Abdomen: Small and large bowel, blood supply of intestine and the portal system

**SMALL INTESTINE**

- Average length 6 metres (20 feet)
- Range 3-10 metres (10-33 feet)
- Patients can survive with 2/3 removed. Little if any effect by removing 1/3

**ORIGIN OF SMALL BOWEL MESENTERY**

15 cm (6") long.
Starts at the duodenojejunal junction, just to left of L2 vertebra and extends down and to the right to right sacro-iliac joint at S2 sacral level. Contains superior mesenteric vessels, lymphatics and autonomic nerves.

**BLOOD: Ileal & jejunal brs of superior mesenteric artery.**
**NERVES: General visceral afferents in lesser splanchnics (sympathetic) reffered to T10 (para-umbilical)**

<table>
<thead>
<tr>
<th></th>
<th><strong>JEJUNUM</strong></th>
<th><strong>ILEUM</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>2/5, red, wide bore, thick wall</td>
<td>3/5, pink, narrow bore, thin wall</td>
</tr>
<tr>
<td>Macroscopic</td>
<td>Valvulae conniventes, plicae circulares ++, sparse arcades</td>
<td>Smooth wall, Peyer's patches, multiple arcades</td>
</tr>
<tr>
<td>Mesentery</td>
<td>Lies superiorly, attached to left of aorta, less fat</td>
<td>Lies inferiorly, attached to right of aorta, fatty mesentery</td>
</tr>
<tr>
<td>Histology</td>
<td>Tall villi, Long crypts</td>
<td>Short villi, Short crypts</td>
</tr>
</tbody>
</table>

Note: At base of crypts are Paneth cells that produce lysozyme. Also terminal ileum is site for absorption of vitamin B12 and bile salts
MECKEL'S DIVERTICULUM
SMALL BOWEL MESENTERY
SMALL BOWEL SECRETIONS

MECKEL'S DIVERTICULUM
• Said to be present in 2-3% of people, 2-3 inches" long and 2-3 feet from the ileocaecal valve but these statements are probably only 2/3 true!
• May contain gastric, pancreatic, liver, carcinoid or lymph tissue
• May attach to umbilicus via a vitello-intestinal tract which may or may not leak but may cause intestinal obstruction as a volvulus can wrap around it
• Symptoms very similar to appendicitis
• Lies on antemesenteric border of ileum

ORIGIN OF SMALL BOWEL MESENTERY
• 6 inches (15cm) long
• Starts at the duodenojejunal junction, just to left of L2 vertebra and extends down and to the right to reach the right sacro-iliac joint at S2 sacral level
• Contains superior mesenteric vessels, lymphatics and autonomic nerves

SECRETIONS FROM SMALL BOWEL
• Mucus, lysozyme, secretin, somatostatin, cholecystokinin, serotonin and endomorphin, VIP, GIP, etc
CAECUM AND APPENDIX

CAECUM

- On mesentery
- Below ileocaecal valve
- Retrocaecal fossa behind it
- 3 taenia meet at base of appendix
- Ileocaecal valve is a double fold of mucosa & circular muscle of ileum which acts as an anti-reflux mechanism

APPENDIX

- At McBurney's point
- 1/2"-9" (2-25cm) average 7-8cm
- Fully coated diverticulum
- Variable mesentery
- Appendicular artery usually from posterior caecal artery. It is an end artery hence appendix can easily become gangrenous
- Appendix moves posterior and medial with caecal expansion
ASCENDING AND TRANSVERSE COLON

ASCENDING COLON
• 15cm (6")
• From ileocaecal valve to hepatic flexure
• Retroperitoneal
• Anterior: Coils of small bowel & omentum

Posterior relations
- Liver (anterior) cut away to show upper pole of kidney
- Right kidney
- Quadratus lumborum
- Transversus abdominis
- Iliohypogastric
- Ilio-inguinal
- Lateral femoral cutaneous nerves
- Iliacus

TRANSVERSE COLON
• 45cm (18")
• Between hepatic and splenic flexures
• Fixed at both ends
• Hangs on transverse mesocolon

Transverse mesocolon
- Hepatic flexure
- Splenic flexure
- Greater omentum
DESCENDING AND SIGMOID COLON

DESCENDING COLON
- 30cm (9-12")
- From splenic flexure to brim of pelvis
- Retroperitoneal
- Appendices epiplioicae ++
- Lies on psoas, iliacus, transversus abdominis, quadratus lumborum

Posterior relations
- Left subcostal artery/vein/nerve
- Iliohypogastric nerve
- Ilio-inguinal nerve
- Lateral femoral cutaneous nerve
- Genitofemoral nerve
- Gonadal artery/vein
- External iliac artery/vein

SIGMOID COLON
- 15-45cm (5-30")
- From pelvic brim to S3 midline
- On mesentery
- Appendices epiplioicae +++
- Taenia become progressively more as a longitudinal coat

Sigmoid colon is excised to expose the base of its mesentery which crosses:
- Common iliac artery bifurcation
- Left ureter
- Left sacro-iliac joint

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LARGE BOWEL - GENERAL

- Approximately 5 foot (1.4m)
- Partially retroperitoneal (see individual segments of bowel)
- Outer longitudinal muscle in three flat bands - Taenia Coli
- Taenia only in colon and caecum - not in rectum or appendix
- As taenia are shorter than the bowel they cause inner haustations called Valvulae Conniventes
- Inner circular muscle
- Appendices epiplciae are little tags of fat at the mesentery border of the bowel - not in appendix, caecum or rectum
- Crypts with goblet cells but no villi
- Lymphatics: Alongside superior/inferior mesenteric vessels to para-aortics to coeliac and on upwards
- Nerves: Parasympathetic - vagus to 2/3 along transverse colon then S2,3,4 to rest of bowel. With sympathetics T10-L2 for vasoconstriction and pain. Note some pelvic organ pain is with parasympathetics

- Appendices epiplciae
- Taenia coli
- Sacculations
- Haustations
- Mesentery

THEY ALL STOP BEFORE THE RECTUM BEGINS
PRINCIPLES OF BOWEL ARTERIAL SUPPLY
COELIAC TRUNK

DIVISIONS OF GUT

FOREGUT
Coeliac Axis

MIDGUT
Superior mesenteric

HINDGUT
Inferior mesenteric

COELIAC TRUNK

Left gastric
Hepatic
Right gastric
Gastroduodenal
Superior pancreaticoduodenal

Oesophageal branches of left gastric
Short gastrics
Splenic
Left gastro-epiploic (greater curvature & omentum)
Right gastro-epiploic (greater curvature & omentum)

WATERSHED BETWEEN FOREGUT AND MIDGUT

Superior pancreaticoduodenal
2nd part of duodenum
Inferior pancreaticoduodenal
SUPERIOR & INFERIOR MESENTERIC ARTERIES

Middle colic
Inferior pancreatico-duodenal
Right colic
Ileocolic with anterior & posterior caecal branches
Appendicular from posterior caecal branch of ileocolic
Marginal artery
Superior mesenteric
Inferior mesenteric
Left colic with superior & inferior branches

Note: marginal artery is weak link at junction of mid & hind gut, 2/3 along transverse colon
ABDOMINAL AORTA AND
RIGHT EXTERNAL ILIAC ARTERY

Coeliac trunk T12
Superior mesenteric L1
Renal
Inferior mesenteric L3
Bifurcation L4
Common iliac
Inferior epigastric
Deep circumflex iliac
Cremasteric branch via deep inguinal ring

Inferior phrenic
Suprarenal branch
Suprarenal
Apical, upper, posterior, middle & lower branches of renal
Ureteric branches
Gonadal
Lumbar/spinal
Median sacral
Internal iliac
External iliac
Superior pubic branch

Inguinal ligament. Artery passes under it at mid-inguinal point

Relations of aorta
Left lateral: Sympathetic chain
Right lateral: IVC, Cisterna chyli
Both lateral: Azygos veins, para-aortic nodes, coeliac ganglia
Anterior: Pancreas, splenic vein, left renal vein, 3rd part duodenum, mesentery, nodes, autonomic plexus, lesser sac, stomach, omentum, small bowel
Posterior: T12-L4 vertebrae, left lumbar veins
Note: marginal artery is weak link at junction of mid & hind gut, 2/3 along transverse colon
HEPATIC PORTAL SYSTEM

Drains venous blood from:
Whole bowel from lower 1/3 oesophagus to upper anal canal
Spleen, pancreas, gall bladder

To: Liver sinusoids

Formed by: Superior mesenteric & splenic behind neck of pancreas.
Inferior mesenteric joins splenic at variable distances along it