Basic GI Anatomy

The following document is intended as an introduction for students doing the GI rotation in Year 3, containing information I think is fundamentally important to grasp before starting the clinical attachment. Apologies for the poor diagrams (I am no Da Vinci or Vesalius).
My reference text in writing this has been Gray's Anatomy for Students *(Drake et al. 2005 Churchill Livingstone)*, and I would recommend this book, along with the combined wisdom of the Edinburgh anatomy staff, a glance at an embryology text book, and a colour atlas of anatomy to help with the first few weeks of the attachment.

Key is to understand the embryology:

Other than recognising the organs, the key to understanding the GI system is to have a grasp of the basic embryology. The GI system is split up into foregut, midgut and hindgut, and if you can recognise which structures are present in each part, this will help to understand much of the pathology (the obvious example being why the initial pain of appendicitis is umbilical). Working backwards, when you are confronted with a clinical problem, think of which part of the gut it relates to; this will help with learning symptoms and forming a differential diagnosis.

Foregut- distal oesophagus, stomach, proximal duodenum (all suspended by ventral and dorsal mesenteries)
Also note development of liver and creation of epiploic foramen/foramen of Winslow (with development of the greater and lesser sacs, and the greater and lesser omenta)

Midgut- distal duodenum, jejunum, ileum (all on mesenteries), ascending colon (retroperitoneal) and proximal 2/3 transverse colon (suspended in mesentery, greater omentum hangs over)

Hindgut- Distal 1/3 transverse colon (mesentery), descending colon (retroperitoneal), sigmoid colon (intraperitoneal) and superior rectum

There is a good diagram illustrating this on pg 295 of Gray's Anatomy for Students.

Understand Mesenteries

Another important concept is mesenteries; specifically which structures are intraperitoneal and which are retroperitoneal (as mentioned above). It is easiest to grasp this concept from looking at a well-illustrated textbook, but put simply I like to remember the embryology, and related to that, remember the branches of the abdominal aorta (as described by the picture and discussion below). If you can picture in your mind celiac, sup mesenteric and inf mesenteric arteries, with the GI organs and mesenteries appearing like fan-coral from those stalks (with anastomoses distally) you will have a good picture of how the system works, how disease fits with this system, and why treatment takes a certain approach.

Rectus Sheath

As an aside, surgeons always love to ask about the layers being cut through during an operation. Again, you really need to look at a well-illustrated textbook for a good picture of this, but I like to have a quick list in my mind to fire off (from superficial to deep):

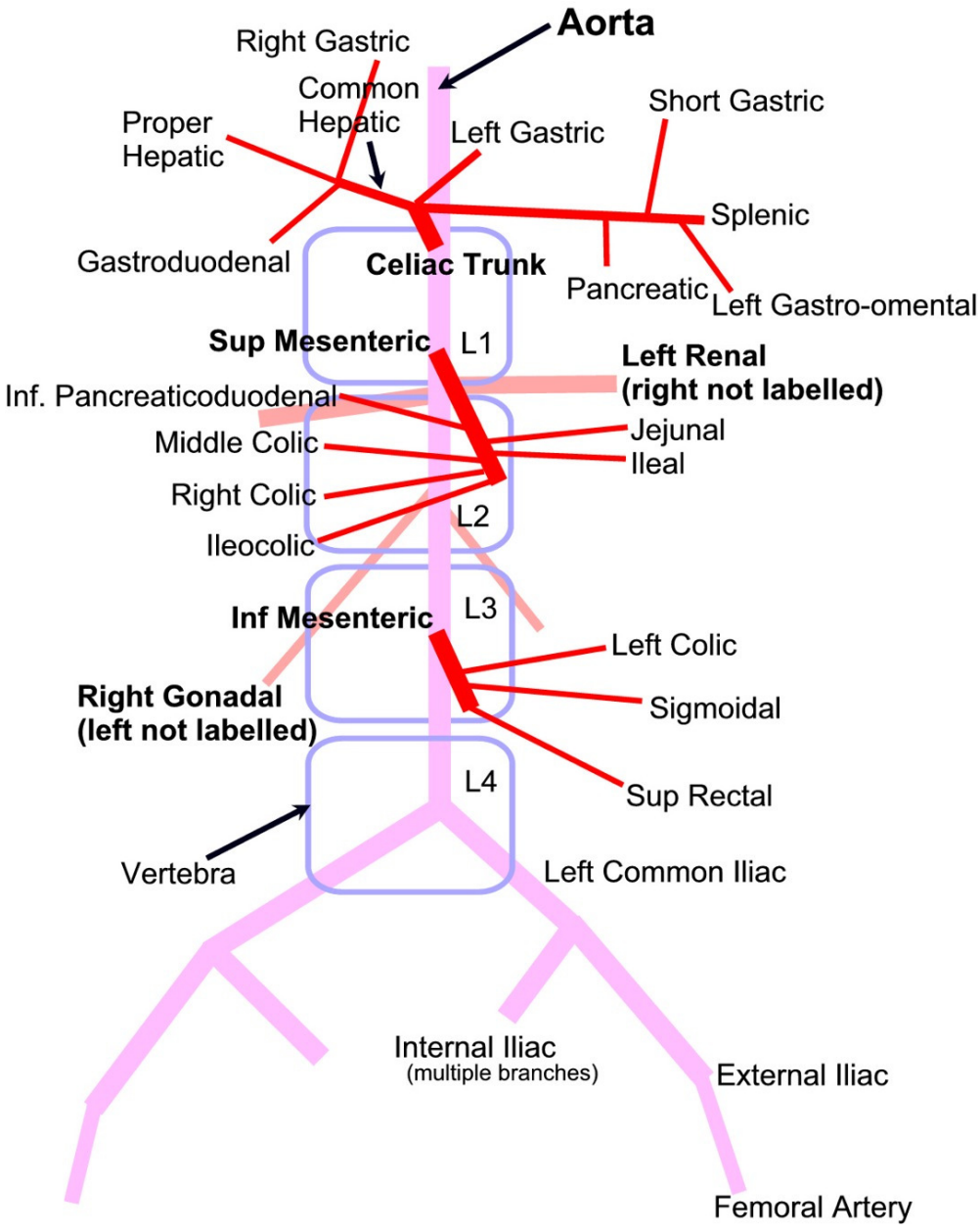
1. Skin
2. Superficial Fascia
    a. Fatty layer- Camper's
    b. Membranous layer- Scarpa's
3. Muscle and/or Aponeurosis:
    a. Rectus Abdominis Muscle
    b. Linea Alba (in between rectus muscles)
    c. Aponeurosis of External oblique, internal oblique and tranversus abdominis

    Check a textbook for detail on this. Midway between umbilicus and pubic symphysis, rectus abdominis stops having aponeurosis deep to it (all the aponeurosis moves superficial), and therefore the muscle lies directly on the transversalis fascia. The transition point is marked by the arcuate line.
4. Transversalis Fascia
5. Parietal Peritoneum
6. (Visceral Peritoneum)

Vasculature (and biliary tree):

Below are diagrams of the arterial system, the portal venous system, and finally the biliary tree. These cover basic detail, and there is obviously much more to understand (I would recommend looking at a textbook so you understand the relationships between these diagrams and the surrounding organs). Ultimately, though, I like to have these basic pictures to pin further work around, and, as mentioned above, to relate these pictures to the pathology.

Branches of the Abdominal Aorta:

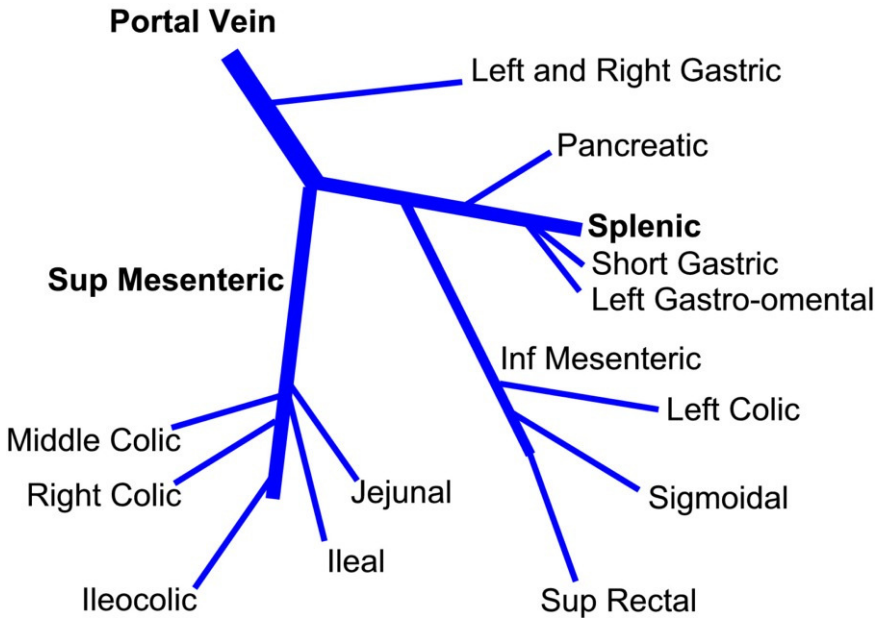


Celiac: **Left Gastric**- Oesophageal Branches
Left Gastric itself travels along lesser curvature of stomach
Splenic- Small branches to pancreas
Short Gastric arteries, in gastro-splenic ligament (supplying fundus of stomach)
Left Gastro-omental artery (supplying greater curvature of stomach)
Common Hepatic- Gastroduodenal- branches: right gastro-omental artery
sup pancreaticoduodenal artery
Right Gastric
Proper Hepatic- In free edge of lesser omentum, left of bile duct,
anterior to portal vein *(good to know the relationships of these)*
Branch for cystic artery
- Divides to right and left hepatic arteries near porta hepatis

Sup. Mesenteric- Inf. Pancreaticoduodenal
Jejunal
Ileal
Middle colic, right colic and ileocolic (supplying terminal ileum, cecum,
ascending colon and proximal 2/3 transverse colon)

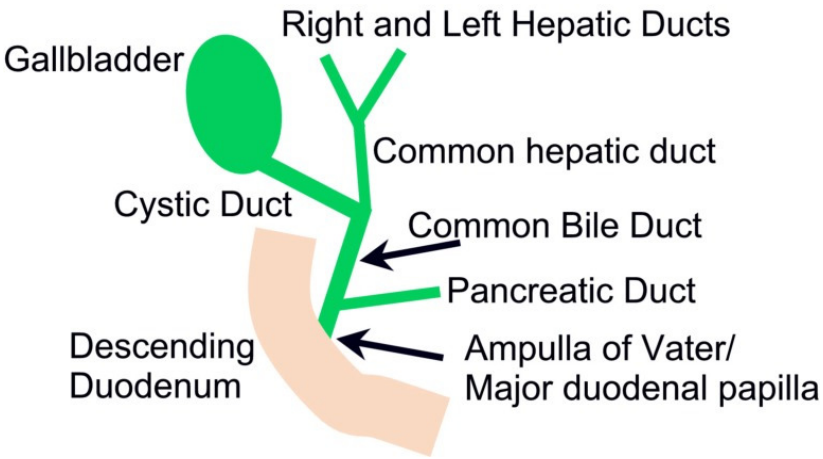
Inf. Mesenteric- Left colic (supplying distal 1/3 of transverse colon, and descending colon)
Sigmoidal arteries (supplying lowest part of descending colon and sigmoid colon)
Superior rectal

Portal Venous System:



On approaching the liver, portal vein divides into left and right branches
This anatomy of the portal venous system is important in understanding the effects of portal hypertension.

Biliary Tree:



Good understanding of this anatomy is required for cholecystecomy: cystic duct and artery are ligated, but care must be taken not to damage the common bile duct.

Obviously this is a very quick overview of the basic points that I find helpful in understanding the GI system. This is in no-way exhaustive of the points you will need to know/get questioned on during a GI attachment (for example, I have not touched on the features of individual organs: sections of the stomach; lobes, recesses and falciform ligament of the liver; haustrae and taenia coli in the colon), but it should be a useful start.

Unrelated to anatomy, it is really useful to remember what increases in LFTs relate to:
Bilirubin- increased in transport deficiency
ALT- increased with hepatocellular damage
Alk Phos- increased in biliary obstruction
GGT- increased when there is enzyme induction

James P. Blackmur
Edinburgh Student Surgical Society Publicity Officer
And 4th Year MBChB Undergraduate at Edinburgh University
March 2009