

Digestive System

University of Jordan
Faculty of Medicine
Batch of 2013-2019



Slide Sheet Handout Other

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Sheet #: 8

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Date:

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Gross anatomy of the large intestines

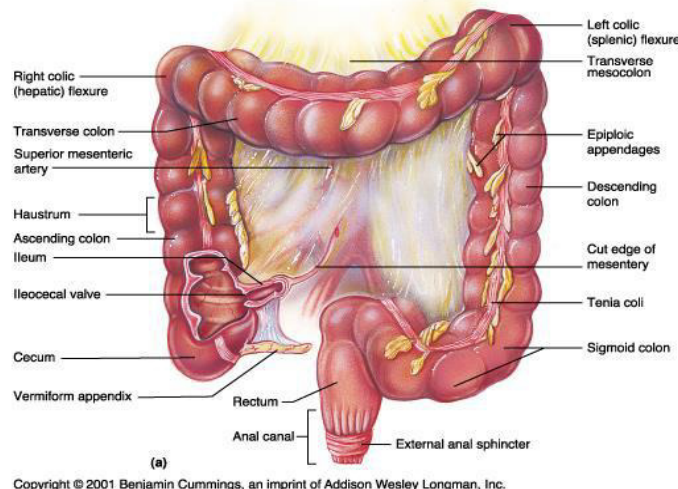
Note : like the previous sheet :P , this sheet contains all the extra information written in the slides and not said by the doctor .In addition to all the extra information said in section 2 recording .Good luck

- General characteristics about the large intestines

1- the length of the large intestines is 1.5-2.5 meter and the diameter of the large of intestines is larger than the small intestines

2- The large intestines starts from the ileocecal valve and ends at the anus and it includes the cecum and appendix -

>ascending colon ->transverse colon -
>descending colon -> sigmoid colon -
>Rectum ->anal canal



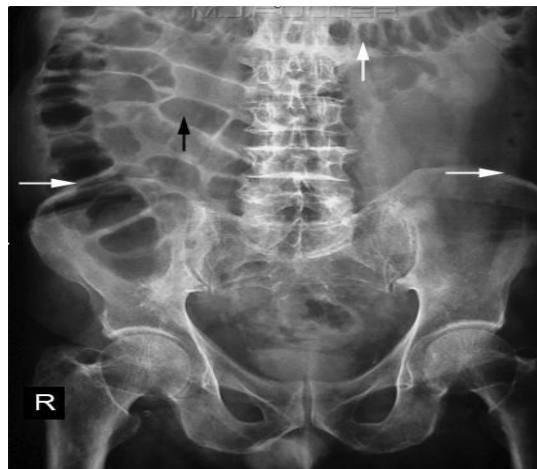
3- There are parts of the large intestines that are intraperitoneal like the cecum , appendix (it has mesoappendix) , transverse colon (has transverse mesocolon) , sigmoid colon (has sigmoid mesocolon) .The retroperitoneal parts of the large intestines are : the ascending colon , the descending colon , the Rectum

4- The peritoneum around the ascending and descending colon is anterior and on both sides that's why there are right and left lateral paracolic gutter which is a space between the abdominal wall and the colon .The right paracolic gutter is lateral to the ascending colon and the left paracolic gutter is lateral the descending colon .

5-The large intestines are characterized by the presence of 3 separate longitudinal ribbons of smooth muscles from the outer longitudinal layer of muscularis externa called **Tenia coli** and it is found all over the large intestines **except in the appendix and the Rectum** .

6-The large intestines also have **appendices epiploica** which is a bulge of fat projecting from the serosal surface of the colon .It's found all over the large intestines **except the Appendix ,Cecum and Rectum.**

7-There are Haustrations or Sacculations in the large intestines that gives the colon the segmented appearance .It's highly important in X-ray to distinguish between the colon and the small intestines .The haustrations are formed from the contractile activity of taenia coli and they are not found in the small intestines because the small intestines lack teania coli .

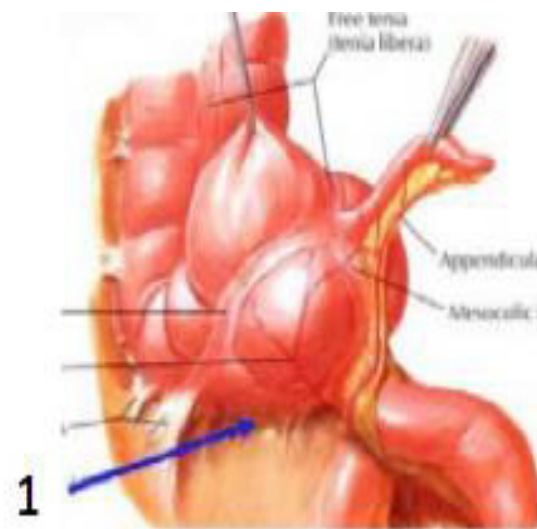


8- The histology of the large intestines : It's lined by simple columnar epithelium with large number of goblet cells and no villi .There is no paneth cells at the base of crypts of lieberkuhn and the gland is simple tubular gland .

Cecum

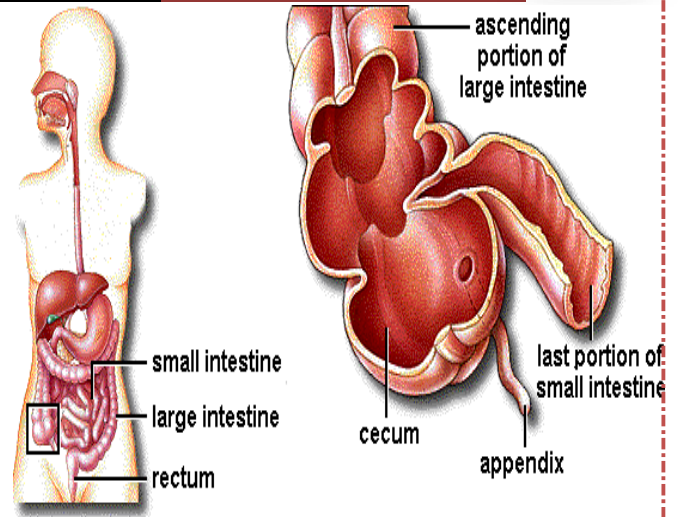
-it is a blind-ended pouch situated in the right iliac fossa , it lies above the lateral half of the inguinal ligament .

-it has a diameter 2.5-3 inches and it is completely covered by peritoneum **but it doesn't have a mesentery** ,it is fixed in the posterior abdominal wall of the right iliac fossa . This fixation creates recesses or pouches , the most important pouch is the retrocecal pouch (pointed by the arrow in the figure) , this pouch is important clinically because sometimes when we look for the appendix we find it in the retrocecal pouch . In addition the retrocecal pouch is a common site for internal hernia where part of the terminal ileum get inside the pouch and become pressurized .



- The cecum is connected to the ascending colon superiorly , ileum medially at the ileocecal valve , appendix is attached posteriomedially to the cecum 1 inch below the ileocecal valve

-We have 3 openings in the cecum : 1- for the appendix 2- for the ileum 3- for the ascending colon

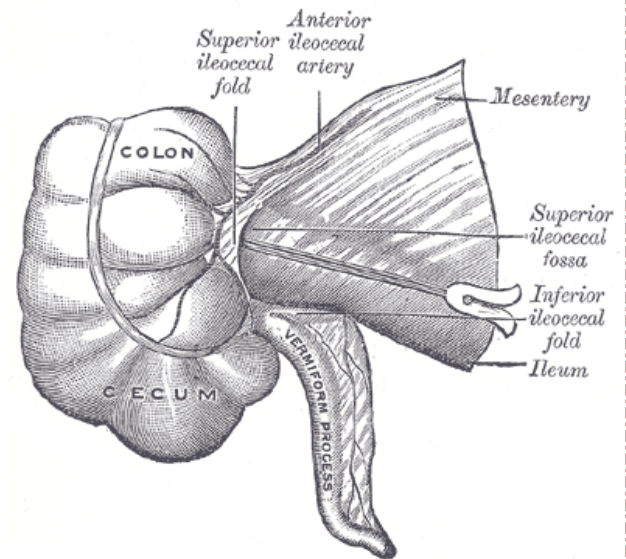


- As we said the cecum is completely covered by peritoneum but has no mesentery that's why it has many pouches including :
 - 1- Superior ileocecal recess
 - 2- Inferior ileocecal recess
 - 3- Retrocecal recess which is the most important one since the appendix can be found in it and it is a common site of internal hernia of the terminal ileum
- Even though the cecum doesn't have a mesentery it possesses a considerable amount of motility
- The cecum has three longitudinal muscular bands, the taenia coli that extend till reaching the base of the appendix. They converge on the base of the appendix and provide for it a complete longitudinal muscle coat .That's why the teniae coli of the cecum is considered an important land mark because it will lead us to the base of the appendix since the appendix doesn't have taenia coli (important) .

Relations of the cecum

Anteriorly

- 1- Coils of small intestines especially the ileum
- 2- The greater omentum : if it was long in the greater sac it can be found anterior to the cecum .That's why in case of appendicitis we will find the greater omentum surrounding the appendix since it is the police man of the abdomen
- 3- Anterior abdominal wall : where we examine the cecum



Posteriorly

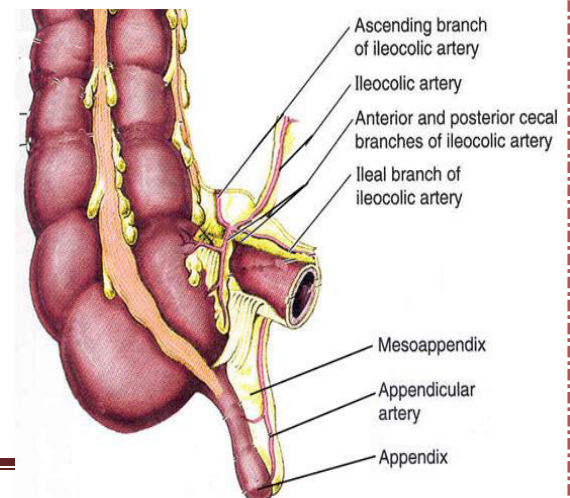
- 1- Psoas major muscles and iliacus : since the cecum is in the right iliac fossa we find these 2 muscles and they join to insert into the lesser trochanter
- 2- Femoral nerve
- 3- Lateral cutaneous nerve of the thigh
- 4- Appendix : if it was in the retrocecal pouch we find it posteriomedial to the cecum

Medially

Small intestines mainly the ileum

Blood supply of the cecum

Anterior and posterior cecal artery which are branches from the ileocecal artery which is a branch from the superior mesenteric artery.



In other words : the superior mesenteric artery terminate at the root of the mesentery as iliocecal artery which gives anterior and posterior cecal artery. (the anterior cecal artery lies anterior to the cecum, the posterior cecal artery lies posterior to the cecum).

-the posterior cecal artery give a branch called the appendicular artery which runs through the mesoappendix and it is the only blood supply to the appendix .

Venous drainage of the cecum

Anterior and posterior cecal veins drain the cecum then they form the iliocecal vein which drains into the superior mesenteric vein to ultimately reach the portal vein

Note : The doctor said that you should pay attention to the figures in the slides because questions may come from them .For example from the figures in the slide you can notice that the superior mesenteric artery is medial to the superior mesenteric vein and this might come in the exam .

Lymphatic drainage of the cecum

The lymph vessels pass through several mesenteric lymph nodes ->finally reach the superior mesenteric lymph nodes that are situated around the origin of superior mesenteric artery .

Nerve supply of the cecum

Parasympathetic innervation : vagus nerve from the superior mesenteric plexus

Sympathetic innervations : from the lumber sympathetic chains in the abdomen and they arrive through plexus of nerves surrounding the superior mesenteric vessels

Ileocecal valve

- It is rudimentary structure that is similar to the cardiac sphincter of the stomach so it's a physiological valve

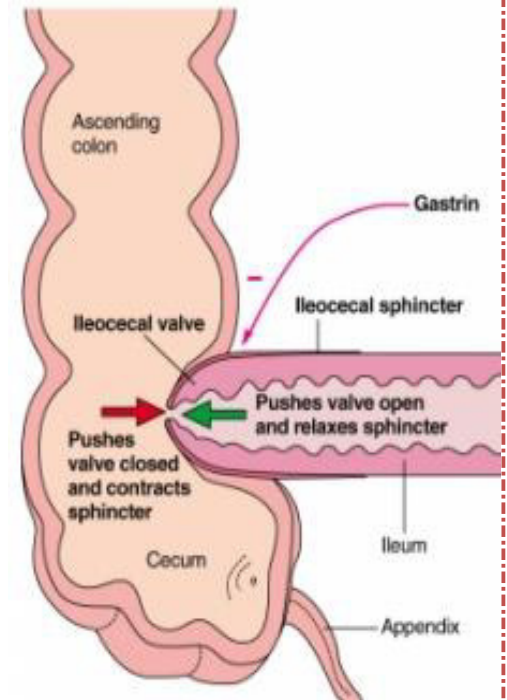
-It prevents regurgitation of the cecal material again to the ileum##. How ?

The valve has two horizontal folds of mucous membrane ,when the pressure increase due to distension of the cecum these folds cause closure to the ileocecal orifice . (Important)

*At the lower end of the ileum there is circular smooth muscles called the ileocecal sphincter, it controls the flow of materials from the ileum toward the cecum (remember that the ileocecal valve prevents regurgitation of cecal materials and it is 2 horizontal folds of mucous membrane while the ileocecal sphincter controls the flow of materials from the ileum toward the cecum and it is made of smooth muscles).

##It's written in the slide that the ilioccal valve plays little or no part in the prevention of reflux of cecal contents into the ilium. → We asked the dr. about it and he said that what is written in the slide is wrong.

- Those smooth muscles of the ileocecal sphincter increase in tone (contract) when the cecum is distended and they decrease in tone (relax) by the effect of **gastrin hormone** produced in the stomach .



Appendix

-The appendix is the most clinically important part of the large intestines since inflammation in the appendix (appendicitis) can only be treated surgically by appendectomy that's because it has a very narrow lumen so any foreign object in the appendix causes obstruction of the lumen and appendicitis and there is an increased risk of rupture of appendix.

- If the appendix ruptured, the patient will end up with peritonitis which is a serious medical condition .If it was left untreated it will transform into appendicular abscess that can move with the abdominal cavity .

Anatomy of the appendix

- it is a narrow muscular tube containing large amount of lymphoid tissue , there is a huge variation in the length of the appendix from 2-22 cm .
- the base of the appendix starts at the end of the taenia coli of the cecum (land mark) ,it is attached to the posteriomedial surface of the cecum about 1 inch below the ileocecal junction
- The appendix is completely covered by peritoneum and has a mesentery called mesoappendix (unlike the cecum) ,This mesentery carries that appendicular vessels, appendicular nerves, lymph nodes and fat.

The surgery of appendicitis

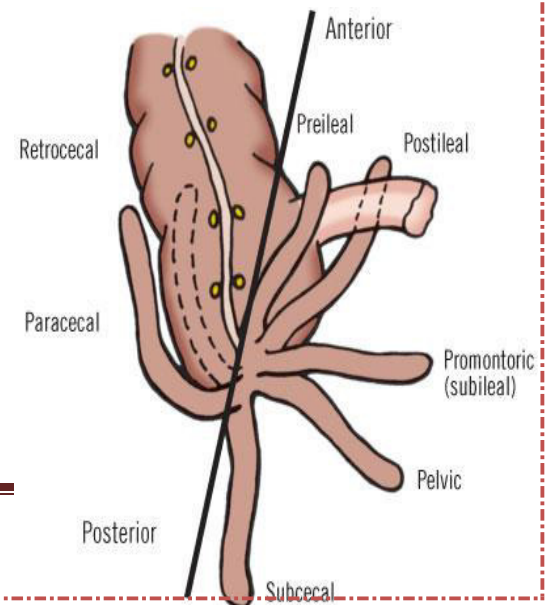
The surgery of appendicitis is called appendectomy ,How it is done ?

- 1- The surgeon makes a McBurney's incision through the skin and superficial fascia because the base of the appendix lies in the McBurney's point (this will be explained later).
- 2- Separation of the abdominal muscles till reaching the peritoneum. We open through the peritoneum to reach the appendix.
- 3- **Ligation of the appendicular artery and vein** in the mesoappendix (Important)
- 4- The surgeon work on the base of the appendix by forming rounded stitches through placing the needle inside and outside the base in a circular way then he cut the appendix and the base of the appendix remains in the cecum .

The position of the appendix

The appendix lie in the right iliac fossa and has many positions :

- 1- Retrocecal : the most common position (74% of people) , it is in the retrocecal pouch posterior to the cecum (common question in exam)



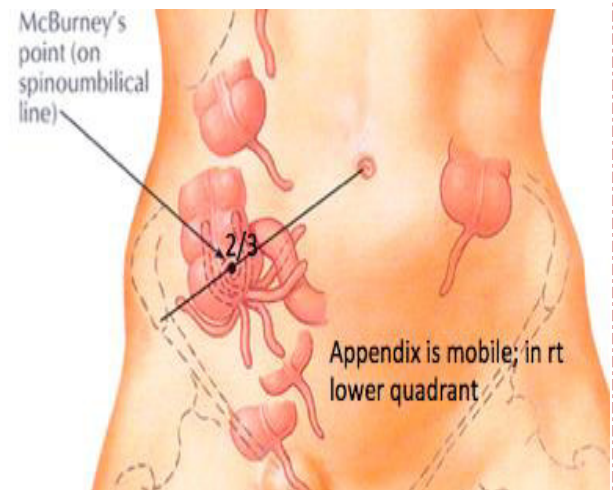
- 2- Pelvic : (21% of patients) it is hanging in the pelvis in relation to the right ovary and uterine tube .

Note : If the doctor is not sure from the diagnosis, the proper Examination to diagnose appendicitis in the pelvis is by **bare rectal examination**. It is done by putting the index in the patient's anal canal and rectum and press against the pelvis, if the patient felt severe pain, there is appendicitis and the appendix is **pelvic** in position.

- 3- Subcecal (3.5 %) : below the cecum
4- Preileal (1%) : in front of the ileum
5- Postileal (0.5 %) : behind the ileum

Surface anatomy of the appendix

- We determine the site of the appendix depending on the base of appendix since it is fixed in position while the remainder of the appendix is free .
- The base of the appendix lies at McBurney's point which is a point at a junction between the upper medial 2 thirds and lower lateral one third of a line extending from the right ASIS and the umbilicus .
- McBurney's incision : it is an incision parallel to the inguinal ligament and pass through McBurney's point .



Blood supply and venous drainage of the appendix

- The appendix is supplied by appendicular artery which is a branch from posterior cecal artery which descend behind the ileum .
- The appendix is drained by appendicular vein which drains into the posterior cecal vein .

Lymphatic drainage of the appendix

Lymph vessels drain into one or two appendicular lymph nodes in the mesoappendix ->eventually drain to superior mesenteric lymph nodes

Nerve supply of the appendix (Important)

When a patient come to you with appendicitis you ask him where did the pain start , if the pain started around the umbilicus and then it was concentrated around the right iliac fossa it is appendicitis ,why ?

Because the skin around the umbilicus is supplied by T10 and the peritoneum surrounding the appendix is supplied by the tenth intercostal nerve (T10), that's why it begins around the umbilicus then it will be concentrated in the right iliac fossa around the appendix ,this is called referred pain (important)

Clinical notes about the appendix

- 1- Acute appendicitis : uncommon in the two extremes of life (newborns and elderly).
- 2- Thrombosis in the appendicular artery causes gangrene in the appendix since it's the only blood supply of the appendix ,gangrene in the appendix causes rupture in the appendix and peritonitis

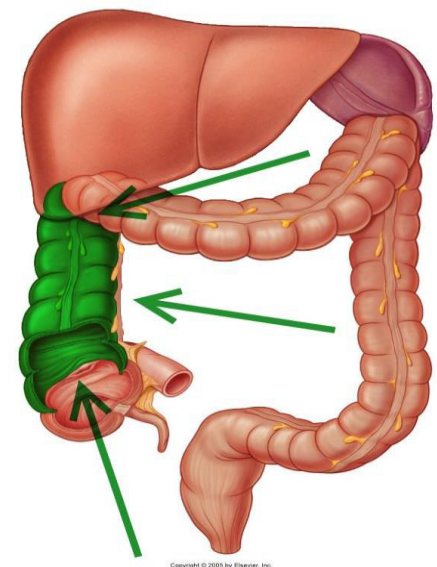
This is opposite to the gallbladder : if thrombosis happened in the cystic artery there will be no gangrene in the gallbladder because the gallbladder receives direct blood supply from the visceral surface of the liver which it is embedded in (important)

- 3- Perforation in the appendix causes peritonitis and sometimes if greater omentum surrounded the infection it could form abscess and this abscess can pass through the gutter to the sub-diaphragmatic space and cause sub-diaphragmatic abscess ,Or it can go to Morison pouch .

- 4- Treatment of appendicitis is appendectomy .If a girl comes with appendicitis like symptoms you keep her under observation for 48 hours , if the blood analysis shows increased amount of **leukocyte** that's an indication of appendicitis. You should ask about her menstrual cycle because it may associate with severe pain in the right iliac fossa and appendicitis-like signs. If you are 60 % sure that it is appendicitis you should do an appendectomy even if the appendix is normal to stay in the safe side and avoid rupture which causes peritonitis and many complications.

Ascending colon

- The ascending colon is about 5 inch (13 cm) long
- It lies in the right lower quadrant which means that it starts from the right iliac fossa from the cecum and ascend upwards to the inferior surface of the right lobe of the liver where it turns to the left and forms an impression on the right lobe of the liver called the right colic impression (right hepatic flexure).
- It's characterized by all the characteristics of the large intestines : it has taenia coli , sacculations , appendices epiploica .
- The ascending colon is retroperitoneal , it is covered by peritoneum on the anterior and on both sides making it fixed in position due to the attachment to the posterior abdominal wall .Because of that we have medial and lateral right paracolic gutter on the side of the ascending colon (the medial is closed and the lateral is an open space) .That gutter causes spreading of the infection to subphrenic pouch or Morison pouch



Relations of the ascending colon

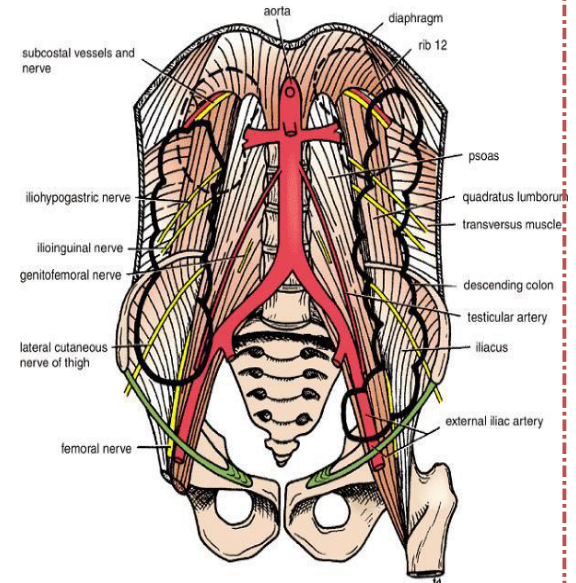
Anteriorly (like the cecum)

- 1- Coils of small intestines
- 2- Greater omentum
- 3- Anterior abdominal wall

Posteriorly

- 1- Muscles including : iliacus , quadratus lumborum ,origin of transverses abdominis
- 2- The iliac crest
- 3- Lower pole of the right kidney
- 4- Nerves : iliohypogastric and ilioinguinal nerves

Note : the psoas major muscles is away from the ascending colon and has a posterior relation with the cecum and **L1 nerves pass posterior to the ascending colon and not posterior to the cecum (important)**

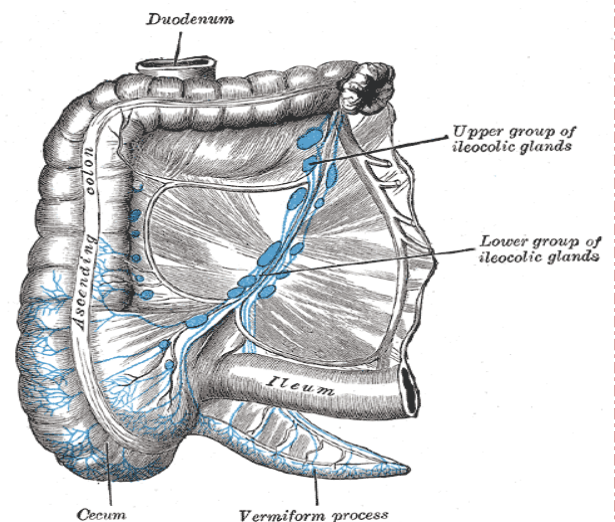


Blood supply and venous drainage of the ascending colon

-ileocolic artery and right colic artery branches from superior mesenteric artery

- ileocecal vein and right colic vein drain the ascending colon and eventually drain to the superior mesenteric vein

Important note :we have right colic artery (For ascending), middle colic artery (for transverse) and find that all colic arteries *anastomose* with one another .So we can say that the ascending colon is supplied by right and middle colic arteries ,ileocolic artery .



Lymphatic drainage of the ascending colon

Lymphatic vessels from the ascending colon pass through lymph nodes along the course of colic blood vessels to eventually drain into the superior mesenteric lymph nodes around the origin of superior mesenteric artery .

Nerve supply of the ascending colon

Parasympathetic innervations is still from the vagus nerve through superior mesenteric plexus and this innervations will continue till the lateral third of the transverse colon

Transverse colon

- It's about 15 inches extends across the abdomen occupying the umbilical region
- It extends from the right colic flexure below the right lobe of the liver to the left colic flexure below the spleen (so the spleen has an impression from the transverse colon called the left colic or splenic flexure) .
- The transverse colon has transverse mesocolon which is 2 layers of peritoneum that terminates in the **anterior boarder of the pancreas** (important)
- Phrenicocolic ligament is located between the diaphragm and left colic flexure ,This ligament is highly important because it prevent spread of infection upwards to the diaphragm so the pus **بفضل نازل** To the pelvis .Because the phrenicocolic ligament suspend the left colic flexure to the diaphragm , the left colic flexure is higher in level than the right colic flexure
- Transverse colon has all the features of large intestines : it has taenia coli ,sacculation and appendeces epiplolca

- The transverse mesocolon is attached to the superior boarder of the transverse colon while the posterior layers of greater omentum are attached to the inferior boarder .

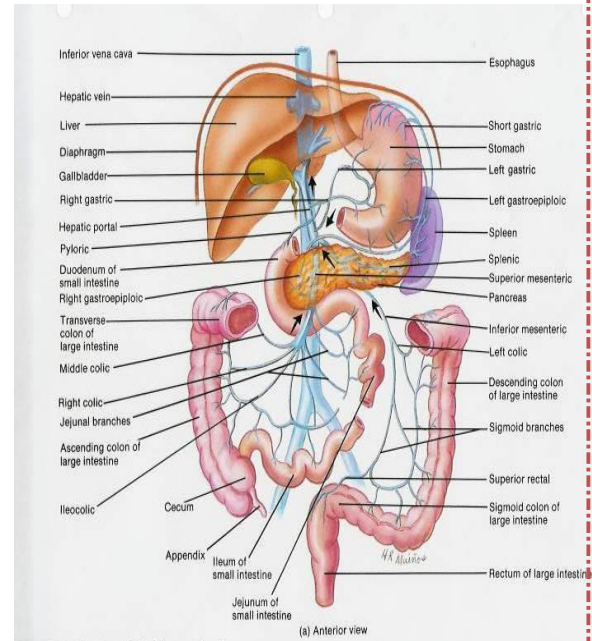
Relations of the transverse colon

Anteriorly

- 1- Greater omentum
- 2- Anterior abdominal wall (umbilical region)

Posteriorly

- 1- 2nd part of the duodenum (**important**)
- 2- Head of pancreas
- 3- Coilds of jejunum and ileum



Blood supply and venous drainage of the transverse colon

- The proximal 2/3 are supplied by middle colic artery which is a branch from the superior mesenteric artery (midgut) while the distal 1/3 is supplied by left colic artery which is a branch from inferior Mesenteric artery because the lateral third belongs to hindgut .
- Also the right colic flexure of the transverse colon receives blood supply from the right colic artery while the left colic flexure receives from the left colic artery
- Venous drainage is the opposite : the superior mesenteric vein drain the proximal 2/3 which joins with the splenic vein to form the portal vein ,while the distal 1/3 is drained from inferior mesenteric vein which drains into the splenic vein

Note: distal = lateral, proximal = medial

Lymphatic drainage of the transverse colon

- Lymphatic vessels follow the arteries , the proximal 2/3 to colic lymph nodes -> superior mesenteric lymph nodes while the distal third (lateral third) is drained by colic lymph nodes -> inferior mesenteric lymph nodes .

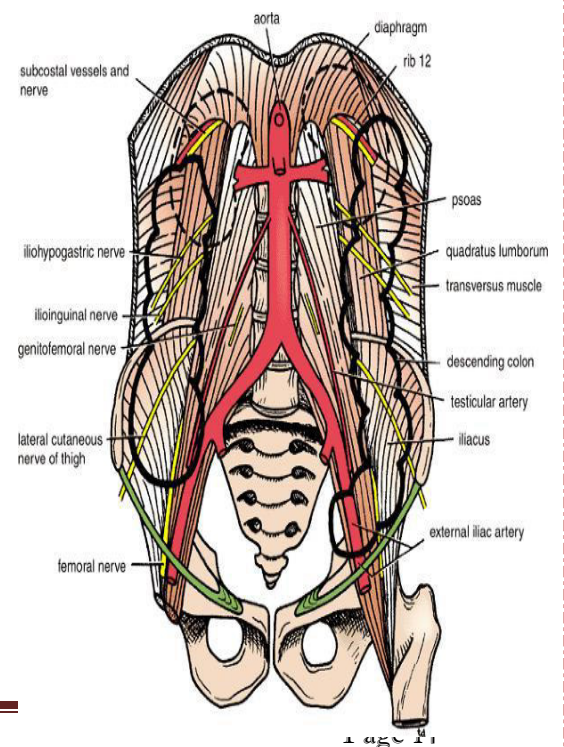
Nerve supply of the transverse colon (important)

- the proximal 2/3 receives sympathetic and parasympathetic innervations from the superior mesenteric plexus, the parasympathetic is through vagus nerve.
- the distal 1/3 receives sympathetic and parasympathetic innervations from inferior mesenteric plexus, the parasympathetic is through S2,S3,S4 pelvic nerves

Note : the Transverse mesocolon varies in length between individuals , if it was too long the transverse colon might be at the level of the pelvis and if it was small the transverse colon can adhere to the stomach.

Descending colon

- it is 10 inches in length ,it starts from the left colic flexure till reaching the inlet of the pelvis and it continue as sigmoid colon (Descending colon is retroperitoneal while the sigmoid is intraperitoneal and has sigmoid mesentry).
- The peritoneum covers the descending colon anteriorly and on both sides creating medial and lateral left paracolic gutter.



Relations of the descending colon

Anteriorly (like descending)

- 1- Coils of small intestines
- 2- The greater omentum
- 3- Anterior abdominal wall

Posteriorly

- 1- Muscles : **left psoas muscles** , origin of left transverses abdominus , left quadratus lumborum , left iliacus (in the pelvis)
- 2- Nerves : left femoral nerve , left iliohypogastric and ilioinguinal nerves , left lateral cutaneous nerve of the thigh , subcostal nerve
- 3- Lateral boarder of left kidney
- 4- The left iliac crest

Blood supply and venous drainage of the descending colon

- Left colic artery and sigmoidal arteries branches from the inferior mesenteric artery
- Inferior mesenteric vein drain the descending colon which terminates in the splenic vein
- Inferior mesenteric lymph nodes around the origin of inferior mesenteric artery drain the descending colon

Nerve supply of the descending colon

-parasympathetic innervation is by S2,S3,S4 sacral spinal nerves through inferior mesenteric plexus

-Sympathetic innervations is by splanchnic nerves through inferior mesenteric plexus

The end

-special dedication to omar alqeisi (ابو خلع)