the manubrium sterni and the pupic symphysis reaching the tip of the right costal cartilage
  - -it is surgically known to have on it’s anterior wall a vein of mayo which is a landmark for the sphincter

Clinical application:

Perforated peptic ulcer whether it is in the stomach or the duodenum allows an amount of air to pass into the abdominal cavity below the diaphragm, particularly below the right capula which is pushed up by the liver (the highest region in the abdomin)

- the patient will suffer from an abdominal pain
- the x ray will show a dark spot in this region because of the air
- The pyloric sphincter controls the outflow of gastric contents into the duodenum.
- The sphincter receives motor fibers from the sympathetic system and inhibitory fibers from the vagus nerve

- **Function of pyloric opening controlled by:**
  - Hormonal influences from stomach & duodenum
  - Nerve fibers
  - Filling stomach → Myenteric fibers → relaxation of sphincter

- **Remember:**
  - The parasympathetic system is responsible for the peristaltic movement, gives innervation to the muscles in order to contract and gives innervation to the glands in order to secrete their contents (secretomotor)
  - The sympathetic system gives innervation to the sphincter in order to open and the evacuation process takes place

### Curvatures of stomach

1. **The lesser curvature**
   - Forms the right border of the stomach
   - Extends from the cardiac orifice to the pylorus
   - It ends at the angular incisure (constant notch like the acute angle and which is a landmark that separates the body from the pylorus)
   - It gives attachment to the lesser omentum (two folds of peritonium extending from the lesser curvature to the portahepatis and the fissure of the ligamentum venosa reaching the diaphragm)

2. **The greater curvature**
   - Much longer than the lesser curvature
   - Extends from the left of the cardiac orifice, over the dome of the fundus, and along the left border of the stomach to the pylorus
   - It gives attachment to the greater omentum (two folds of peritonium that descend downward then ascend upward to the transverse colon containing the left and right gastroepiploic vessels, nerves, fat and lymphatics)

### Mucous membrane
- The mucous membrane of the stomach is thick and vascular and is thrown into numerous folds, or rugae mainly longitudinal in direction.
- The folds flatten out when the stomach is distended.
- Rugae are oriented obliquely and transversely while the lesser curvature rugae are oriented longitudinally (special for fluids).
- Most fluids go through the lesser curvature rugae.
- Few amount of fluids will be mixed when you receive fluids during a meal.

![Stomach Anatomy](image)

- **Muscular wall of stomach**
  - The muscular wall of the stomach contains longitudinal fibers (outer surface), circular fibers (inner surface), and oblique fibers (inner most).

![Peritoneum of Stomach](image)

- **Peritoneum of stomach**
- The peritoneum (visceral peritoneum) completely surrounds the stomach.
- It leaves the lesser curvature as the lesser omentum
- It leaves the greater curvature as the gastroplenic ligament and the greater omentum
- The gastroplenic ligament extends from the upper part of the greater curvature to the spleen, and the greater omentum extends from the lower part of the greater curvature to the transverse colon
- **The lesser curvature** is suspended from the liver by the **lesser omentum**
- **Gastrophrenic ligament** between the fundus and the diaphragm.

• **Relations of stomach**

**Anterior- superior**

- The anterior abdominal wall (epigastric region)
- the left costal margin
- the left pleura and lung (above the fundus)
- the diaphragm
- the left lobe of the liver

**Posteriorly = stomach bed**

- The lesser sac (separates the organs from the posterior wall of the stomach)
- the Lt. crus of diaphragm (originated from the lateral side of the lumbar vertebra)
- the spleen (c shaped organ located on the lateral end of the stomach forming the lateral boundary, part of it is located posterior to the stomach and the other part is located anteriorly)
- the left suprarenal gland
- the upper part of the left kidney
- the splenic artery (above the upper border of the pancreas)
- the body of pancreas (the splenic vein is located behind the pancreas so it is not a content of the stomach bed)
- the transverse mesocolon
- the transverse colon

• **blood supply**
- The GI tract divided embryologically into:
1. Foregut (supplied by the celiac trunk (the first branch of the abdominal aorta) and ends at the level of the second part of the duodenum (at the openings of the common bile duct and the pancreatic duct)

2. Midgut (supplied by the superior mesenteric artery and ends at the lateral third of the transverse colon)

3. Hindgut (supplied by the inferior mesenteric artery and ends at the level of the rectum and the upper half of the anal canal)

- The arteries are derived from the branches of the celiac artery
- The celiac trunk arise from the front of the abdominal aorta and its located at the level of T12 to L1 above the pancreas
- Its 1 cm long

- Relations of celiac artery
  - On each side: celiac ganglia + lymphatic nodes
  - Crus of diaphragm and lumbar nerves
  - Its Branches for foregut

- Main distribution
  - Lt. gastric a
  - Splenic a
  - Hepatic a

- 1- The left gastric artery
  - Arises from the celiac artery
  - It passes upward and to the left to reach the esophagus
  - Then descends along the lesser curvature of the stomach
  - It supplies the lower third of the esophagus and the upper right part of the stomach

The hepatic artery gives two branches:

1. The right gastric artery

2. The gastroduodenal artery which lies behind the first inch of the duodenum and gives 2 branches:

A. The right gastroepiploic

b. The superior pancreaticoduodenal artery

- 2- The right gastric artery
  - Arises from the hepatic artery at the upper border of the pylorus
  - Runs to the left along the lesser curvature.
  - It supplies the lower right part of the stomach.

- 3- The short gastric arteries
  - Arise from the splenic artery (5-7 arteries)
- Arises from splenic artery in the gastrosplenic ligament
- pass upward in the gastrosplenic to supply the fundus

- **4- The left gastroepiploic artery**
  - Arises from the splenic artery before the hilum of the spleen
  - Passes forward in the gastrosplenic (ligament)
  - Supply the stomach along the upper part of the greater curvature in the greater omentum

- **5- The right gastroepiploic artery**
  - Arises from the gastroduodenal branch of the hepatic artery
  - It passes to the left and supplies the stomach along the lower part of the greater curvature in the greater omentum.

- **Venous drainage**
  - the portal vein arises behind the neck of the pancreas by the union of the splenic vein and the superior mesenteric vein
  - The veins drain into the portal circulation
  - The left and right gastric veins drain directly into the portal vein
  - The short gastric veins and the left gastroepiploic veins join the splenic vein
  - The right gastroepiploic vein joins the superior mesenteric vein (which meet the splenic vein behind the neck of pancreas to form the portal vein)

- **Lymphatic drainage**
  - Follow the arteries of stomach
- The left and right gastric nodes
- The left and right gastroepiploic nodes
- The short gastric nodes
- All lymph from the stomach eventually passes to the celiac nodes located around the root of the celiac artery on the posterior abdominal wall.
PLEASE REFER TO THE SLIDES

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