

Digestive System

University of Jordan
Faculty of Medicine
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Slide Sheet Handout Other

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Sheet #: 5

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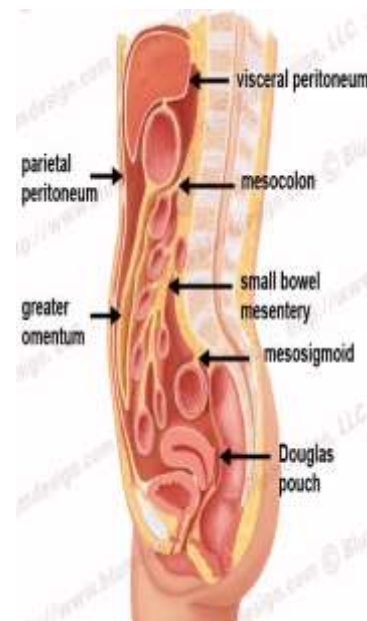


The Peritoneum

Some of the content of this lecture has been re-arranged for better organization. Don't panic!

The peritoneum is a thin serous membrane that surrounds the abdominal cavity. It consists of the *parietal peritoneum* and the *visceral peritoneum*. Imagine the peritoneum as a blown-up round balloon inside a sealed abdomen. Its thin outer membrane ends up lining the internal surface of the abdominal wall which is composed of the anterior abdominal wall, the posterior abdominal wall and the undersurface of the diaphragm. It also covers some of the pelvic organs including the upper surface of the urinary bladder, the fundus of the uterus along with the posterior surface of the body of the uterus down to the cervix then it passes anteriorly to the rectum. *This is the parietal peritoneum.*

Please refer to the adjacent picture as we trace the pathway the parietal peritoneum takes as it lines the abdomen. It starts from the undersurface of the diaphragm above the liver and lines the anterior abdominal wall as it descends downward to pelvis in order to cover the upper surface of the urinary bladder, posterior surface of the body of the uterus and its fundus down to the cervix then it passes anteriorly to the rectum to enclose the sigmoid colon and transverse colon(which becomes completely covered by peritoneum) then it descends down to the small intestine (which has a mesentery to suspend it from the posterior abdominal wall) where it completely covers the jejunum and ileum in particular, then it go back to the posterior abdominal wall to cover the transverse colon then to the pancreas, then it reaches the lower surface of the liver.





The liver is completely covered with peritoneum except for a small area located under the diaphragm and is called the *bare area of the liver*.

The visceral peritoneum is the layer that covers the viscera. Some organs from the posterior abdominal wall invaginate through the peritoneal wall (“the balloon”) and take on a covering from the wall of the peritoneum. This leads to the classification of abdominal organs into two *main* types;

1- organs that are completely covered by peritoneum (have *completely* invaginated into the peritoneal wall) and are called *intra-peritoneal organs*; such as the transverse and sigmoid colon, jejunum and ileum, and the stomach.

2- organs that remain in the posterior abdominal wall so that the peritoneum is just anterior to them and are called *retro-peritoneal organs*; such as the kidneys, the pancreas and most of the duodenum.

The *peritoneal cavity* is the *potential* space between the parietal peritoneum and the visceral layer of the peritoneum; sometimes it is considered as non-existent as the visceral layer is tightly adherent to the parietal layer but if air were to be introduced to the abdomen, this “potential space” would become very apparent.

The *abdominal cavity* is the space confined by the diaphragm above, and the pelvic inlet below.

The large intestine is composed of several parts that vary in their peritoneal coverings;

The transverse and sigmoid colons are *intra-peritoneal*.

The ascending and descending colons are *retro-peritoneal*.



The peritoneal cavity is divided into two spaces or sacs;

1. *The greater sac*; which is located above the liver. It is located between the stomach and the anterior abdominal wall (so it's posterior to the anterior abdominal wall); in front of the greater omentum.
2. *The lesser sac*; which is located below the liver, behind the stomach and in between the two layers of the greater omentum up to the transverse colon. It is located above the mesentery of the transverse colon (which is called the meso-colon).

The greater and the lesser sac communicate with each other through the **epiploic foramen**, which is also known as the **foramen of Winslow** or the **omental foramen**.

The epiploic foramen is *deep* to the free edge of the lesser omentum and is very important surgically. Any surgery performed posterior to the stomach requires entry through this foramen, which is the only open entry point as every other area is closed off.

An omentum consists of two layers of peritoneum that are rich in fat, lymphatic vessels and lymph nodes, nerves and blood vessels.

The **Greater Omentum** is formed of two layers of visceral peritoneum that extend from the greater curvature of the stomach and first part of the duodenum upwards to the transverse colon downwards. It descends as two layers and ascends as two layers

The **lesser omentum** is formed of two layers of peritoneum that extend from the porta hepatis of the liver, fissure for ligamentum venosum, the diaphragm and the first inch/ superior part of the duodenum to the lesser curvature of the stomach. *It definitely has a free edge!*

So the stomach is attached to both greater and lesser omenta.

A **ligament** is a thickening of peritoneum connecting two organs; there are ligaments that connect the spleen, stomach, pancreas and kidneys to other organs.

Mesentery of the small intestine is formed of two layers of peritoneum that completely cover the jejunum and ileum and attach them to the posterior abdominal wall



The Lesser Sac

(also known as the omental bursa based on embryological origins)

It is located posterior to the stomach, posterior to the lesser omentum and between the two layers of the greater omentum, and has the spleen at its lateral side.

Why is the lesser sac present?

It is a space located behind the stomach to allow for the expansion of the stomach posteriorly when it is full

Walls of the lesser sac:

Superior wall: from the undersurface of the diaphragm and the caudate lobe of the liver in front of the posterior abdominal wall

Anterior wall: lesser omentum, peritoneum of the posterior wall of the stomach, and the anterior two layers of the greater omentum as it falls as two layers from the stomach.

Inferior wall: conjunctive area of the anterior and posterior two layers of the greater omentum

Posterior wall: posterior two layers of the greater omentum, transverse colon and transverse meso-colon, and peritoneum covering posterior abdominal wall.

Left wall:

-**Spleen**; is completely covered by peritoneum up to its hilum so it's intra-peritoneal. At its hilum, the peritoneum thickens to form ligaments which are:

-**gastro-splenic ligament**; attaches the stomach to the spleen

-**spleno-renal ligament** (also known as the lieno-renal ligament); connects the hilum of the spleen to the left kidney.

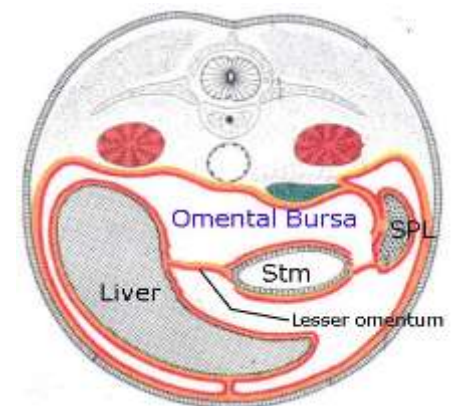
Right wall: the omental foramen of Winslow and the free edge of the lesser omentum.

The free edge of the lesser omentum has two important structures that are located superior to the epiploic foramen:

- 1- Hepatic artery
- 2- Portal vein
- 3- Common bile duct

How is the stomach completely covered by peritoneum?

The lesser omentum from the porta hepatis of the liver comes as two layers; one that is anterior to the stomach and the other as posterior to the stomach. These two layers meet at the greater curvature and descend a variable distance as two layers then they ascend as two layers to surround the transverse colon. After covering the transverse colon, the two layers go posteriorly to the anterior border of the pancreas.



Why is this important?

Because the anterior border of the pancreas receives an attachment from the posterior abdominal wall and a layer from the transverse colon (transverse meso-colon) so that the pancreas remains within the posterior abdominal wall and the visceral peritoneum attaches only to its anterior border making the pancreas retro-peritoneal.

The Greater Sac

It is located deep to the anterior abdominal wall, below the diaphragm, and above the pelvic viscera.

It is divided by the greater omentum into upper and lower compartments or into anterosuperior space and infero-posterior space.



The upper or anterosuperior compartment is further divided by the falciform ligament of the liver into right and left compartments.

The inferoposterior compartment is further divided by the mesentery of the small intestine (which attaches the small intestine to the posterior abdominal wall) into upper and lower compartments. (Slides say right and left)

The falciform ligament is composed of two thickened layers of peritoneum that connect the liver to the anterior abdominal wall and the diaphragm.

Boundaries of the omental (epiploic) foramen

This is very important!

Anteriorly: free border of the lesser omentum and its content; the hepatic artery, the portal vein and the bile duct

Posteriorly: Inferior vena cava

Superiorly: caudate process of caudate lobe of liver

Inferiorly: First part of the duodenum

Functions of the peritoneum

- 1- It secretes a lubricating serous fluid between the parietal and visceral that continuously moisten the associated organs and prevents friction
- 2- Fat storage between the two layers of peritoneum such as omenta
- 3- A role in immunity since it is rich in lymphatics and lymphocytes
- 4- Supports the viscera (remember the abdominal viscera are supported by the abdominal muscles, the intra-abdominal pressure and the peritoneum)



The abdominal viscera (organs) are divided into intra-peritoneal, retro-peritoneal and inter-peritoneal based on their relationship to the peritoneum

Intra-peritoneal viscera

- viscera is almost totally covered with visceral peritoneum
- example, stomach, 1st & last inch of duodenum, jejunum, ileum, cecum, vermiform appendix, transverse and sigmoid colons, spleen and ovary

The duodenum (25 cm/ 10 inches in length) has four parts; it is mainly retro-peritoneal except for the first and last inches (*this will be explained in subsequent lectures*)

Retro-peritoneal viscera

- Behind the parietal peritoneum
- they are partially covered by peritoneum on their anterior surfaces only
- Examples: kidneys, suprarenal glands, pancreas, descending and ascending colon, upper 3rd of rectum, duodenum (except for the first and last inch), ureters, abdominal aorta and Inferior Vena Cava (IVC)

Inter-peritoneal viscera

- Such organs are not completely wrapped by peritoneum
- Examples; liver, gallbladder (because it is embedded in the visceral surface of the liver and so it isn't completely covered by peritoneum. However; in some people the gallbladder has a mesentery meaning it's completely covered by peritoneum), urinary bladder (only the superior surface is covered) and uterus (its



fundus, posterior surface of the body down to the cervix are the only areas covered by peritoneum)

- Some books consider the liver as inter-peritoneal because it has an area not covered by peritoneum; the bare area of the liver. The bare area of the liver is surrounded by the coronal and the triangular ligaments

The Peritoneal Reflections

- A peritoneal reflection that connects the intestine and body wall is usually named according to the part of the gut to which it is attached.
- For example, the two-layer reflection to jejunum and ileum that connects them to the posterior abdominal wall is termed the mesentery of the small intestine; that connecting the transverse colon to the anterior border of the pancreas is the transverse meso-colon.
- Some peritoneal reflections between organs or between the body wall and organs, are termed ligaments or folds. Most of such ligaments or folds contain blood vessels. Examples of ligaments include the gastro-splenic and lieno-renal ligaments.
- Broad peritoneal sheets associated with stomach are termed omenta like the greater and less omenta. The omenta contain large quantities of fat, blood vessels, nerves and lymphatics.

Omenta

These are two-layer folds of peritoneum that connect two organs like the liver and the stomach or the stomach and the transverse colon.

There are two omenta; *the greater omentum* (which fills up the abdominal cavity) and *the lesser omentum*.



The Lesser Omentum

In some books, the lesser omentum is divided into two ligaments;

Hepatogastric ligament from porta hepatis to the lesser curvature of stomach

Hepatoduodenal ligament

Extends from porta hepatis to the superior part of the duodenum

Don't forget the three important structures in the free edge of the lesser omentum!

Contents of the lesser omentum:

- Blood vessels → Rt. & Lt. gastric vessels
- Lymph nodes & lymphatic vessels
- Fat
- Autonomic N.S → sympathetic + parasympathetic (which come from the vagus nerve)

The Greater Omentum

- It is the largest peritoneal fold.
- It consists of a double sheet, folded on itself so that it is made up of four layers.
- The anterior two layers descend from the greater curvature of stomach and superior part of duodenum (inferior surface of the first part of the duodenum) and hangs down like an apron in front of coils of small intestine then turn up on the back of itself, and ascend to the transverse colon.
- So it descends as two layers and ascends as two layers to attach at the anterior and posterior surfaces of the transverse colon. Then they form the transverse meso-colon

What's between the two layers of the greater omentum?

The lesser sac!



- The upper part of the greater omentum which extends between the stomach and the transverse colon is termed the **gastrocolic ligament**.

Contents of the greater omentum

- Gastroepiploic vessels
- Lymph nodes & lymphatic vessels
- Fat
- Autonomic N.S → sympathetic + parasympathetic (vagus nerve)

Remember:

The lesser omentum contains the *gastric* vessels

Whereas;

The *greater* omentum contains the *gastroepiploic* vessels

Functions of the Greater Omentum

The greater omentum is called “the policeman of the abdomen” because any infection in any organ occurring anywhere in the abdomen gets surrounded by the omentum as an attempt to localize the infection and prevent any further spread.

In evidence; when a surgeon decides to perform an appendectomy (surgical removal of the appendix) because of a suspected appendicitis (inflammation of the appendix) and sees the omentum surrounding the appendix he can infer that there has been an infection that got “busted” by the police to localize it and “arrest” any further spread. The surgeon might actually get suspicious if the appendix wasn’t surrounded by omentum!

Therefore, the greater omentum has a protective function; it plays a role in immunity as it limits migration of infections in addition to being a storehouse for fat.



Mesenteries of the Peritoneum

1- Mesentery of small intestine

It suspends the small intestine from the posterior abdominal wall

Root of the mesentery

- 15 cm long
- It begins from the ligament of trietz or the duodeno-jejunal junction at the level of L2 on the left side and ends on the right side of the sacroiliac joint.
so the root of the mesentery *runs obliquely* from the left to the right

Contents of the mesentery

- the jejunal and ileal branches of the superior mesenteric artery & veins
- nerve plexuses
- lymphatic vessels
- the lymphatic nodes,
- connective tissue
- fat

The superior mesenteric artery provides most of the blood supply to the jejunum and ileum.

It terminates as vasa recta and also forms arcades (the "windows" of the mesentery) which act as one of the basis for differentiating the jejunum from the ileum. (*this will be covered in subsequent lectures too*)

2- Mesoappendix

- Triangular mesentery— extends from terminal part of the ileum to the appendix
- The Appendicular artery, which is a branch of the posterior cecal artery, runs in free margin of the mesoappendix



3- The Transverse Meso-colon

- It is a broad two-layer fold that completely covers the transverse colon (therefore; it is intra-peritoneal)
- It connects the transverse colon to the anterior border of the pancreas.

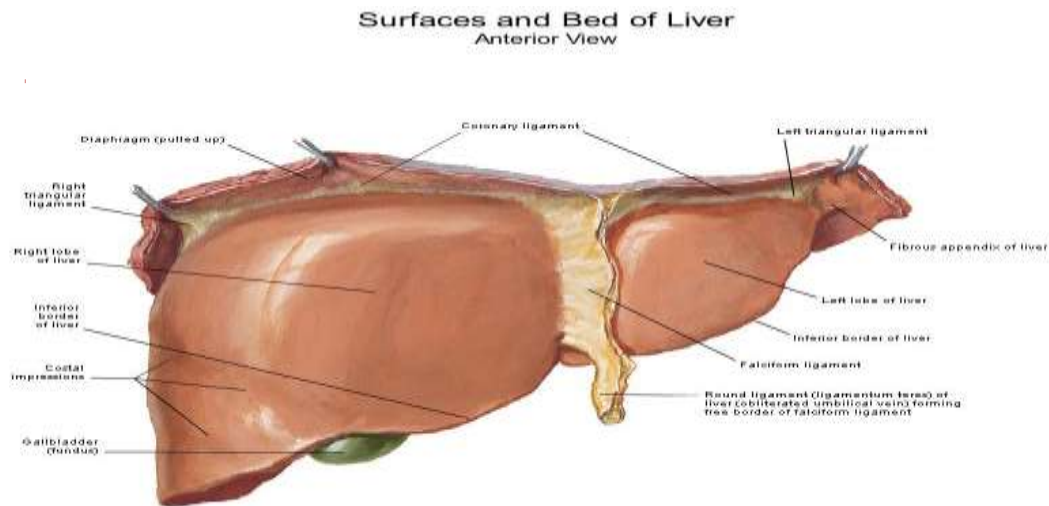
4- Sigmoid Meso-colon

- The mesentery completely covering the sigmoid colon
- Contents
 - The sigmoid vessels
 - Lymphatic vessels
 - Nerves
 - The left Ureter descends into the pelvis behind its apex.

Ligaments of the Peritoneum

All ligaments are two layers of the peritoneum that undergo thickening; the name of the ligament indicates its attachments because ligaments connect two organs together.

Ligaments of the Liver (all are found within the two layers of peritoneum)



- ① The **falciform ligament of liver**; it attaches the liver to the anterior abdominal wall and the diaphragm;
Sickle shaped;
Free border of the falciform ligament contains Ligamentum teres (obliterated umbilical vein)
- ② The **ligamentum teres hepatis**; (also known as the round ligament of the liver); it represents an obliterated umbilical vein and is attached to the portal vein
- ③ The **coronary ligament**; it surrounds the bare area of the liver and ends as the right and left triangular ligaments
- ④ The **right triangular ligament**
- ⑤ The **left triangular ligament**; along with the right triangular and coronary ligaments it surrounds the bare area of the liver
- ⑥ The **hepatogastric ligament**; runs between the liver the and the stomach
- ⑦ The **hepatoduodenal ligament**; runs between the liver the first inch of the duodenum



Ligaments of the Spleen

- **Gastrosplenic ligament**
 - Connects the fundus of stomach to hilum of spleen.
 - Contents; the short gastric & left gastroepiploic vessels pass through it.
- **Splenorenal ligament (more important!)**
 - It extends between the hilum of spleen and left kidney.
 - Contents;
 - The splenic vessel
 - Lymphatic vessels, nodes & nerve
 - **the tail of pancreas**

The significance of the spleno-renal ligament becomes evident upon performing a splenectomy.

Any trauma on the left side affecting the 9th, 10th, 11th ribs might cause rupture of the spleen and leads of bleeding because the spleen is a reservoir of blood which would require a splenectomy; this surgical procedure requires ligation of the splenic blood vessels but since the tail of the pancreas is also present in the ligament, one must pay extra attention so as to NOT injure the tail of the pancreas.

Any injury to the tail will cause release of the pancreatic enzymes that will infiltrate the peritoneum and damage it (infection); a situation that is potentially fatal.

- **Phrenicosplenic ligament** ; attaches the spleen to the diaphragm
- **Splenocolic ligament**; attaches the spleen to the colon



4- Ligaments of the Stomach

- Hepatogastric ligament
- Gastrosplenic ligament
- Gastrophrenic ligament
- Gastrocolic ligament
- Gastropancreatic ligament

5- The suspensory ligament of duodenum

- Sometimes named **Treitz ligament**
- This ligament connects the junction between duodenum & jejunum to the right crus of the diaphragm.
- It is surgically important because it serves as a landmark of the beginning of the jejunum

The duodenum is largely retro-peritoneal but the last inch is intra-peritoneal. This critical junction is where the ligament of Treitz attaches and signals the beginning of the jejunum

6- The phrenicocolic ligament

- It is a fold of peritoneum which is continued from the left colic flexure to the diaphragm opposite the 10th and 12th ribs.

This sheet is dedicated to AWN 😊