

The Peritoneum

The peritoneum is a thin serous membrane.

Imagine the abdominal cavity, and it is مبطن بغشاء. We visualize it as a بالون كبير منفوخ inside the abdominal cavity. The walls of this balloon form the **parietal peritoneum**, therefore lining the anterior and posterior abdominal walls, and the diaphragm above, and the pelvic viscera below. The **visceral peritoneum** is غشاء البالون يحيط بكل يدي, therefore, زبي ما أجيب إيدي وأدخلها بالبالون المنفوخ and remains attached to the posterior abdominal wall. Such organs are **intraperitoneal** organs, such as the stomach, jejunum, ileum, spleen, and the transverse colon.

So the peritoneum consists of:

1- Parietal peritoneum which lines all the edges of the abdominal cavity.

2- Visceral peritoneum which covers the intraperitoneal viscera.

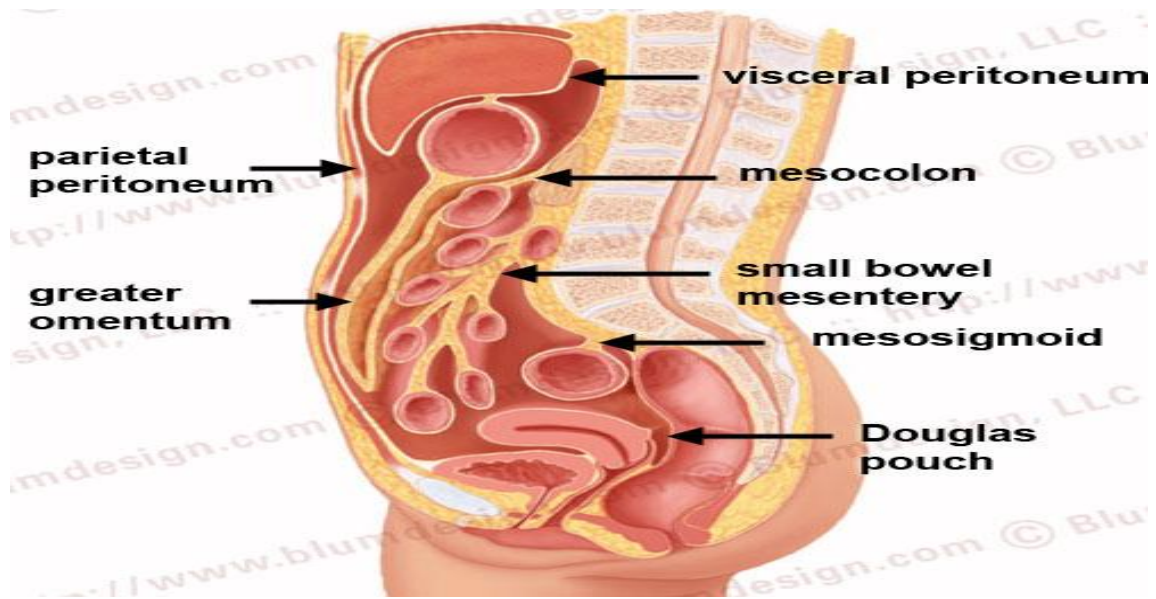
So the difference between the parietal and the visceral peritoneum; is that the **parietal** only **lines the edges of the abdominal cavity**; the anterior and the posterior abdominal wall, and the diaphragm and pelvic viscera. However, the **visceral completely covers certain viscera**. The visceral peritoneum might also extend from the viscera to the posterior abdominal wall by two layers forming the **mesentery** (for the intestines) and the **mesocolon** (for the colon).

3- Peritoneal cavity

It is the remaining abdominal cavity between the parietal and the visceral layers of the peritoneum.

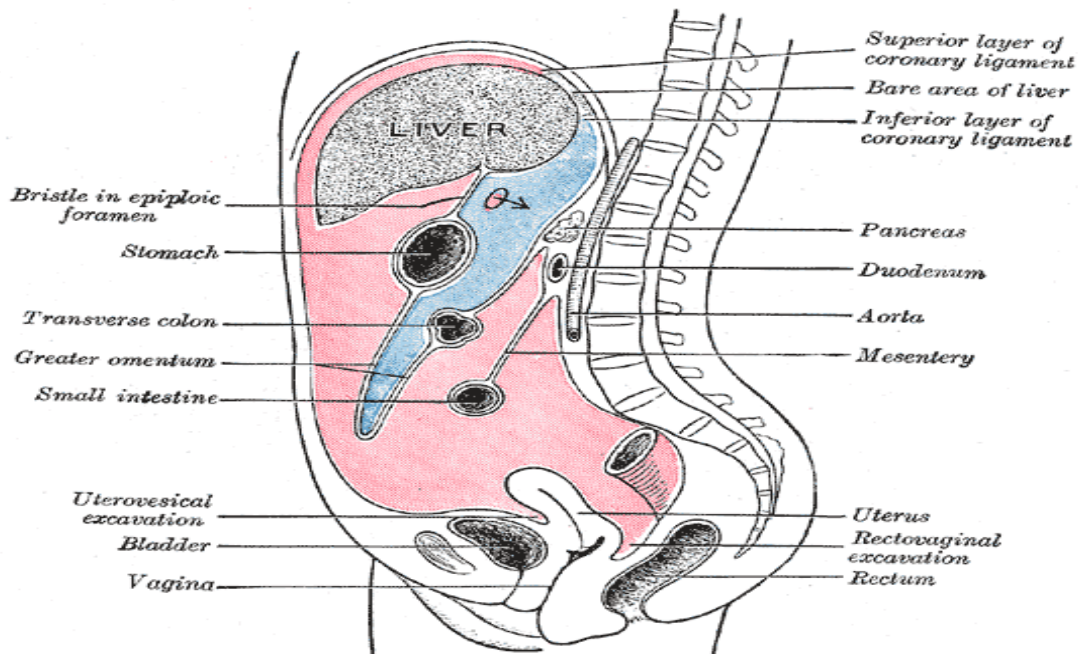
The peritoneal cavity or sac is a potential space; it might not be found as an open space, but if you pump air into it, it will reveal itself.

In the male the sac is completely closed, but in the female it is open to the exterior by the vagina (**how:** the vagina connects the exterior of the body to the uterus then to the fallopian tube. The fallopian tube at its junction with the ovaries is open to the peritoneal sac).



This picture is a mid-sagittal section. The parietal peritoneum reaches the diaphragm above and covers the superior surface of the liver. In the pelvis it lies above the urinary bladder and the uterus, then it continues posteriorly to the posterior abdominal wall, and continues upwards until it reaches the diaphragm from behind. **Now focus on the visceral peritoneum:**

- ⦿ Notice that the stomach (circle under the liver just posterior to the arrow indicating the parietal peritoneum) is **COMPLETELY** surrounded by peritoneum, having ONE layer anterior to it and ONE layer posterior to it.
- ⦿ Then the peritoneum extends under the stomach down into the abdominal cavity and up to the transverse colon forming a two layered fold of peritoneum called the **greater omentum**.
- ⦿ The sigmoid and transverse colon and the small intestines also form **invaginations** in the parietal peritoneum, forming a viscera peritoneum. They are connected with the posterior abdominal wall by the **mesentry**, the **meso-** and **mesosigmoid-colon**.
- ⦿ Note that the mesocolon attaches the transverse colon to the pancreas (a retroperitoneal organ), not directly to the posterior abdominal wall.
- ⦿ After covering over the bladder and the uterus in females, the parietal peritoneum forms the “**rectovaginal**” pouch (**Douglas pouch**) and continues to the posterior abdominal wall.
- ⦿ **The duodenum and the pancreas are retroperitoneal.**



The Peritoneal cavity inside the peritoneum is a closed sac. It is divided into the **Greater sac** and the **Lesser sac**, with a communication between them through the **epiploic foramen**.

The greater sac is the pink area in this picture. It has the following relations:

- ⊙ **Superiorly:** it lies under the diaphragm and the caudate lobe of the liver.
- ⊙ **Anteriorly:** the anterior abdominal wall.
- ⊙ **Inferiorly:** it lies above the pelvic viscera.
- ⊙ **Posteriorly:** it lies in front of the posterior abdominal wall, forms the visceral peritoneum around the intestines (small intestines and transverse colon), and extends as the mesentery and the mesocolon.

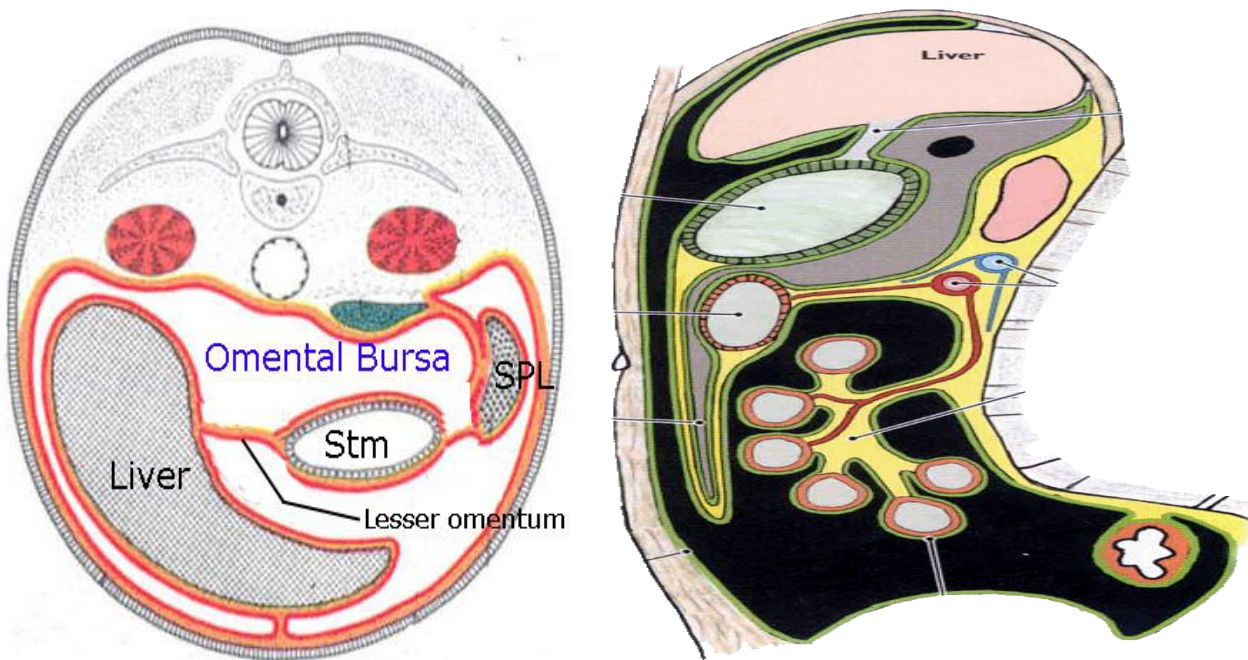
The lesser sac is the blue area in this picture. It is located **behind the stomach, under the liver and the diaphragm, in front of the pancreas and the duodenum and the transverse colon**, and **between the two folds of the greater omentum**. The greater omentum is a two layered peritoneal fold covering the stomach, continuing downwards, folding upwards to attach to the anterior and posterior faces of the transverse colon, and continuing upwards to **attach to the pancreas**.

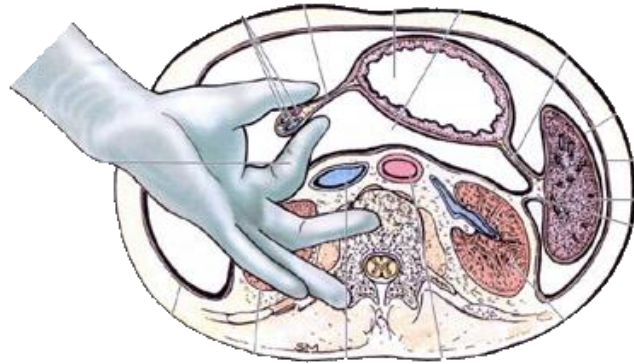
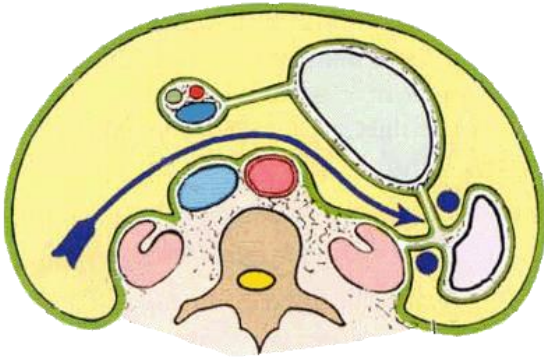
The **epiploic foramen**, a connection between the greater and the lesser omentum, is **urgically VERY important**. It allows surgeons to reach the area behind the stomach in the lesser sac, and is the **ONLY** connection between the two sacs.

The stomach is attached to the liver by two layers of peritoneum, the **lesser omentum**, coming from the liver (the porta hepatis) above to the lesser curvature of the stomach below.

The lesser sac, or **Omental Bursa**, has the following relations:

- ⦿ Deep to the lesser omentum and the Epiploic foramen.
- ⦿ Behind the posterior peritoneum of the stomach, the lesser omentum, and anterior two layers of greater omentum
- ⦿ Under the peritoneum covering diaphragm and caudate lobe of the liver.
- ⦿ Above the conjunctive area of the anterior and posterior two layers of greater omentum.
- ⦿ In front of the posterior layers of greater omentum, transverse colon and transverse mesocolon, and peritoneum covering posterior abdominal wall





The picture on the left is a transverse section from an inferior view. The right side of the section is the person's left side. The big arrow enters through the epiploic foramen into the lesser sac.

The hand in the right picture holds the free end of the lesser omentum, and the index finger is inserted through the epiploic foramen. The lesser sac is between the surgeon's hand and the spleen.

The epiploic foramen is also known as the Omental foramen.

The relations of the foramen:

- ⦿ Posterior: the inferior vena cava
- ⦿ Anterior: the free edge of the lesser omentum containing the portal vein, the hepatic artery, and the common bile duct (important question).
- ⦿ Superior: the caudate lobe of the liver.
- ⦿ Inferior: the first inch of the duodenum.

Other relations of the lesser sac:

- ⦿ Left: the spleen, gastrosplenic ligament, and splenorenal ligament.
- ⦿ Right: the omental foramen.

The liver is completely covered by peritoneum except the bare area. The peritoneum forms a deflection at this area forming the coronary ligament with edges called "triangular ligaments".

The stomach is COMPLETELY covered by the peritoneum. The peritoneum at the lesser curvature forms the lesser omentum, and at the greater curvature forms the greater omentum.

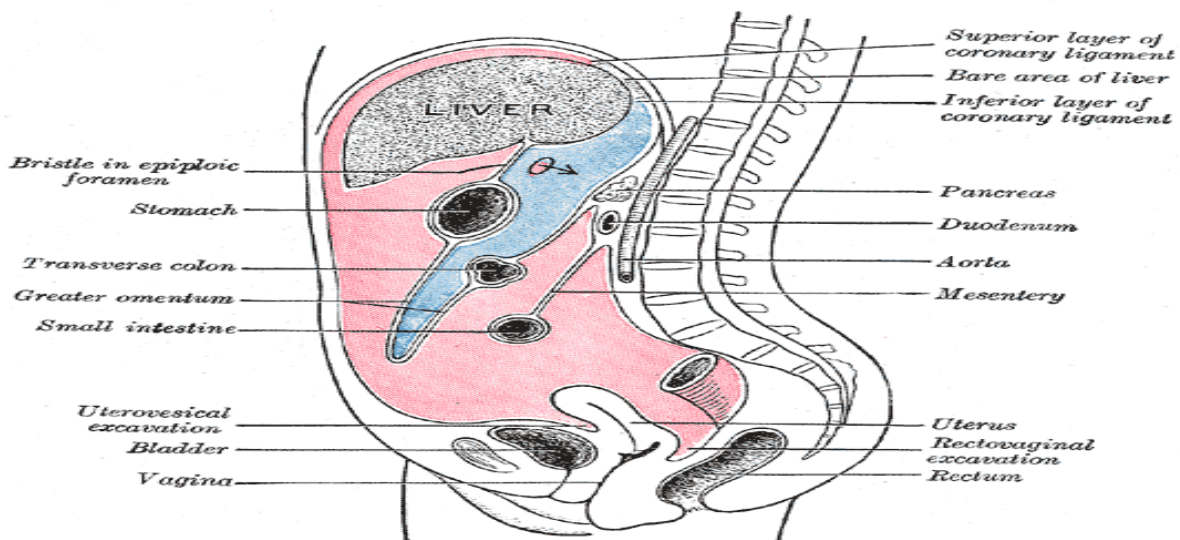
The transverse colon is intraperitoneal, while the ascending and the descending colon are retroperitoneal.

The transverse colon has mesentry called the mesocolon attached to the anterior border of the pancreas.

The greater omentum has two layers, one anterior and one posterior to the stomach. They meet under the stomach, descend into the abdominal cavity, and ascend as two layers to surround the transverse colon. Therefore, the lesser sac is located between four layers of peritoneum, two ascending and two descending layers.

The duodenum is retroperitoneal except the first inch (continuation of the stomach) and the last inch (continues as the jejunum). The anterior surface of the duodenum is faced by the peritoneum at the posterior abdominal wall, fixating it in position.

The jejunum and the ileum of the small intestines have long mesenteries covering the small intestines in the free edge of the mesentry. The fixed end continues as the posterior parietal peritoneum. Since the jejunum and the ileum are 5-6 meters long, the free edge of the mesentry is 5-6 meters long.

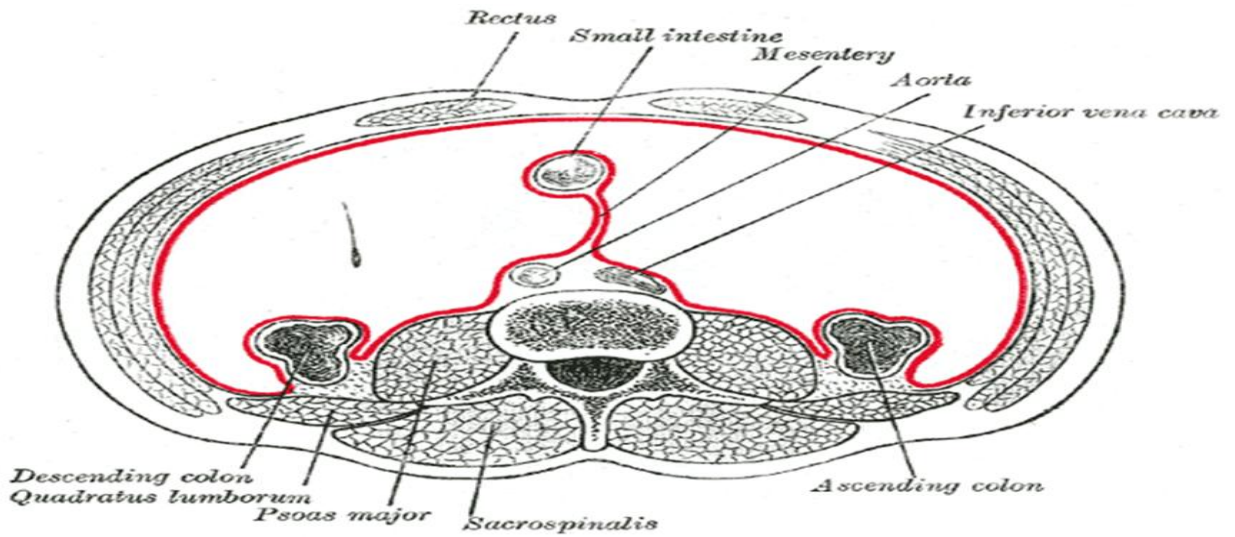
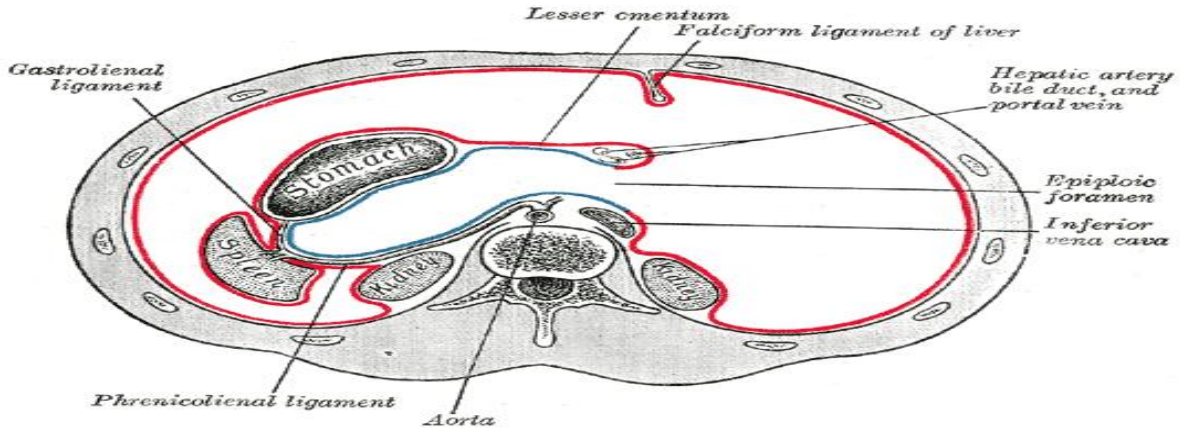


As you can see in this picture, the greater omentum divides the greater sac into an antero-superior part and a postero-inferior part.

The falciform ligament is two layers of peritoneum separating the right and left lobes of the liver anteriorly.

The antero – superior is divided by the Falciform ligament into:

- ⦿ Right part
- ⦿ Left part

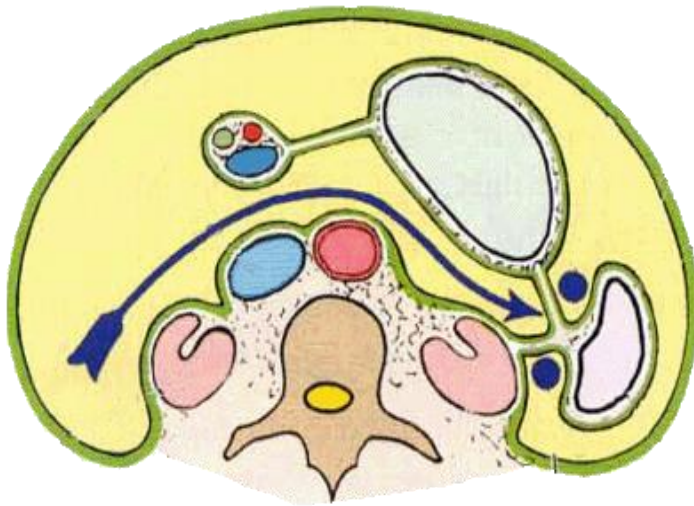


The greater sac of the peritoneum is divided into right and left parts by:

1. Mesentery of the Small intestine (divides the postero-inferior part)
2. Falciform ligament of the liver (divides the antero-superior part)

The omental (epiploic) foramen, is a short, vertically flattened passage, about 3cm long.

It lies between the liver and duodenum, just above the first part of the duodenum, behind the lesser omentum, in front of the inferior vena cava.

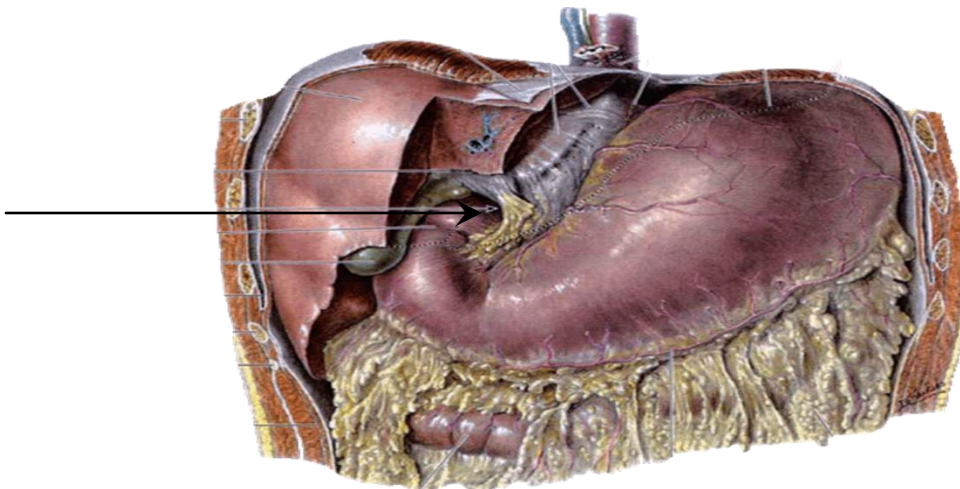


Liver in Situ



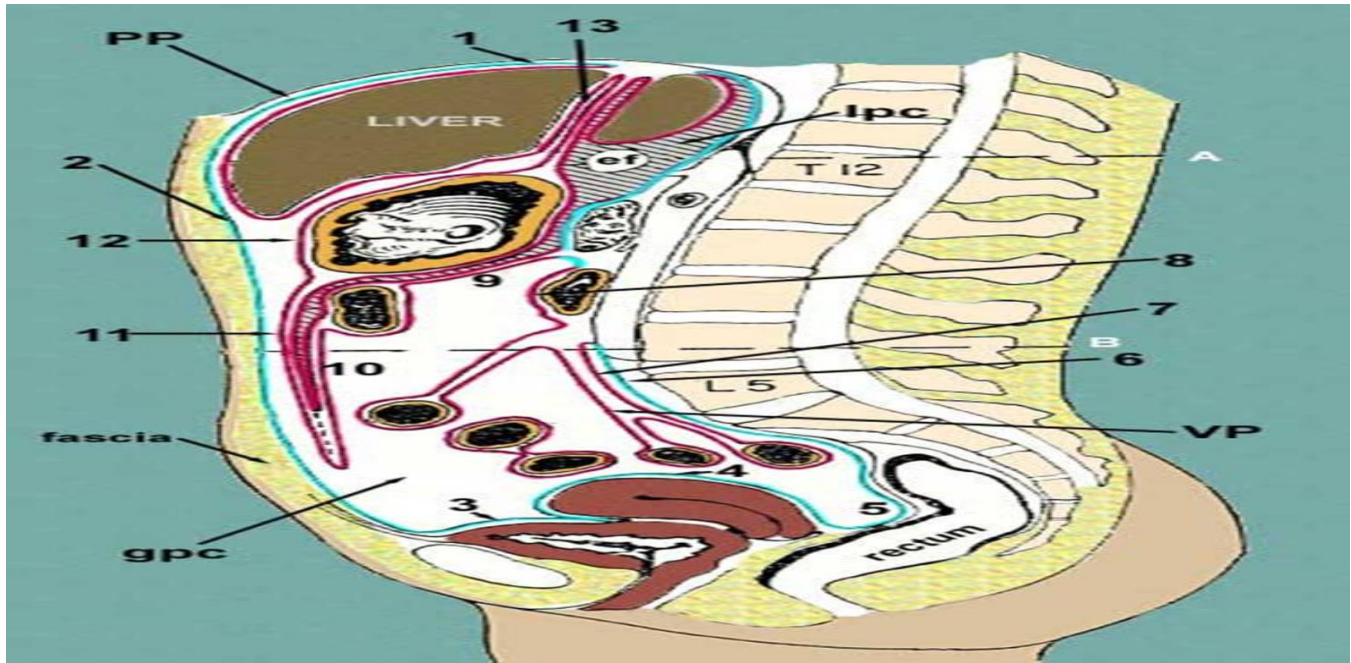
Notice in the pictures above that the lesser omentum is attached to the lesser curvature of the stomach and to the porta hepatis of the liver, and continues in the fissure of the liver as ligamentum venosum to reach the diaphragm above. **In its free edge** (notice the opened area to show the contents in the right image) you can see the red (hepatic artery), blue (portal vein - posterior), and green (bile duct). Also, notice the opening behind the lesser omentum, and its free border, which is the epiploic foramen.

In the left picture (inferior view, right side is left hand for person), notice that the lesser sac reaches the hilum of the spleen. **What are the two white lines from the spleen?** These are ligaments, thickenings of peritoneum, which attach the stomach to the hilum of the spleen (gastrosplenic ligament), and the left kidney to the spleen (spleno or lienorenal). These two ligaments, as shown, are present at the left end of the lesser sac next to the hilum of the spleen.



Notice that the **epiploic foramen pointed by the arrow** between the duodenum and the lesser omentum. In this picture, the foramen is located **under the lesser omentum and the caudate lobe of the liver and above the first inch of the duodenum.**

Note: The omental bursa (lesser sac) communicates with the greater sac through the **omental foramen.**



Here, number 12 is the stomach. Number 8 is the pancreas. The transverse colon is clearly surrounded by the ascending to layers of the greater omentum (#10).

Superior to the EF (the epiploic foramen) is the caudate lobe of the liver, and inferior is the first inch of the duodenum.

Relations of the foramen:

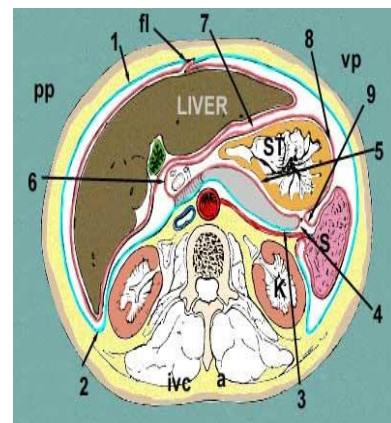
☉ Anteriorly: Free border of lesser omentum contains:

1. Bile duct (Right & anterior)
2. Hepatic artery (Left & anterior)
3. Portal vein (posterior)

☉ Posteriorly: I.V.C

☉ Superiorly: Caudate process of caudate lobe of liver

☉ Inferiorly: First part of duodenum

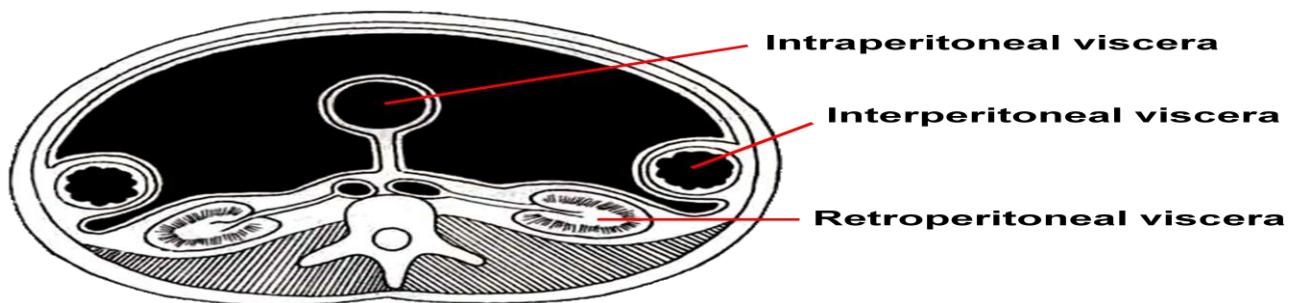


Functions of the peritoneum

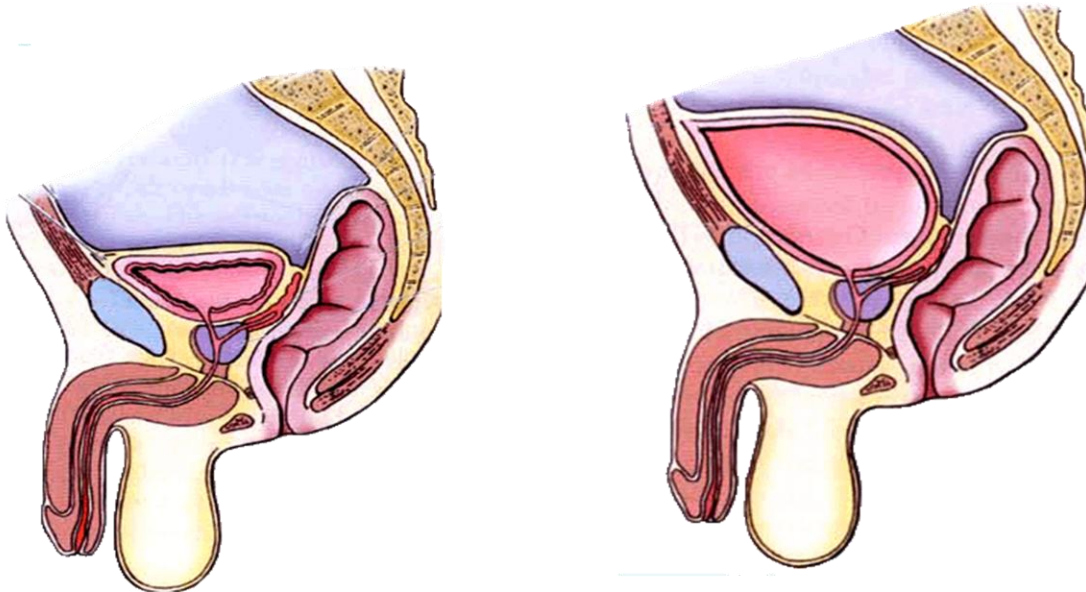
- ⦿ Secretes a lubricating serous fluid that continuously moistens the associated organs. The lubricating serous fluid produced by the peritoneum prevents friction between the viscera.
- ⦿ Fat storage. The greater and the lesser omentum and the mesentery contain lots of fat.
- ⦿ Defensive role by the presence of lymphatic vessels & nodes; any two layers of peritoneum contain autonomic fibers, fat, and lymph nodes, and CT with macrophages between them.
- ⦿ Support viscera

The relationship between viscera and peritoneum

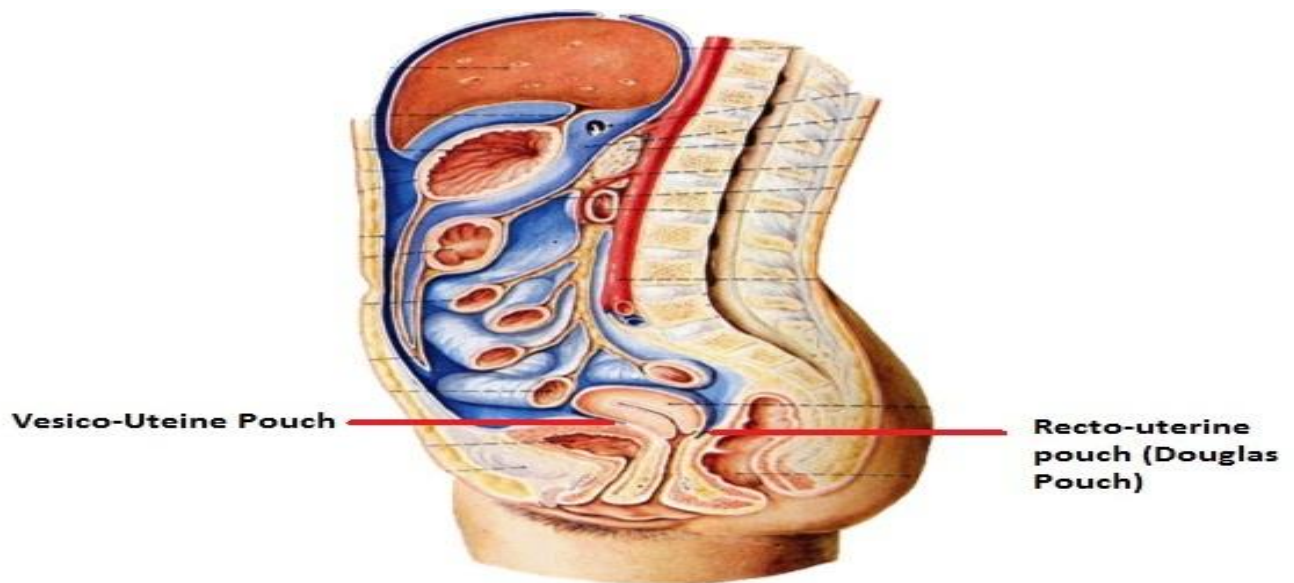
- ⦿ **Intraperitoneal viscera:** are viscera that are almost totally covered with visceral peritoneum. Example: stomach, 1st & last inch of duodenum, jejunum, ileum, cecum, vermiform appendix, transverse and sigmoid colons, spleen and ovary.



- ⦿ **Interperitoneal viscera:** are organs that are not completely wrapped by peritoneum, with one of their surfaces attached to the abdominal walls or to other organs. Example: liver, gallbladder, urinary bladder and uterus. These organs have a **bare area, which is the area not covered by peritoneum.**
Sometimes, the **gallbladder** has a mesentery, making it completely covered by the peritoneum. But usually, it is on the liver, leaving an impression.
The peritoneum covers the urinary bladder from above only. It covers only the fundus of the uterus.
- ⦿ **Retroperitoneal viscera:** are organs that lie on the posterior abdominal wall behind the peritoneum. They are partially covered by peritoneum; on their anterior surfaces only. Example: Both kidneys, suprarenal glands (especially the left one), pancreas, descending and ascending colon, upper 3rd of rectum, duodenum, ureter, aorta, and I.V.C.



The peritoneum only covers the upper anterior surface of the rectum. It forms the **rectovesical** pouch, which is the depression anterior to the rectum. It also forms the recto-uterine pouch (**Douglas** pouch) in females between the rectum and the uterus. (right image)



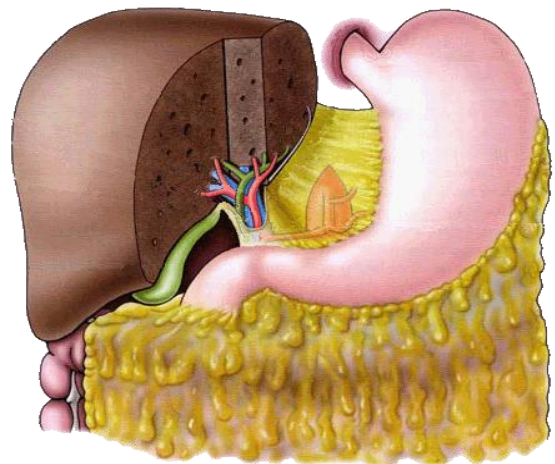
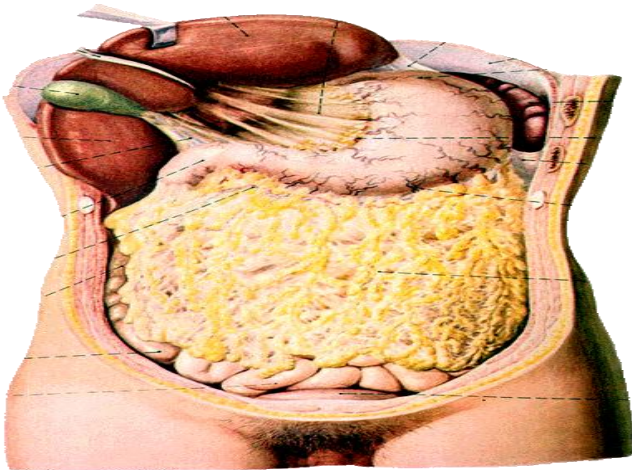
The Peritoneal Reflections or folds

The peritoneal reflections are two layers of peritoneum anterior or posterior to an organ. Certain terms, often arbitrary, are commonly used for 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 reflection to jejunum and ileum is termed the mesentery, while that to the transverse colon is the transverse mesocolon.

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**. The ligaments of the liver and those of the spleen are originally peritoneal reflections. Also, broad peritoneal sheets associated with stomach are termed **omenta**.

The folds of the peritoneum are formed by excess peritoneum, such as the fold formed around the last inch of the duodenum when it changes from retro- to intra- peritoneal. This is a disadvantage, causing internal hernia in the fold. Such hernia occurs around the cecum too, where the ilium is intraperitoneal and the cecum is retroperitoneal.

1. **Omenta:** are two-layered fold of peritoneum that extends from stomach to adjacent organs. There are two omenta : the Lesser omentum and Greater omentum



- ◎ **The Lesser omentum** is a two-layered fold of peritoneum that extends from porta hepatis, fissure of ligamentum venosum, and the diaphragm to the lesser curvature of stomach and the superior part of duodenum. Thickenings of the lesser omentum form the hepato-gastric ligament and the hepato-duodenal ligaments.
 - Hepatogastric ligament: extends from porta hepatis to the lesser curvature of stomach
 - Hepatoduodenal ligament: extends from porta hepatis to the superior part of duodenum. At its free margine, 3 structures are enclosed (**3 key structures**)

- 1) The **common bile duct** anteriorly.
- 2) The **proper hepatic artery** which is to the left of the common bile duct.
- 3) The **hepatic portal vein** posteriorly.

Contents of lesser omentum:

- ⊙ Blood vessels: the right & left gastric vessels.
- ⊙ Lymph nodes & lymphatic vessels.
- ⊙ Fat.
- ⊙ Autonomic N.S: sympathetic + parasympathetic (vagus nerve)

Greater omentum: It is the largest peritoneal fold, and 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 and hang down like an apron in front of coils of small intestine. Then, they turn up backwards, and ascend to the transverse colon. The two layers are separated to cover the anterior and posterior surfaces of transverse colon. Then they form the transverse mesocolon.

The greater omentum is the policeman of the abdomen. It performs limitation of infections by surrounding infected abdominal organs, such as the appendix. Finding (or not) the greater omentum around the appendix is helpful in diagnosis.

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

In adults, the four layers of greater omentum are frequently adhered together, and are found wrapped about the organs in the upper part of the abdomen.

Contents of Greater omentum:

- ⊙ Gastroepiploic vessels (Right and left Gastroepiploic vessels)
- ⊙ Lymph nodes & lymphatic vessels
- ⊙ Fat
- ⊙ Autonomic N.S: sympathetic + parasympathetic (vagus nerve)

Function Of greater omentum:

1- **protective function:** The greater omentum contains numerous fixed macrophages, which perform an important protective function.

2- **storehouse for fat:** The greater omentum is usually thin, and presents a cribriform appearance, but always contains some adipose tissue, which in fatty people is present in considerable quantity.

3- **migration and limitation:** The greater omentum may limit spread of infection in the peritoneal cavity. Because it will migrate to the site of any inflammation in the peritoneal cavity and wrap itself around such a site, the greater omentum is commonly referred to as the “policeman” of the

peritoneal cavity. **Example:** surrounding the appendix in the case of appendicitis. So finding the greater omentum around the appendix or not, helps in diagnosis.

****Note: The mesocolon is the re-united two layers of the greater omentum after surrounding the transverse colon.**

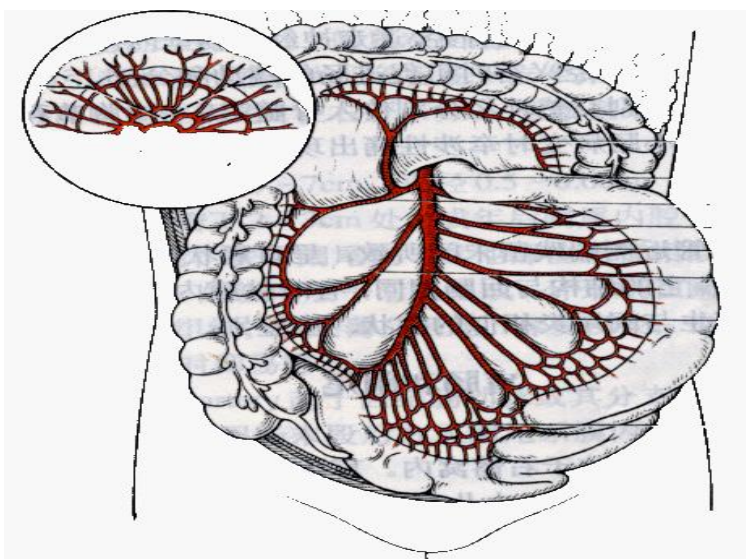
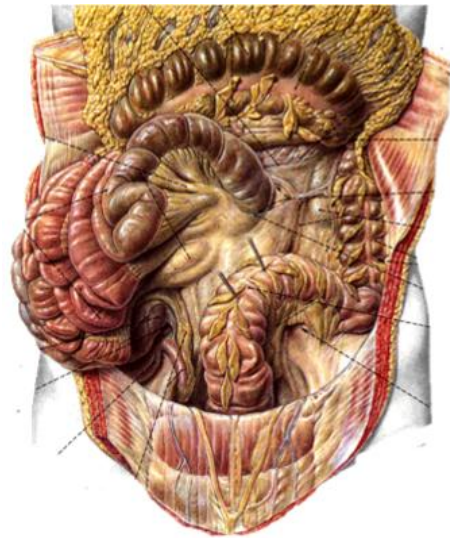
Mesenteries of the peritoneum: are two-layered folds of peritoneum that attach the intestines to the posterior abdominal wall. They cover the intestines at their free end.

1- Mesenteries of small intestine: they suspend the small intestine from the posterior abdominal wall. They are broad and a fan-shaped

The root of mesentery is 15 cm long. It is directed obliquely from left side of L2 vertebra to right sacroiliac joint. The free edge is 5-6 meter long.

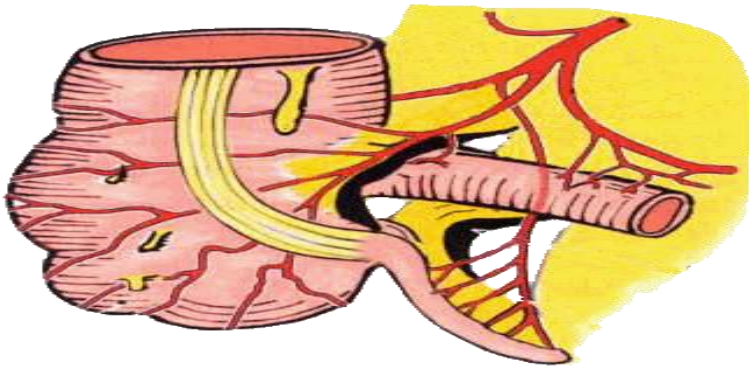
Contents of the mesentery:

- The jejunal and ileal branches of the superior mesenteric artery &veins
- Nerve plexuses
- Lymphatic vessels
- Lymph nodes
- Connective tissue
- Fat



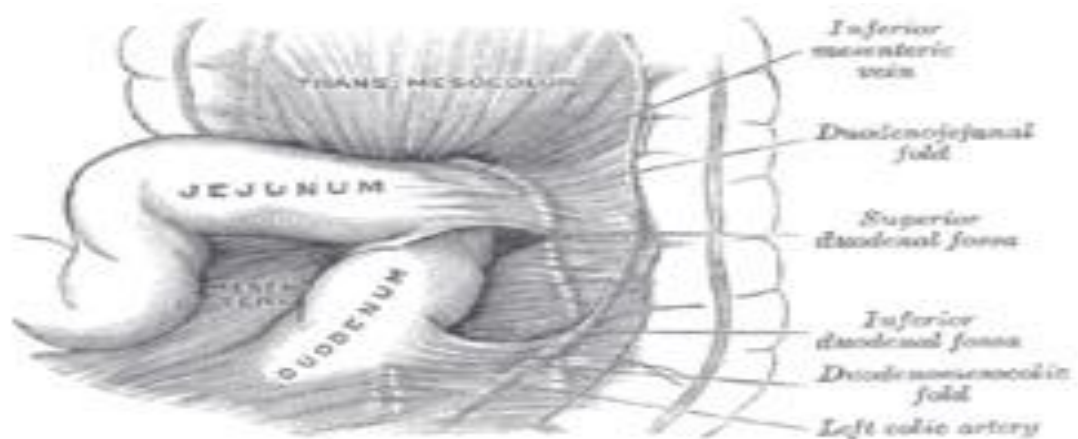
The arteries seen in this picture are present between the two layers of the mesentery. The window-like gaps between arterioles are called **archids**. Archids of the jejunum are larger than those of the ileum, as the artery network of the ileum is more complicated. Vasa recta are the long arteries branching from the main artery.

2- The Mesoappendix is a triangular mesentery that extends from the terminal part of ileum to appendix. The appendicular artery, which originates from the posterior cecal artery, runs in free margin of the mesoappendix.



3. The transverse mesocolon is a broad fold that connects the transverse colon to the anterior border of the pancreas.

Contents: blood vessels, nerves, and lymphatics of the transverse colon.



4. The Sigmoid mesocolon is a fold of peritoneum that attaches the sigmoid colon to the pelvic wall.

Contents: The sigmoid vessels, lymphatic vessels, nerves, and the left Ureter, which descends into the pelvis behind its apex.

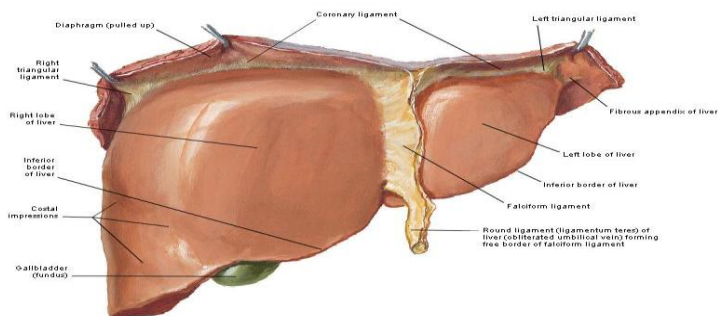


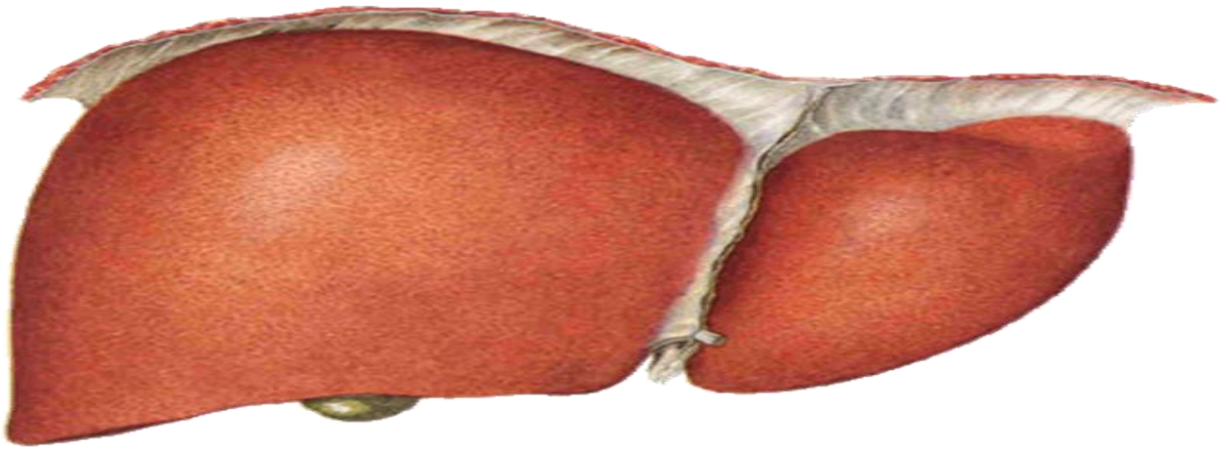
Ligaments of the peritoneum. Many of them are named according to the organs attached to them.

☉ The ligaments of the liver:

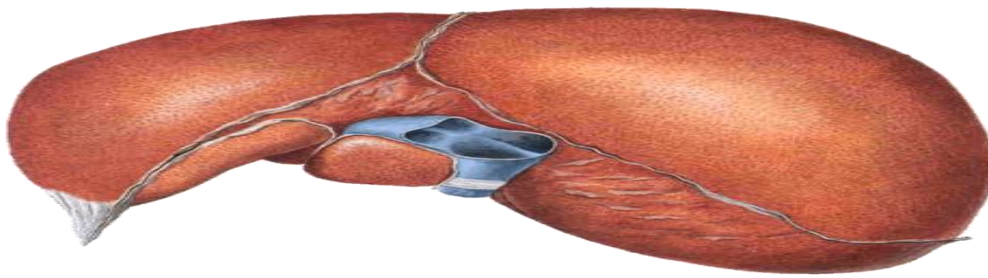
- 1- The falciform ligament of liver.
- 2- The ligamentum teres hepatis.
- 3- The coronary ligament.
- 4- The right triangular ligament.
- 5- The left triangular ligament.
- 6- The hepatogastric ligament.
- 7- The hepatoduodenal ligament.

Surfaces and Bed of Liver
Anterior View





Falciform ligament consists of double peritoneal layer. It is sickle shaped, extends from anterior abdominal wall (umbilicus) to liver, and has a free border containing Ligamentum teres (obliterated umbilical vein).



Coronary ligament:

The area between upper and lower layer of the coronary ligament is the bare area of liver which contract with the diaphragm

Left and right triangular ligaments are formed by the left and right extremity of coronary ligament.

Hepatogastric ligament

Hepatoduodenal ligament

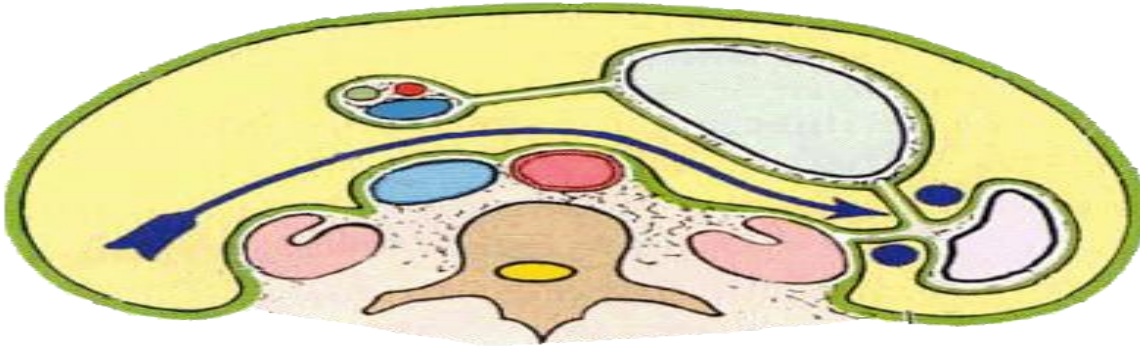
☉ Ligaments of spleen

1- Gastrosplenic ligament, which connects the fundus of stomach to hilum of spleen.

- Contents: the short gastric & left gastroepiploic vessels pass through it.

2- Splenorenal ligament, which extends between the hilum of spleen and left kidney.

- Contents: The splenic vessel, lymphatic vessels, lymph nodes & nerve, and the tail of pancreas



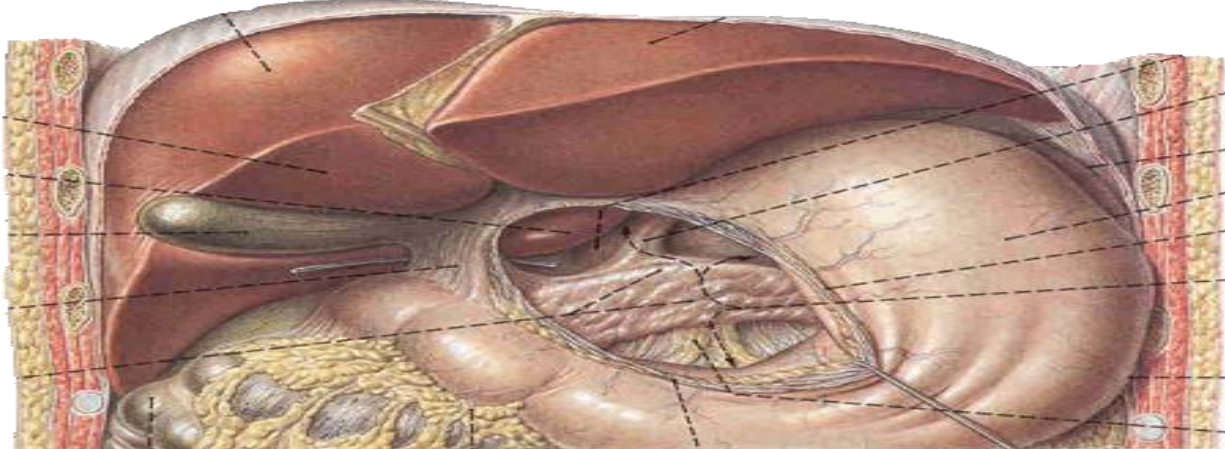
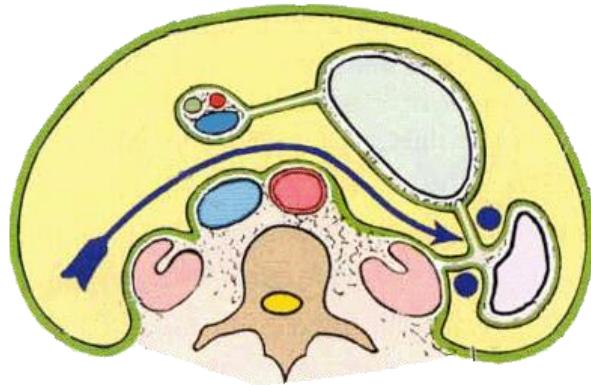
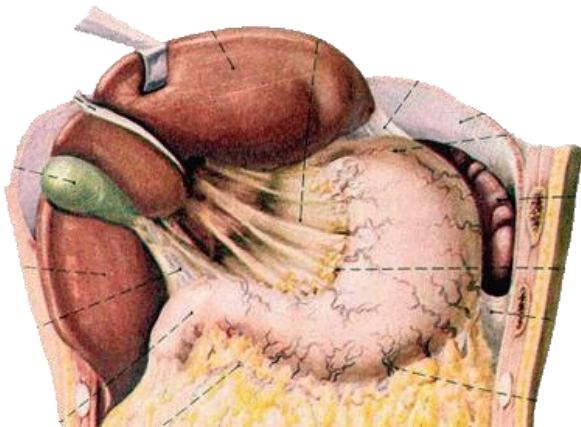
The splenorenal ligament is very important in splenectomy, as it contains tail of the pancreas and splenic vessels. Injuring the tail of the pancreas causes secretions to enter the peritoneal cavity and cause an infection.

3- Phrenicosplenic ligament

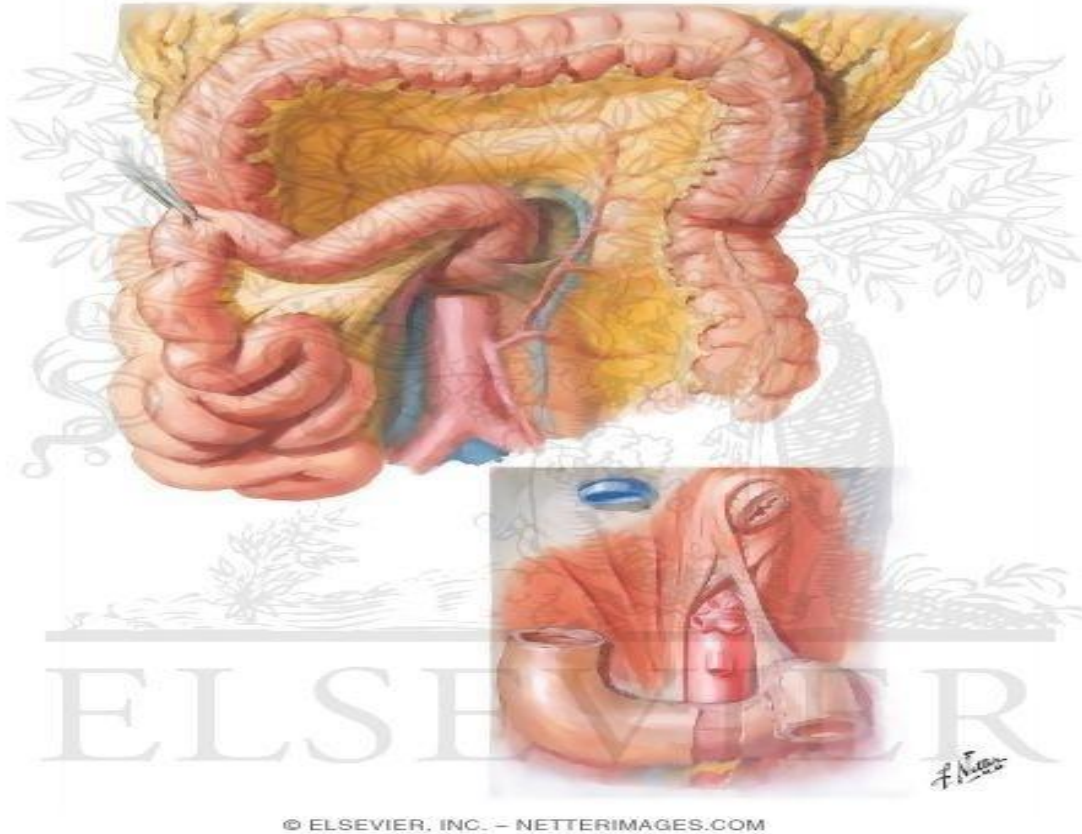
4- Splenocolic ligament

© Ligaments of stomach

1. Hepatogastric ligament
2. Gastrosplenic ligament
3. Gastrophrenic ligament
4. Gastrocolic ligament
5. Gastropancreatic ligament



- © The **suspensory ligament of duodenum**, also known as **Treitz ligament**, is located at **the junction between duodenum & jejunum**. This ligament is attached to the right crus of the diaphragm. It fixates the first part of the duodenum and is a landmark for the beginning of the jejunum.



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