

## Anatomy

### Peritoneum – 2

Peritoneum: a serous membrane, has two types parietal and visceral.

We've mentioned that between the parietal and visceral layers there are Greater sac and lesser sac which are connected via epiploic foramen (also called Winslow, or Omental foramen)

Free edge of the lesser omentum contains

1. hepatic artery
2. common bile duct
3. portal vein

The greater sac is divided into (anterior superior / posterior inferior parts)  
Lesser / greater omentum have two layers of peritoneum, in between the two layers there are fat, lymph vessels, lymph nodes and the most important are blood vessels.

Epiploic foramen boundaries:

Anteriorly: free edge of lesser omentum

Posteriorly: inferior vena cava

Superiorly: caudate process of the liver

Inferiorly: 1<sup>st</sup> inch of duodenum

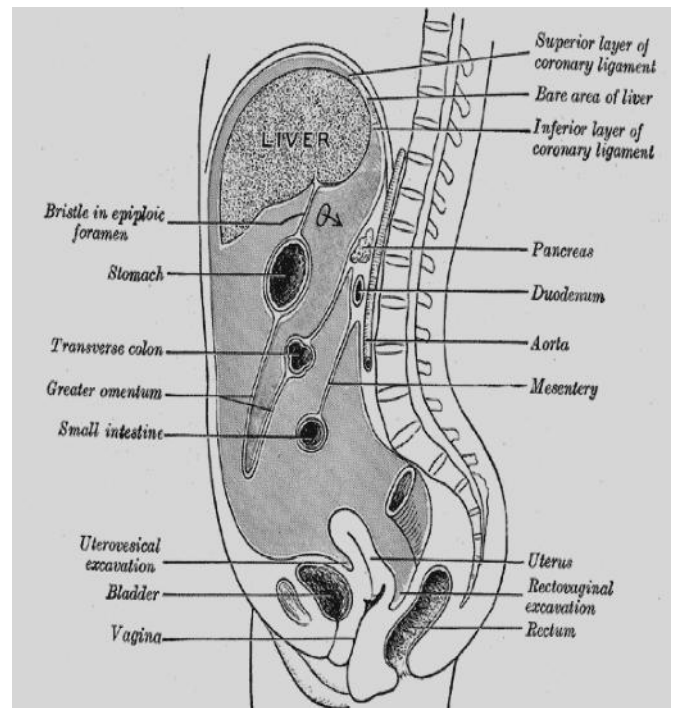
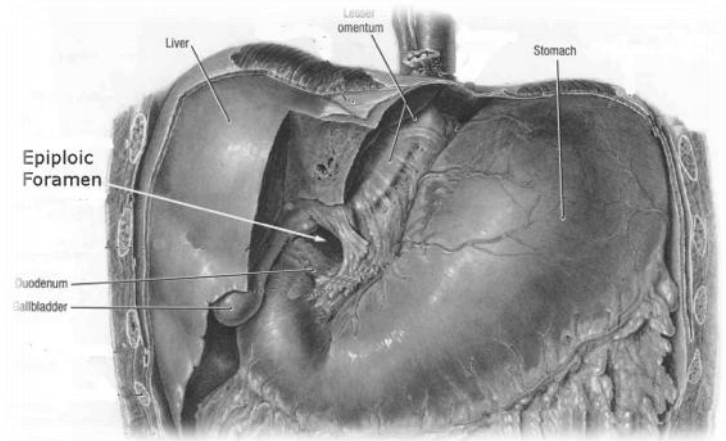
Function of peritoneum:

- 1- Lubrication between visceral and parietal peritoneum
- 2- Fat storage [to produce energy]
- 3- Defense role; due to the presence of lymphatic vessels and nodules [important for immunity]

**REMEMBER:**

As we go distally in the GIT, there is an increase in the GALT (Gut associated lymphoid tissue; e.g. Lymph nodes & lymphocyte)

- 4- Support the viscera



***Organs in the abdomen are classified according to their relation to peritoneum into:***

**1. Intraperitoneal**

Organs which are covered completely with peritoneum.

E.g. Stomach, spleen, jejunum, ileum, transverse colon and sigmoidal colon.

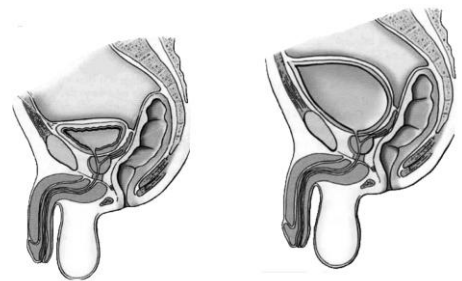
**2. Retroperitoneal**

Organs located behind the peritoneum (specifically parietal peritoneum) in the posterior abdominal wall.

E.g. Suprarenal glands, abdominal aorta, IVC, duodenum (except the 1st & last inches), pancreas except the tail, ureter, colon (ascending and descending), kidneys, Esophagus, and upper 3rd of rectum.

- During development the duodenum has two layers of peritoneum anterior and posterior but the posterior layer will disappear after short time.

**Interperitoneal viscera**



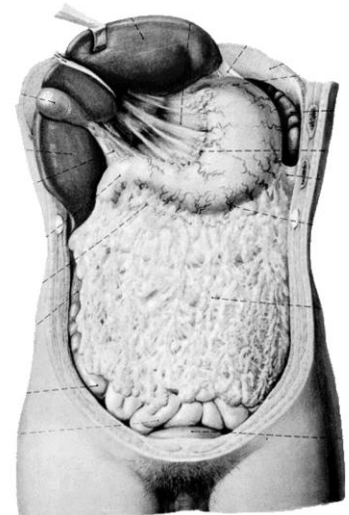
**3. interperitoneal**

Mainly the organs found in the pelvis which are covered by peritoneum superiorly, and they contain bare area; not completely covered.

E.g. Liver, Gall bladder (superior surface covered only), uterus (fundus and cervix) and urinary bladder.

Between the posterior wall of urinary bladder and the anterior wall of the rectum there is a pouch called Rectovesical pouch (peritoneum coming from the anterior abdominal wall covers the upper surface of the urinary bladder, then reaches the anterior wall of the rectum, forming this pouch)

A Pouch: a space made by peritoneum.



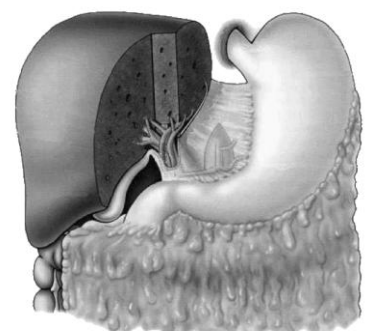
**Peritoneal reflections:**

**1. Omenta: greater omentum & lesser omentum**

Two layers of peritoneum, with great amount of FAT, and blood vessels.

**2. Mesentery:**

Two layers of peritoneum and connected to the posterior abdominal wall.



[[Mesentery has two ends; one free edge for large / small intestine, and the other end connected to the posterior abdominal wall... these 2 ends are a MUST in the mesentery]] Between the two layers there are blood vessels, lymphatics, lymph nodes & fat.

### 3. ligament of the GIT:

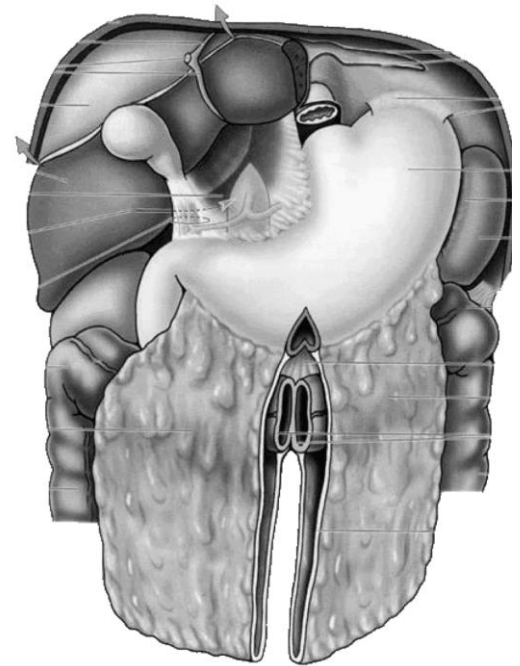
Thickening of the two layers of peritoneum, in between the two layers there are blood vessels, lymphatics & lymph nodes.

E.g. ligaments and attached organs

Gastrosplenic ligament (between Stomach and spleen)

Lienorenal / splenorenal ligament (Spleen and left Kidney)

Gastrophrenic (Diaphragm and stomach)



### Greater Omentum

- two layers of peritoneum formed by the union of the peritoneum on the anterior and posterior surfaces of the stomach at the greater curvature and at the first inch of duodenum, then the two layers descend down in the abdominal cavity, the greater omentum doesn't have a specific distance and covers the whole abdominal cavity, and then the two layers reflect upward as 2 layers and attach to the transverse colon and cover its anterior and posterior wall then continue as mesocolon (also 2 layers of peritoneum) that will attach to the posterior abdominal wall.

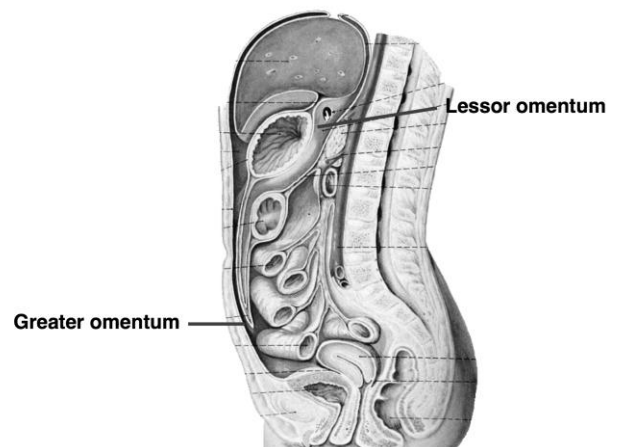
(That's why transverse colon is intraperitoneal organ- completely covered with peritoneum)

Q. First inch and last inch in duodenum are intraperitoneal, explain?

Because lesser & greater omenta are attached to the 1<sup>st</sup> inch, and the last inch is followed by an intraperitoneal part "Jejunum" so it's a gradual transformation from retroperitoneal; into intraperitoneal.

The mesentery of the transverse colon is called mesocolon, which is a direct continuation of the greater omentum and attaches to the posterior abdominal wall (to the anterior border of pancreas.)

There is a ligament in the greater omentum between stomach and transverse colon called gastrocolic ligament.



Contents of the greater omentum:

1. gastroepiploic vessels [arteries and veins]  
Left gastroepiploic branch from splenic artery  
Right gastroepiploic branch from gastroduodenal artery, a branch from the hepatic artery.
2. Lymph vessels and nodes.
3. Fat
4. Sympathetic and parasympathetic innervation.

Function of the greater omentum

1. protective function [ presence of macrophages]
2. fat to produce energy
3. policeman of the abdomen , because of lymph nodes, lymphocytes and lymph vessels, as a result any infection in any organ in the abdomen, the greater omentum will localize the infection.

Clinical notes:

When a patient with abdominal pain comes to the hospital with a potential appendicitis, doctors ask for WBC lab-report (in case of infection there will be an increase in the WBC no.), and they try to repeat the examination several times, especially that the pain is in the right iliac fossa to make sure it's appendicitis. As soon as they cut the abdominal wall layers during surgery, if the greater omentum was surrounding the appendix, then this is a form of localization & it's an infection –appendicitis-, otherwise it's probably not appendicitis.

Sometimes after performing appendectomy, it seems that the pain isn't caused by appendix, but since appendicitis's only treatment is surgery, then if we have a 60% possibility of having appendicitis, we have to perform the operation.

- In the direct and indirect inguinal hernia, the first structure to protrude after peritoneum is greater omentum then the jejunum and ileum may protrude since they are mobile structures.
- Between the 2 ascending layers and the 2 descending layers of the greater omentum, there is a lesser sac, which lies behind the stomach and ascends upward behind the liver.
- Foramen of Winslow is the connection between greater and lesser sacs. It's important in surgery because all the operations performed behind the stomach are done through the Winslow foramen. In case of a big operation "cancer in pancreas" we need wide space, so we cut the two layers of the greater omentum to get to the lesser sac then we close it again "which is very difficult"

### Lesser omentum

- Two layers of peritoneum coming from liver (porta hepatis & fissure of ligmentum venosum) to lesser curvature of the stomach and superior part of duodenum.

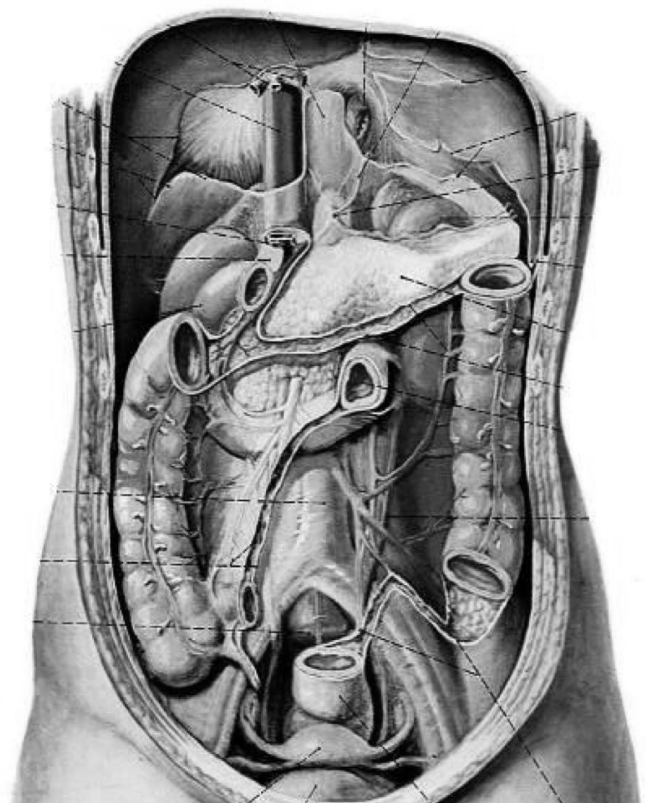
- Content of lesser omentum, between its 2 layers:
  1. Right gastric artery a branch from hepatic artery which is a branch from celiac trunk. (both rt. & lt. gastric arteries are bold supply to the stomach)
  2. Left gastric artery branch from celiac trunk.
  3. Lymph nodes
  4. Fat
  5. Sympathetic innervation ( celiac plexus/ganglion around the celiac trunk) and parasympathetic innervation (vagus nerve)
- Free edge of the lesser omentum contains
  1. hepatic artery
  2. common bile duct
  3. portal vein
- Deep to the free edge there is Winslow foramen (epiploic foramen)
- There are hepatoduodenal ligament (attached to the 1<sup>st</sup> inch of duodenum) and hepatogastric ligament (attached to the lesser curvature of stomach) in the lesser omentum.
- There are right and left vagus nerves in the thorax around the esophagus, as soon as the esophagus passes the diaphragm the right becomes “posterior gastric/vagus” and the left becomes “anterior gastric/vagus”.

### Mesentery

- Two layers of peritoneum that connect the intestine to the posterior abdominal wall (jejunum and ileum), they are attached to the posterior abdominal wall at one end and they form a loop around the jejunum and ileum on the other end.
- The root of the mesentery starts at the jejunum and ends at the ileum, directed obliquely from the left side at L2 to right sacroiliac joint & is 15 cm long.
- The free edge is attached to the small intestine... the mesentery is fan shaped.
- The mesentery has two layers in between are the branches of superior mesenteric vessels which supply jejunum and ileum.

Content:

1. superior mesenteric artery and vein



2. nerve plexus
  3. lymphatic vessels
  4. fat
  5. connective tissue
- superior mesenteric artery gives 12-15 jejunal & ilial branches to supply jejunum and ileum, these branches form between the two layers arcades (window-like) and vasa recta (arteries ends in small intestine)

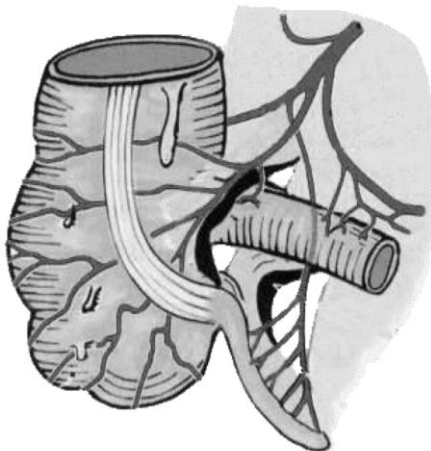
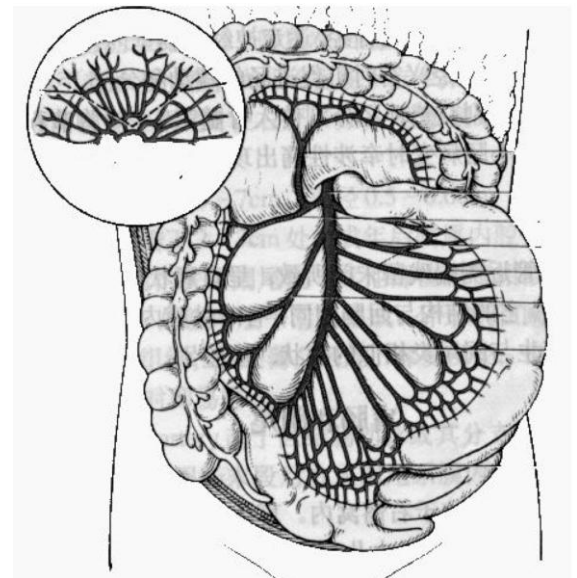
What are the differences between the arcades and vasa recta in both jejunum and ileum?

- jejunum side they are simple arcades(one/two) and long vasa recta
- ileum side they are complicated arcades and short vasa recta

When asked to differentiate between ileum and jejunum we check the mesentery:

1. fat in ileum is much more than fat in jejunum
2. jejunum diameter is larger than ileum
3. small intestine are 6 meter long proximal 2/5 jejunum and distal 3/5 are ileum even though these aren't specific landmarks to depend on
4. simple / complicated arcades

Appendix is completely covered by peritoneum and has a mesoappendix (short mesentery) and has appendicular artery (branch from post. Cecal artery, branch from super. Mesenteric artery)



#### Clinical notes

Appendectomy is a simple surgery performed by ligation to arteries and veins (making two ligations and cut the artery in between) to stop the bleeding, then we form a stitch at the base of appendix in circular shape then we ligate it and cut the appendix.

#### Transverse mesocolon

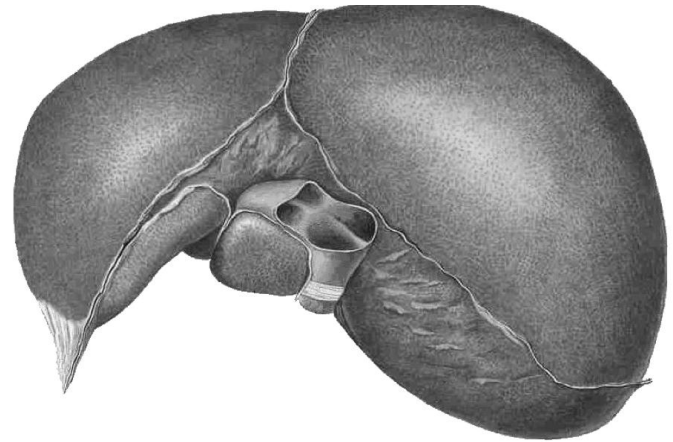
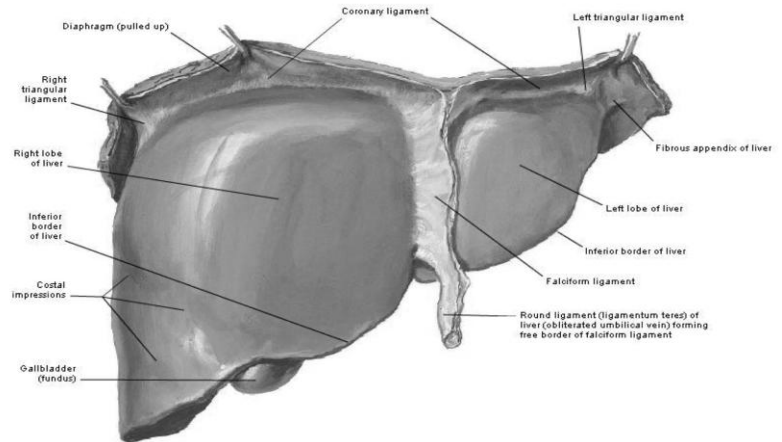
- Greater omentum and mesocolon cover the transverse colon, and they join each other at the sup. & inf., ant. & post. Surfaces of the transverse colon, so it's completely covered with peritoneum

- Mesocolon is attached to the anterior border of pancreas in posterior abdominal wall.
- Content ( Blood vessels, nerves and lymph vessels and nodes)

Sigmoid colon has an inverted v Shaped mesentery and contains sigmoidal blood vessels, nerves, and lymph vessels. And the left ureter passes behind it.

## Ligament of the peritoneum

- thickening of two layers of peritoneum
- the ligaments are named according to the two organs connected between
- examples :
  - 1- Falciform ligament of the liver connects between the liver and anterior abdominal wall and divides the ant. abdominal wall cavity into right and left.
  - 2- Ligamentum teres hepatis , in the free edge of falciform ligament (round ligament of the liver), it's obliterated umbilical vein ( in embryo it forms a connection with left portal vein)
  - 3- Coronary ligament , surrounding the bare area of liver, and at the right side it forms right triangular ligament, and on the left side it forms the left triangular ligament
  - 4- Hepatoduodenal ligament is part of lesser omentum, between the liver and first part of duodenum.



### Notes:

- The gall bladder is found at the visceral surface of the liver.
- Anterior surface is divided into right and left lobe by the Falciform ligament which is attached to anterior abdominal wall, which is sickle shaped ligament
- The venous drainage of the liver are the 3 hepatic veins ( right, central, left) which drain into IVC , which is located at the posterior surface of the liver
- Hepatogastric lig. Between liver and stomach
- Hepatoduodenal lig. Between liver and duodenum
- There are 5 surfaces of the liver we'll talk about them later.

Spleen, the bare area in the spleen is the hilum but it's considered intraperitoneal organ, located laterally from the epiploic foramen

Pastpaper Question:

A tumor behind the stomach in the pancreas that causes adhesion to other organs, if we want to separate adherent organs, all of the following maybe related to adhesion except:

1. Suprarenal glands
2. Left kidney
3. splenic vessels
- 4. Spleen**
5. Pancreas

Gastrosplenic lig. Between spleen and stomach, contents: short gastric and left gastroepiploic vessels pass through it.

Splenorenal, lienorenal ligament :

2 layers of peritoneum between spleen and left kidney, content (Splenic vessels, lymph vessels & nodes and tail of the pancreas)

As a result, any trauma to the left side which may cause injury to 9<sup>th</sup>, 10<sup>th</sup>, 11<sup>th</sup> ribs will cause rupture of the spleen which is a reservoir of blood, causing bleeding of spleen & then we will have to do splenectomy [ so we have to get into Splenorenal/lienorenal ligament, ligate the vessels and stop the bleeding and we have to be careful to other contents of the ligament such as the tail of pancreas which has secretions & in case it was injured, there will be an infection in the abdomen which may cause difficult complications.

phrenicosplenic ligament between [ diaphragm and spleen]  
splenicocolic ligament associated with the left colic flexure

The suspensory ligament of duodenum is also called treitz ligament, it's a landmark for the beginning of the jejunum and the end of the duodenum.

Treitz lig. Is attached between the junction (between the end of duodenum and beginning of jejunum) and the right crus of the diaphragm.



## The peritoneal Recesses and fossa

It's between the organs that transform from [retroperitoneal---- intraperitoneal] OR [intraperitoneal ----- reteroperitoneal]

E.g. cecum (intra) and ascending colon (retro) as a result the peritoneum will extend (increase in length) and form a fold / fossa

We find it frequently – paraduodenal (around the duodenum, at treitz lig.)

- around the cecum
- sigmoid colon
- foramen of Winslow

## Importance of these spaces:

- Internal hernia may occur which is more difficult than external hernia.



E.g. when part of the jejunum or ileum stuck behind the cecum, it will press the blood supply and becomes strangulated (strangulated hernia) (intestinal obstruction...no defecation).

- In X-ray / ultrasound the intestines appear inflated and we can hear the peristaltic movement by stethoscope very loud ( exaggerated)
- Around the duodenum there are superior and inferior duodenal folds which may result in hernia.
- Retrocecal fossa, a space behind the cecum and may cause internal hernia, due to the fact that the appendix might be located there behind the cecum.

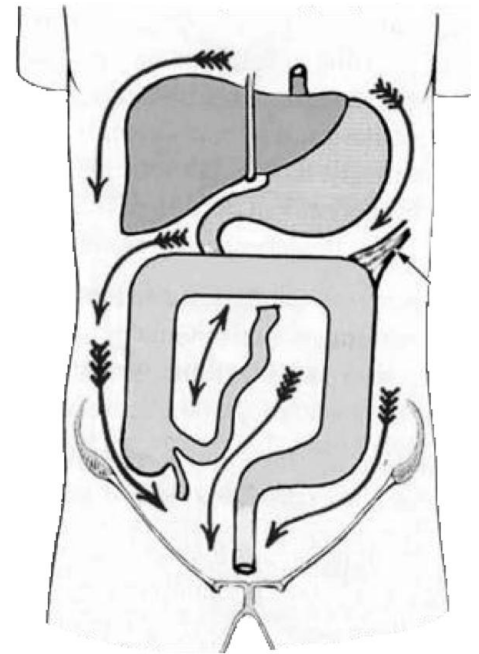
Spaces formed by peritoneum:

Spaces below the diaphragm are separated by falciform lig.

E.g. in case of appendicitis, without treatment, there will be abscess formation in the rt. Iliac fossa region & the patient mainly will sleep on his rt. Side, so the infection may spread upward below the diaphragm on the rt. side (in the subphrenic space) or spreads below the liver into Morison's pouch on the rt. or lt. side.

Spread of infection/ presence of abscess in the subphrenic space can only occur on the right side only, WHY? Because of the presence of a ligament between left colic flexure and diaphragm and the spleen above on the left side, which will prevent the spread of the infection upward to the lt. subphrenic space, on the other hand, spread of the infection to the left (morison's pouch) can happen as on the rt. side.

This figure shows supracolic compartment (subphrenic & subhepatic /Morison's pouch).



## **Gutter**

Space/groove around the descending and ascending colon resulted from the fixation of the ascending & descending colon by peritoneum.

Importance: gives passage to infection

The ascending colon has paracolic gutter on lateral and medial sides

The medial gutter is closed by small intestine and the lateral is opened to morison's and to subdiaphragmatic/subphrenic space.

The descending colon has also lateral and medial paracolic gutter

The medial gutter is opened; gives passage to the pelvis and the lateral gutter is closed but reaches the pelvis... So the infection can pass though to the pelvis.

# Mnemonic

Retroperitoneum organs:

*SAD PUCKER*

- *S* - Suprarenal (*adrenal*) gland
- *A* - *aorta/IVC*
- *D* - *duodenum* (second and third part)
- *P* - *pancreas* (except tail)
- *U* - *ureters*
- *C* - *colon* (ascending and descending)
- *K* - *kidneys*
- *E* - (*o*) *esophagus*
- *R* - *rectum*

For the Intraperitoneal organs remember *SALTD SPRSS* (Pronounced Salted Spursss):

- *S* = *Stomach*
- *A* = *Appendix*
- *L* = *Liver* (Be Careful... in our material it's interperitoneal)
- *T* = *Transverse colon*
- *D* = *duodenum* (only the 1st & last inch)
- *S* = *Small intestines*
- *P* = *Pancreas* (only the tail though)
- *R* = *Rectum* (only the upper 3rd)
- *S* = *Sigmoid colon*
- *S* = *Spleen*