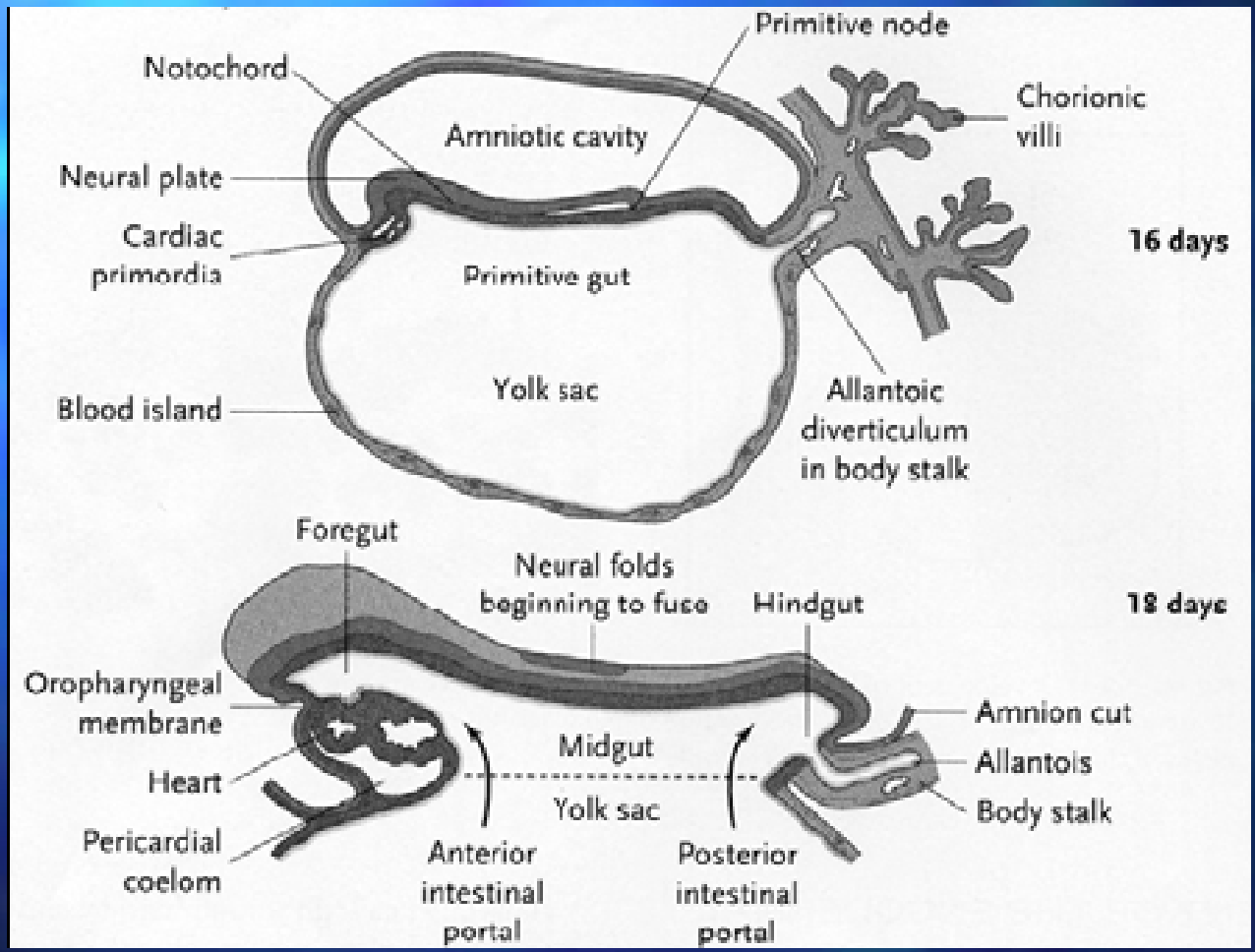
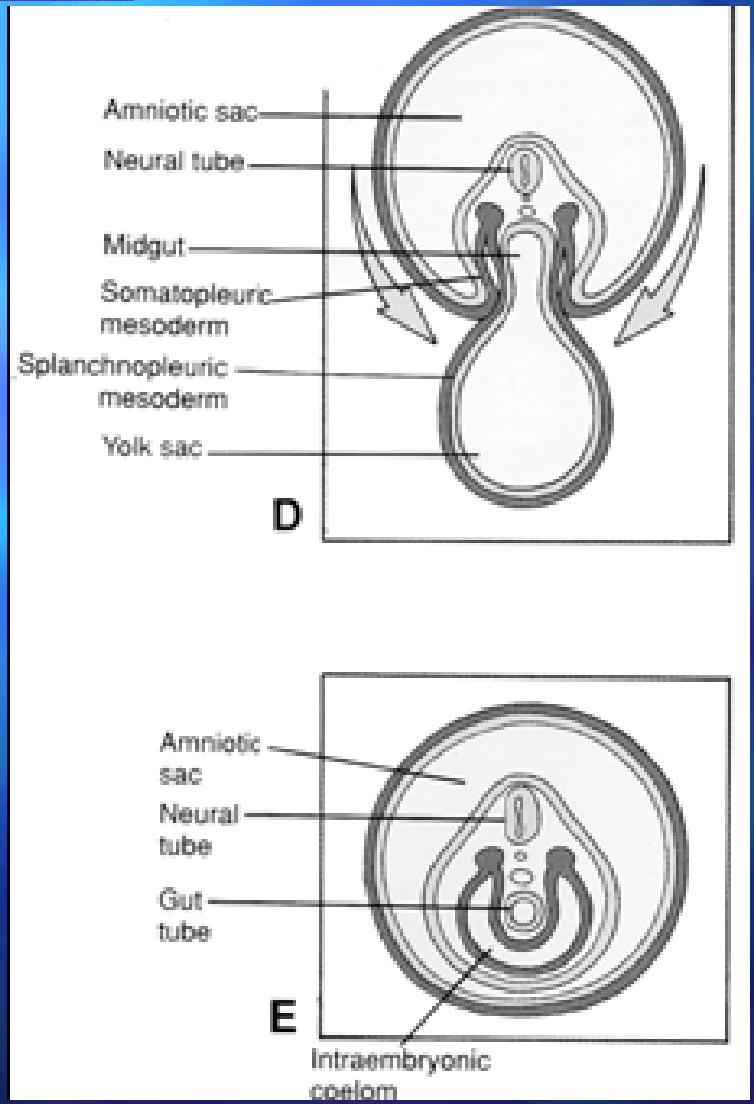
Small Intestine

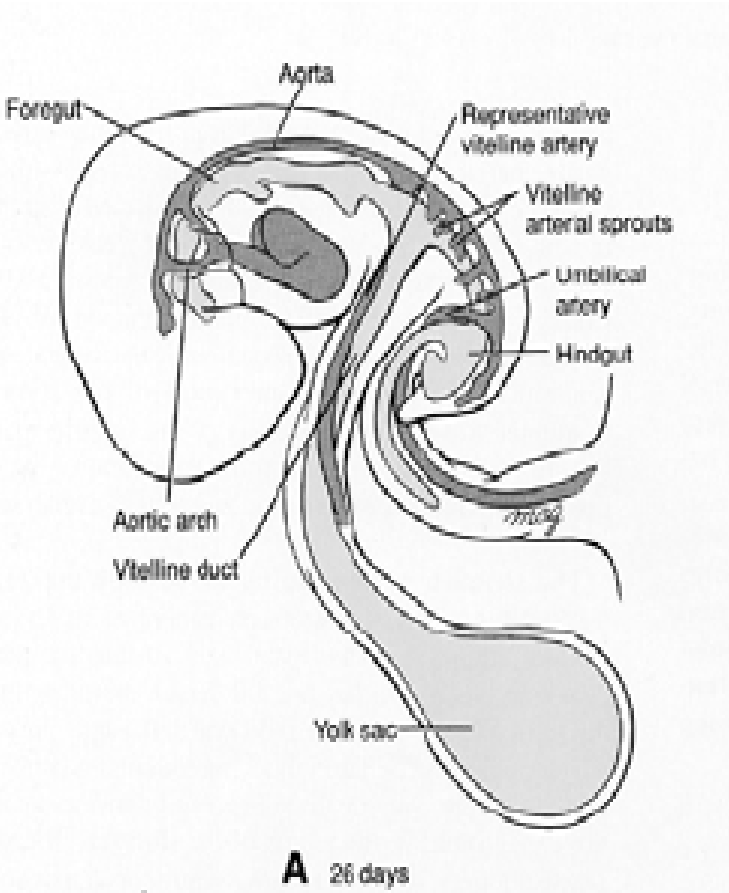
Embryology

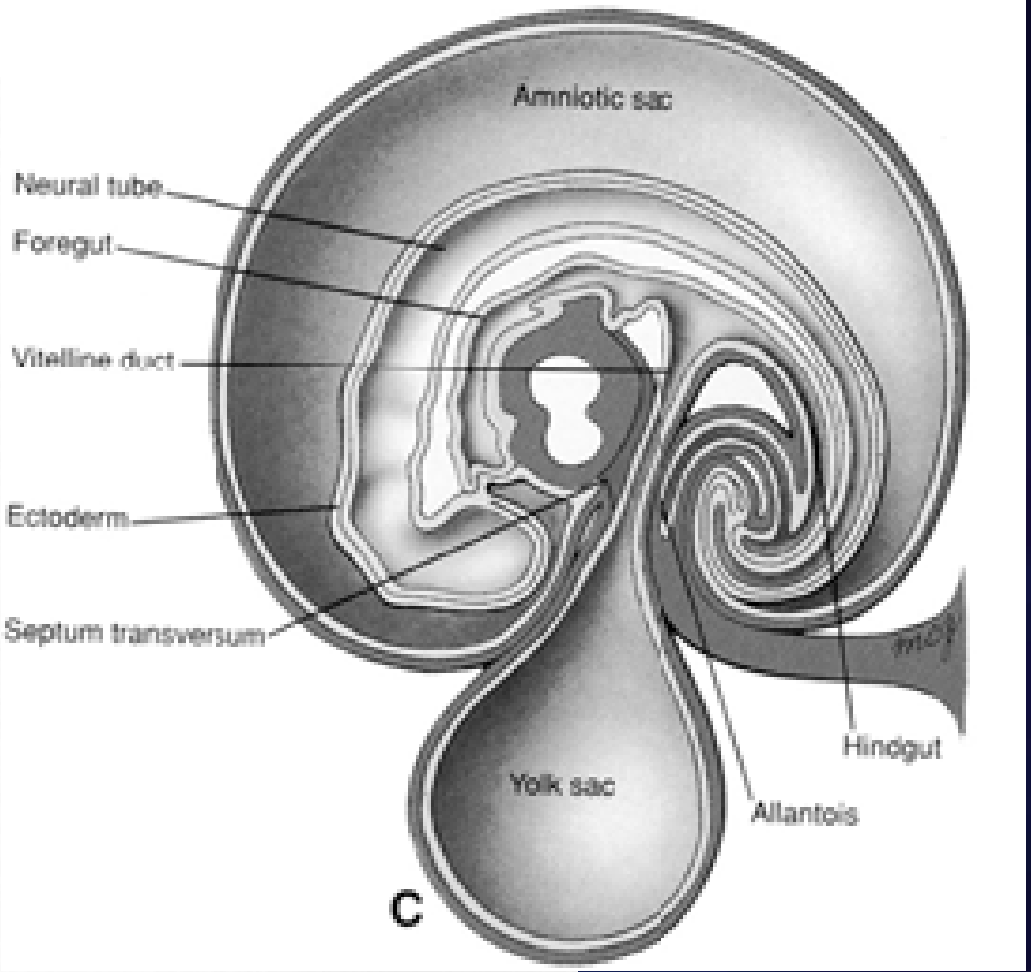

Primitive node
Notochord
Amniotic cavity
Chorionic villi
Neural plate
Cardiac primordia
Primitive gut
16 days
Yolk sac
Blood island
Allantoic diverticulum in body stalk
Foregut
Neural folds beginning to fuse
Hindgut
18 days
Oropharyngeal membrane
Amnion cut
Midgut
Heart
Allantois
Yolk sac
Body stalk
Pericardial coelom
Anterior intestinal portal
Posterior intestinal portal

Embryology

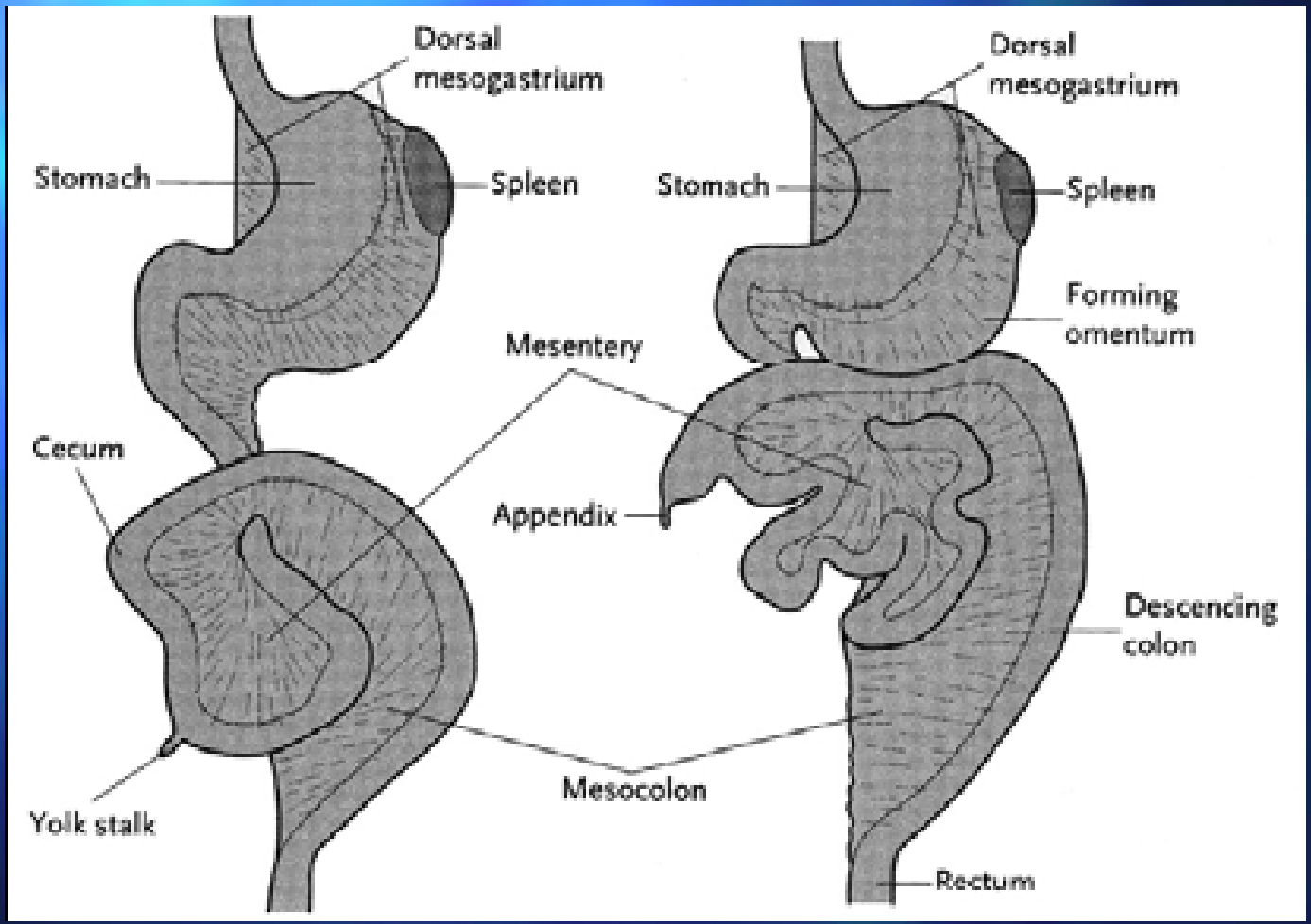

Amniotic sac
Neural tube
Midgut
Somatopleuric mesoderm
Splanchnopleuric mesoderm
Yolk sac
D
Amniotic sac
Neural tube
Gut tube
E
Intraembryonic coelom

Embryology

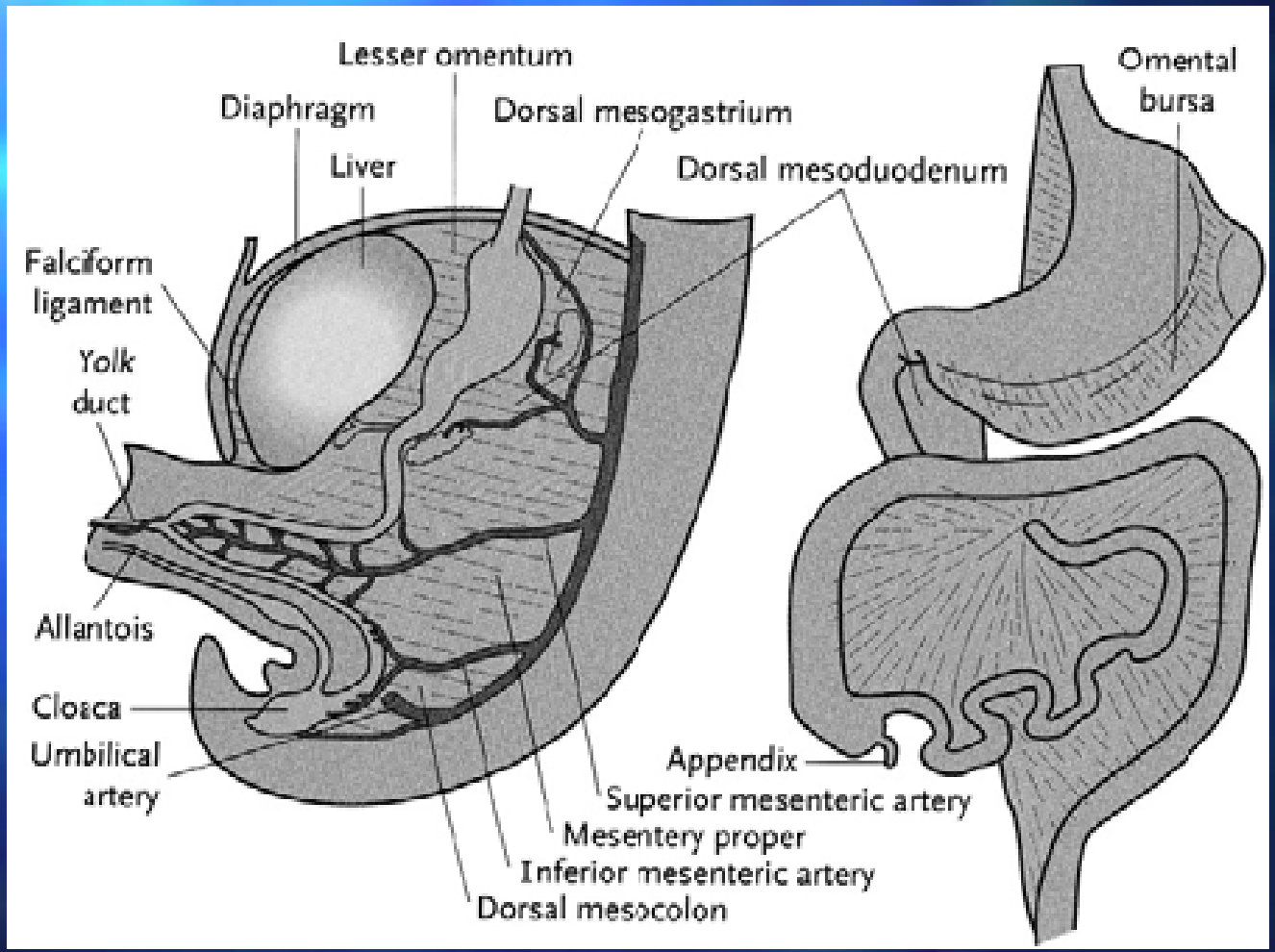

Aorta
Foregut
Representative vitelline artery
Vitelline arteral sprouts
Umbilical artery
Hindgut
Aortic arch
Vitelline duct
Yolk sac
A 26 days


Amniotic sac
Neural tube
Foregut
Vitelline duct
Ectoderm
Septum transversum
Hindgut
Yolk sac
Allantois
C

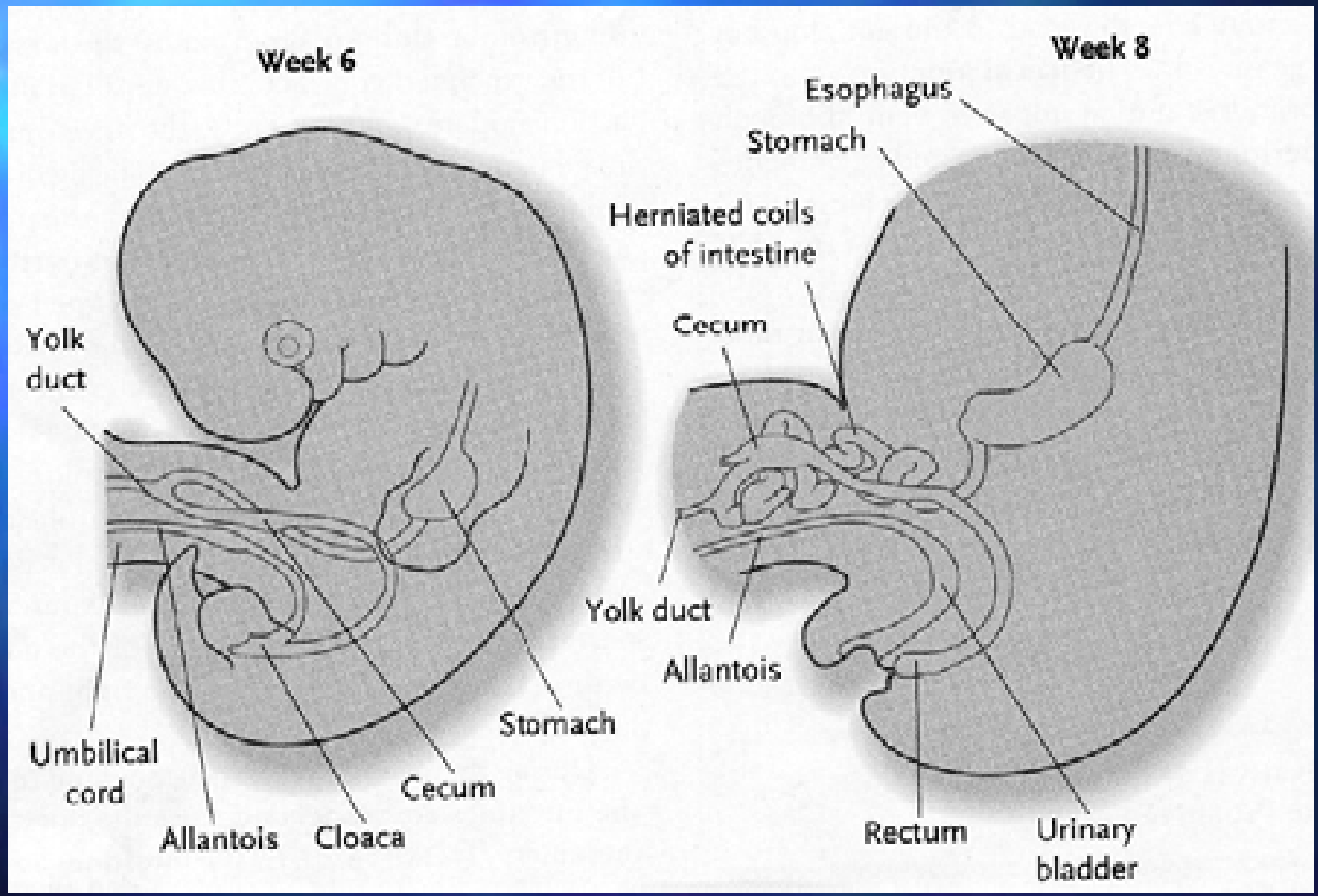
Embryology


Dorsal mesogastrium
Stomach
Spleen
Cecum
Yolk stalk
Mesentery
Appendix
Mesocolon
Dorsal mesogastrium
Stomach
Spleen
Forming omentum
Descending colon
Rectum

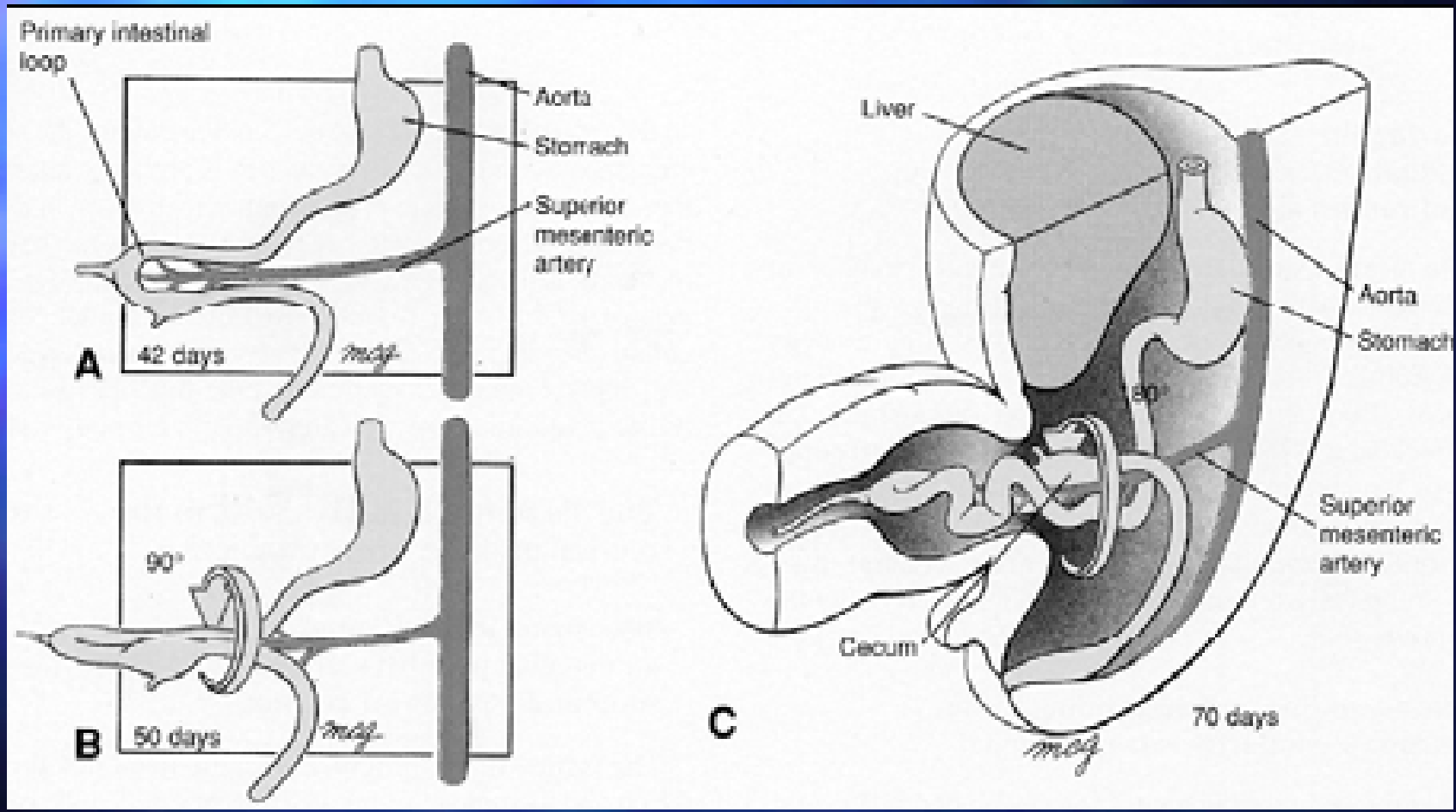
Embryology


Lesser omentum
Diaphragm
Dorsal mesogastrium
Liver
Dorsal mesoduodenum
Omental bursa
Falciform ligament
Yolk duct
Allantois
Cloaca
Umbilical artery
Appendix
Superior mesenteric artery
Mesentery proper
Inferior mesenteric artery
Dorsal mesocolon

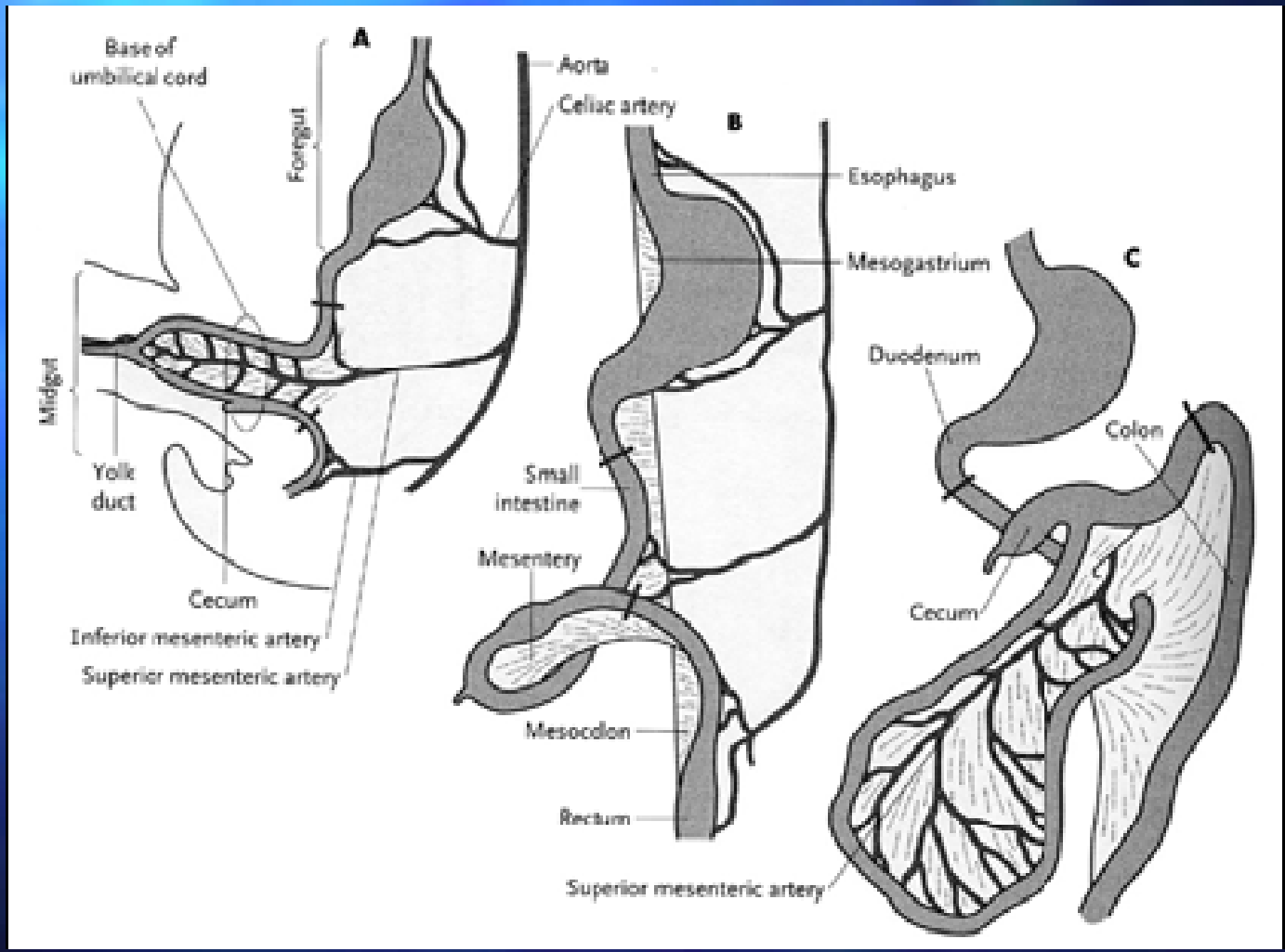
Embryology


Week 6
Week 8
Esophagus
Stomach
Herniated coils of intestine
Cecum
Yolk duct
Yolk duct
Allantois
Stomach
Umbilical cord
Cecum
Allantois
Cloaca
Rectum
Urinary bladder

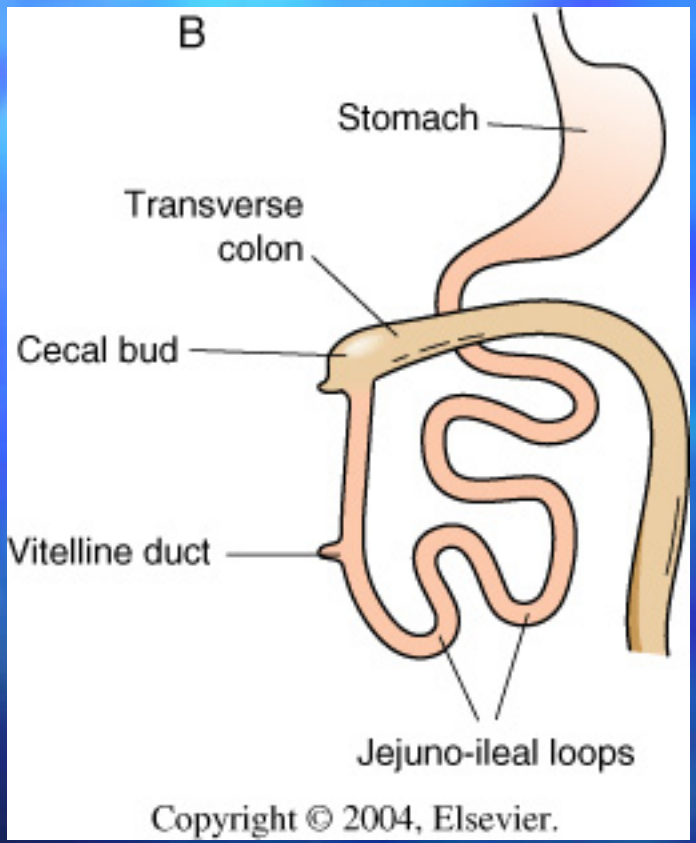
Embryology

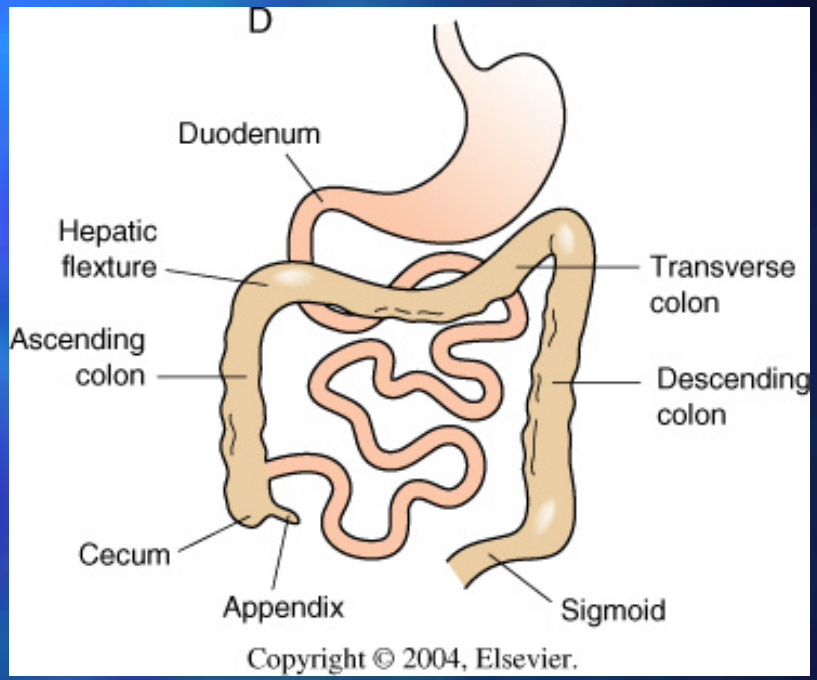

Primary intestinal loop
Aorta
Stomach
Superior mesenteric artery
A
42 days
90°
B
50 days
Liver
Aorta
Stomach
Superior mesenteric artery
Cecum
C
70 days

Embryology


A
Base of umbilical cord
Foregut
Aorta
Celiac artery
Midgut
Yolk duct
Cecum
Inferior mesenteric artery
Superior mesenteric artery
B
Esophagus
Mesogastrium
Small intestine
Mesentery
Mesocolon
Rectum
Superior mesenteric artery
C
Duodenum
Colon
Cecum

Embryology

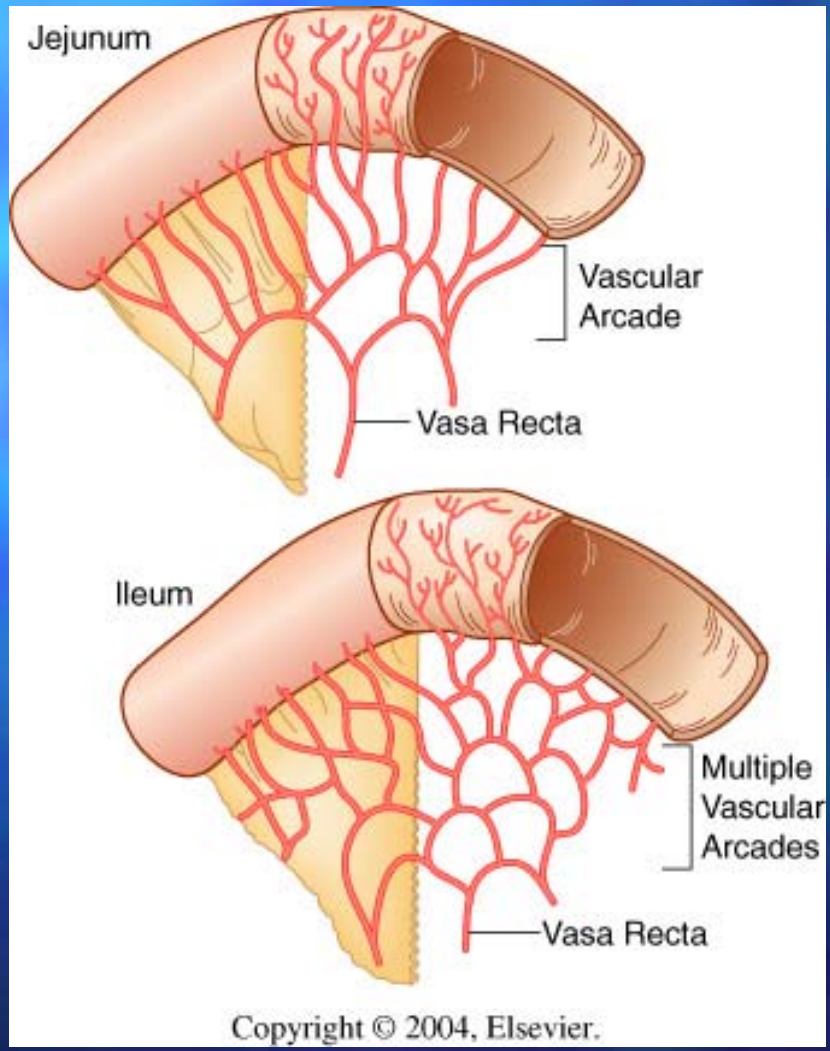

B
Stomach
Transverse colon
Cecal bud
Vitelline duct
Jejuno-ileal loops
Copyright © 2004, Elsevier.


D
Duodenum
Hepatic flexture
Transverse colon
Ascending colon
Descending colon
Cecum
Appendix
Sigmoid
Copyright © 2004, Elsevier.

Anatomy

- 270 to 290 cm
  - Duodenum 20 cm
  - Jejunum 100 to 110 cm
  - Ileum 150 to 160 cm
- Mucosa has transverse folds (plicae circulares)
- Jejunum starts at the ligament of Treitz
- No obvious jej-ileal demarcation
  - Jejunum has larger circumference, is thicker and has different mesenteric vessels

Anatomy


Jejunum
Vascular Arcade
Vasa Recta
Ileum
Multiple Vascular Arcades
Vasa Recta
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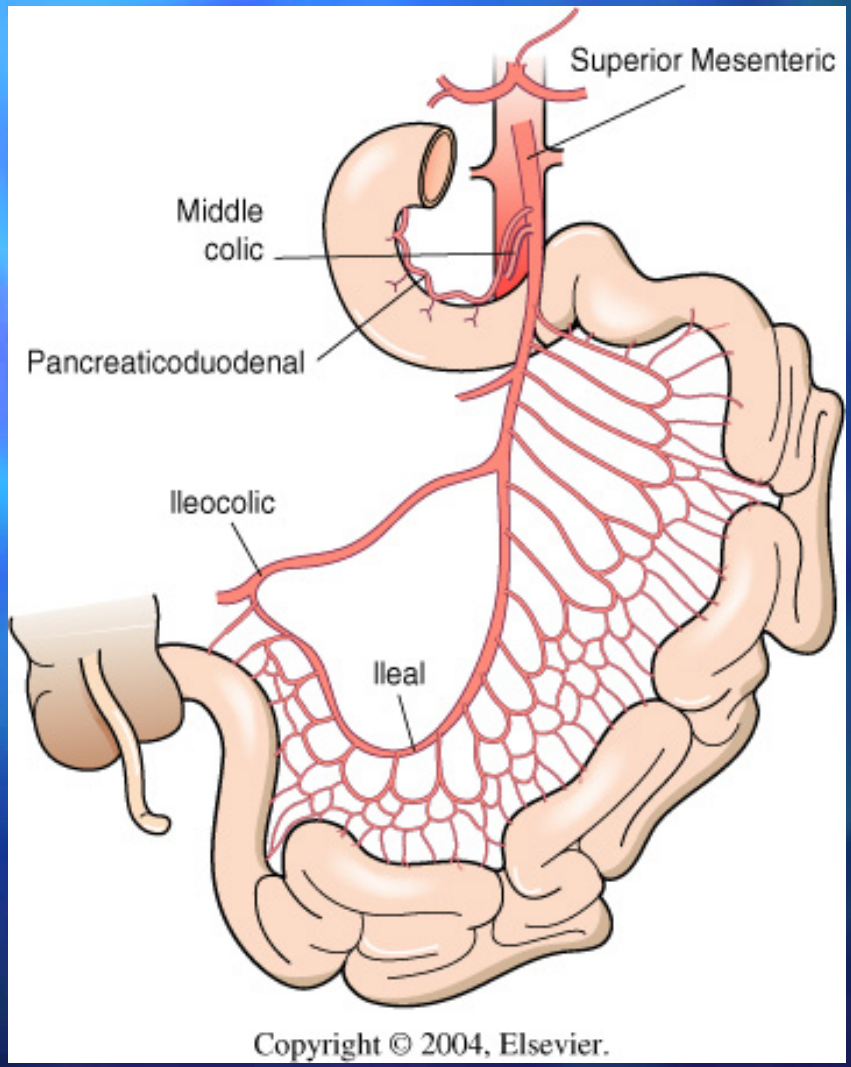
Anatomy: Blood Supply



Anatomy: Innervation

- Autonomic only
  - Parasympathetic
    - Vagus, celiac ganglion
  - Sympathetic
    - 3 pairs of nerves, superior mesenteric plexuses
    - pain

Anatomy: Lymphatic Drainage

- Major deposits of lymphatic tissue
  - Peyer patches in distal small bowel
- Mucosa -> nodes adjacent to bowel -> nodes at the mesenteric arterial arcades -> group of nodes at the base of superior mesenteric vessels -> cisterna chyli
- Fat absorption

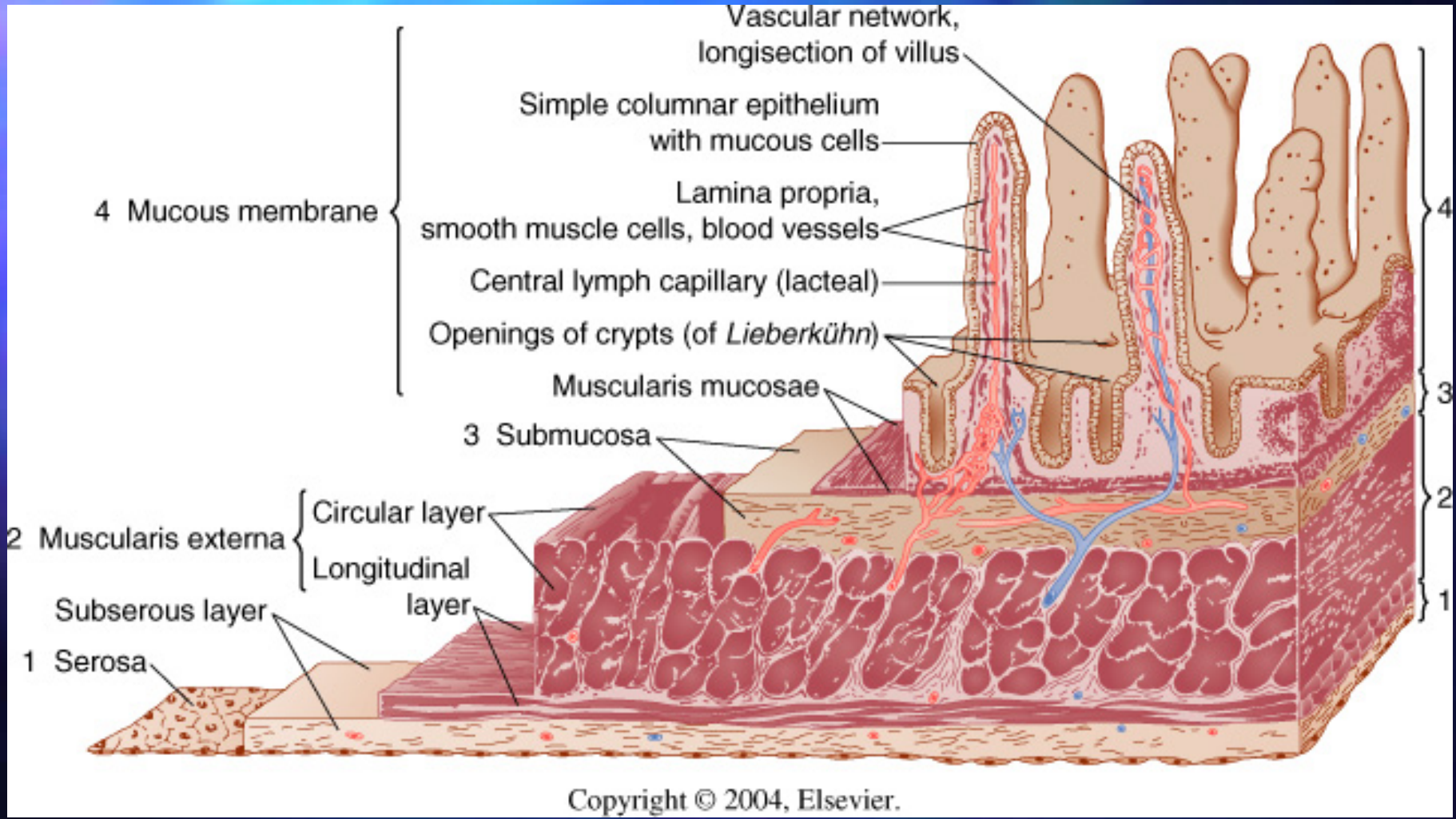
Histology

- 4 layers
  - Serosa: visceral peritoneum
  - Muscularis propria
    - Thin outer longitudinal layer
    - Thicker inner circular layer
    - Auerbach (myenteric) plexus in between
  - Submucosa:
    - fibroelastic tissue with blood vessels and nerves
    - STRONGEST component of intestinal wall
    - Contains Meissner plexus

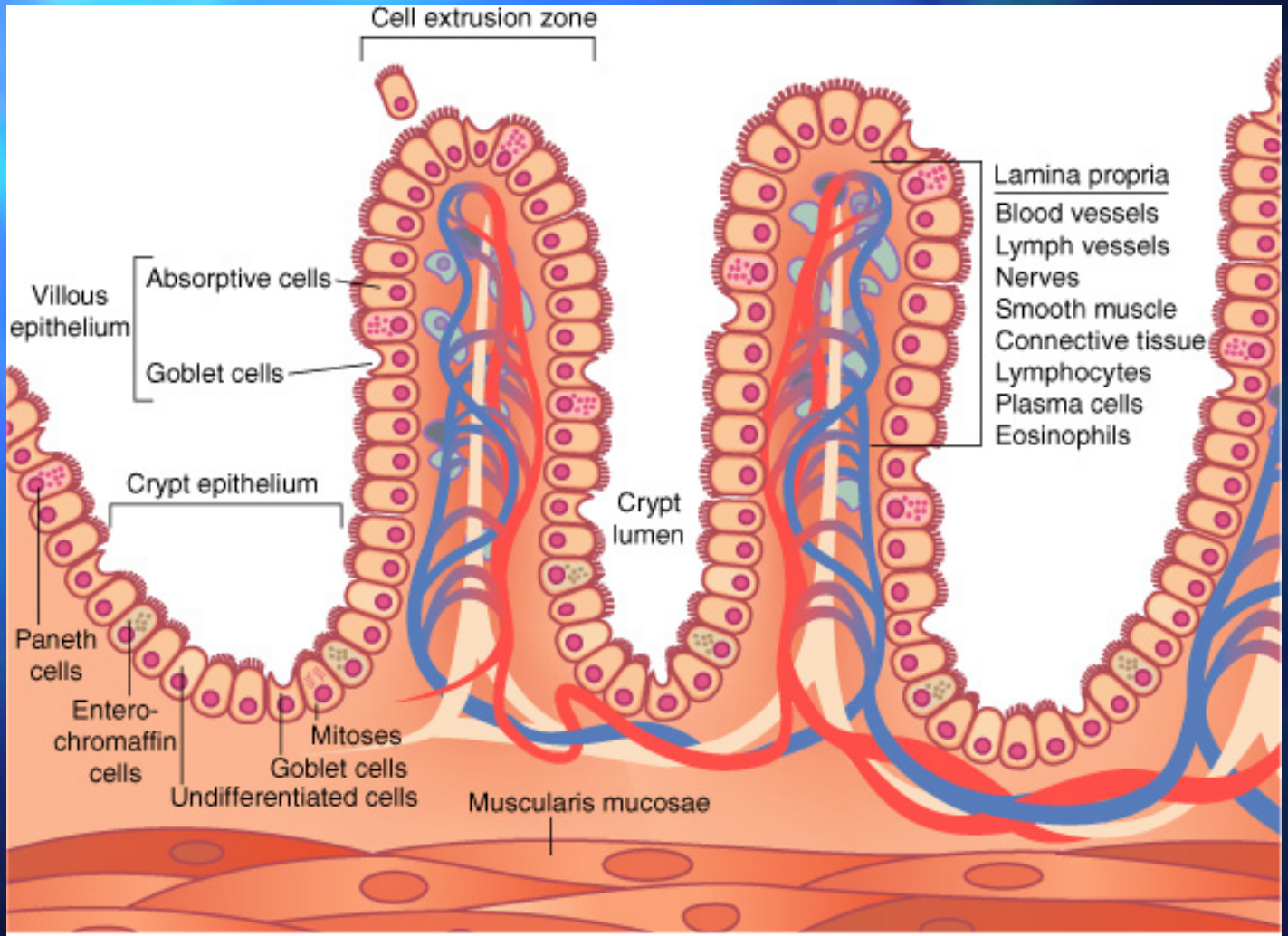
Histology

- 4 layers
  - Mucosa
    - Muscularis mucosa: thin, separate from submucosa
    - Lamina propria: connective tissue, immune function
    - Epithelial layer: covers vili and crypts
      - Goblet cells: secrete mucus
      - Paneth cells: mucosal defense system; secrete lysozyme, TNF, cryptidins
      - Enterocytes: absorption; with microvilli, covered by the glycocalyx
      - Enteroendocrine cells

Histology

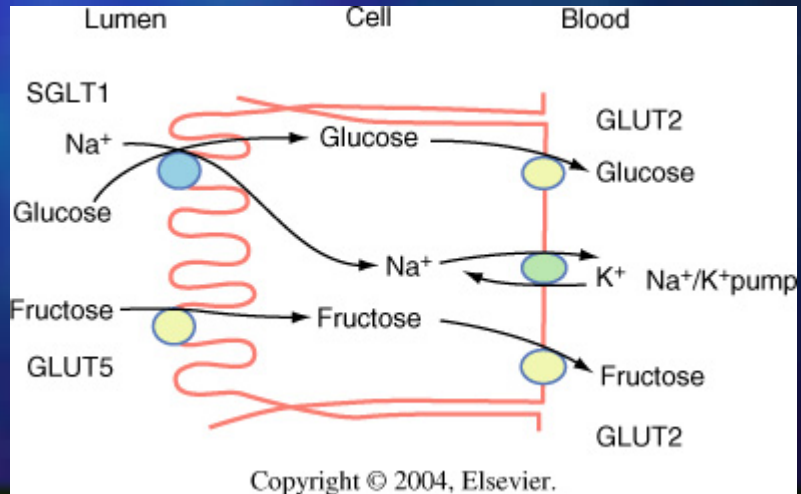


Histology



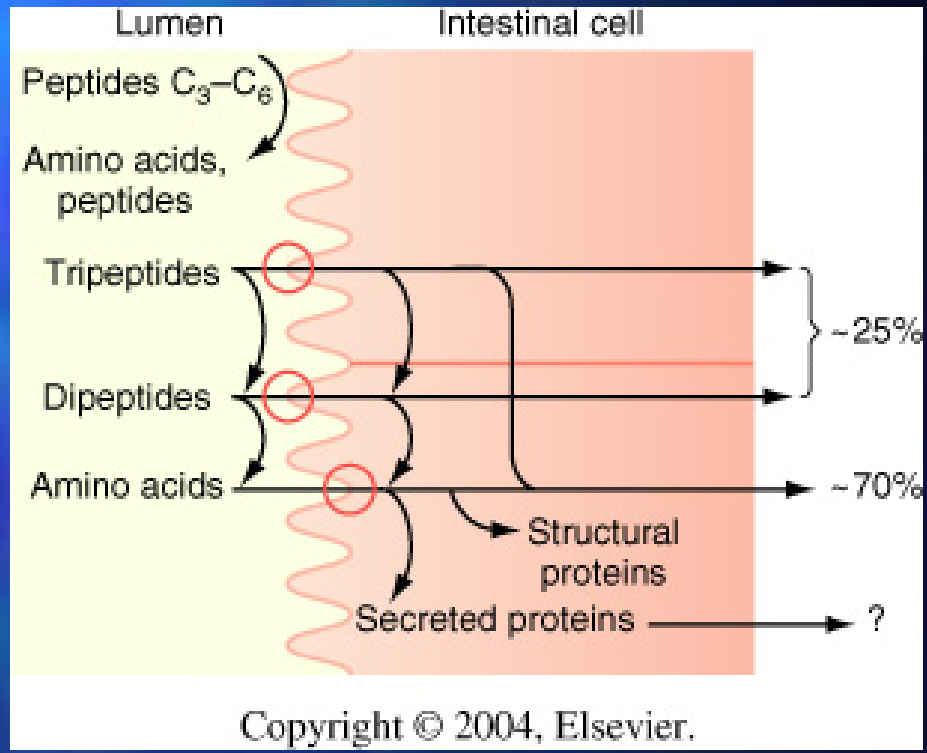
Physiology: Digestion and Absorption

- Carbohydrates
  - Broken down by intra luminal amylase and amylopectin
  - Brush border: maltase, lactase, sucrase, trehalase -> break disaccharides
  - Monosaccharides are absorbed
    - Na cotransport
    - Facilitated diffusion



Physiology: Digestion and Absorption

- Protein
  - 80-90% is absorbed in the jejunum
  - Pancreatic trypsinogen (ENTEROKINASE)
  - Endopeptidases: trypsin, chymotrypsin, elastase



Physiology: Digestion and Absorption

- Fat
  - Emulsification:
    - breakdown of fat globules into smaller sizes
    - Facilitated by bile (bile salts, lecithin)
    - Allows action of pancreatic lipase
  - Micelle formation
    - Bile salts are amphipathic
    - Core of free fatty acids and monoglycerides
    - They simply diffuse into the interior of the cell, without the bile salts

Physiology: Digestion and Absorption

- Fat
  - Intracellular processing
    - Reformation of triglycerides
    - Combination with lipoproteins
      - Short and medium-chain FA may be diluted in blood (portal system)
      - Chylomicrons to lacteals and then lymphatics
  - Enterohepatic circulation
    - Conjugated bile acids are absorbed in the distal ileum -> portal system -> back to the liver
    - Pool of 2-3 g
    - Recirculates 6 times every day
    - 5% lost: resynthesis from cholesterol

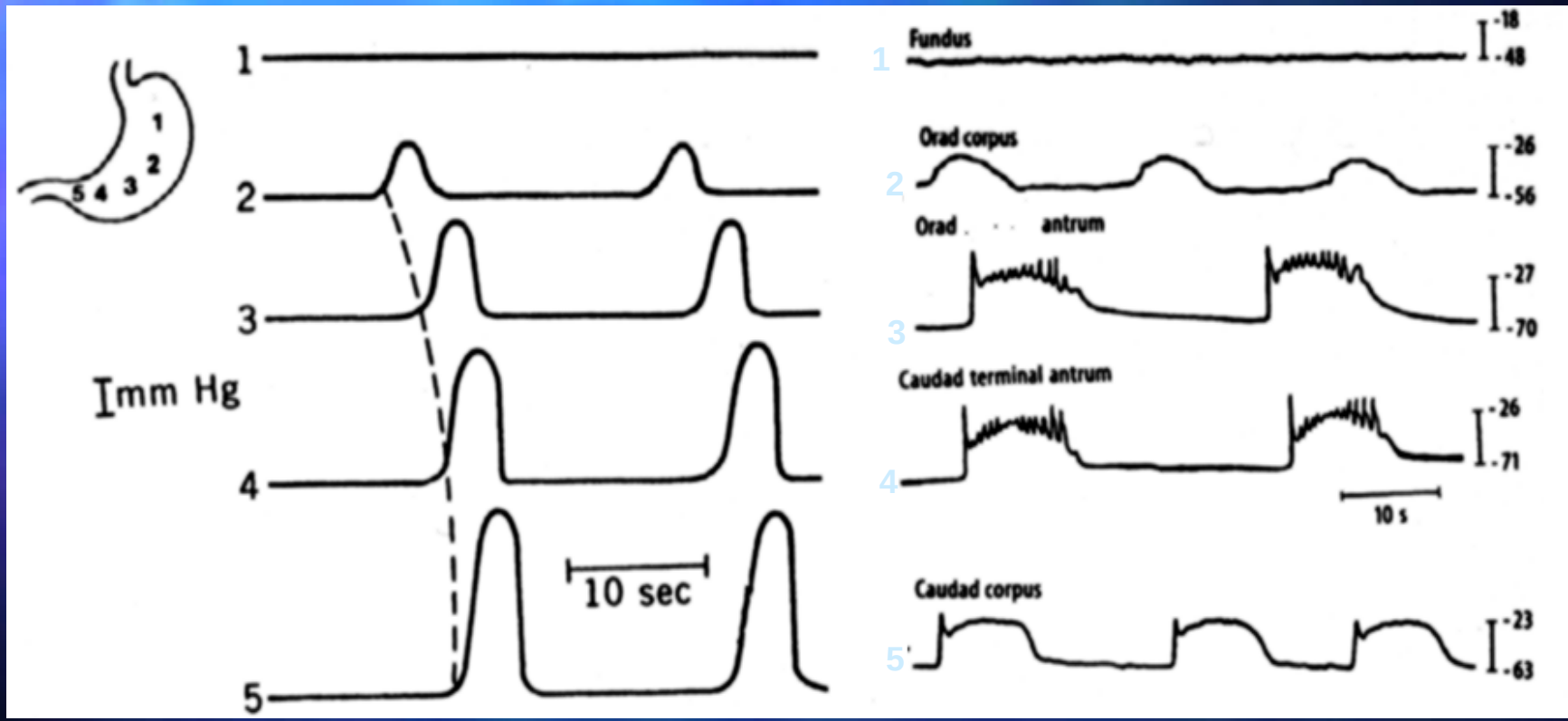
Physiology: Digestion and Absorption

- Water, Electrolytes, and Vitamins
  - Daily: 10 liters water in; 500 cc out
  - Water is absorbed by simple diffusion
  - Na: active transport
  - Cl: passive diffusion
  - HCO3: indirect active transport (Na)
  - Ca: active transport in duod and jejunum
  - Iron: active transport in duodenum
  - Vitamins:
    - Fat soluble (K,A,D,E): distal ileum
    - Water soluble: variable

Physiology: Motility

- Peristalsis
  - 1-2 cm/s
  - Movement of intestinal chyme
  - Duodenum seems to be the pace setter in the fed state
  - Migrating myoelectric complex (MMC) during fasting periods: motilin
  - Parasympathetic: cholinergic vagus stimulates
  - Sympathetic: adrenergic inhibits

Physiology: Motility

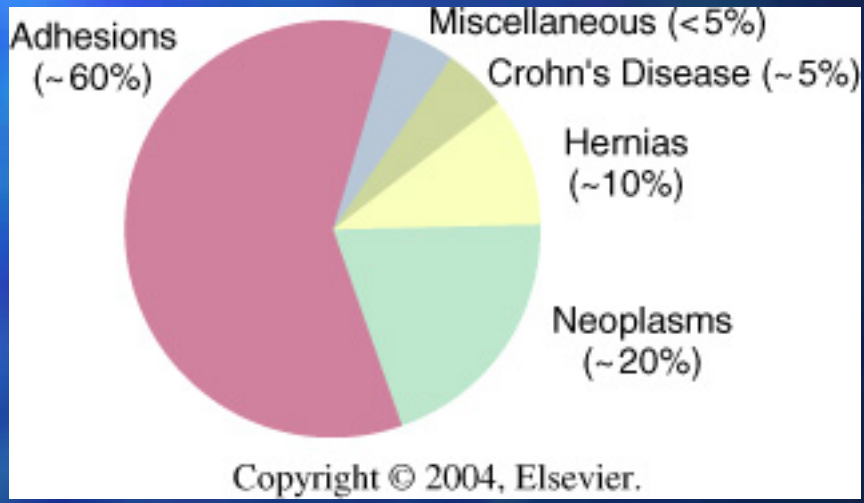


Small Bowel Obstruction

- Causes
  - Extra luminal
    - Adhesions:
      - ~60%
      - Lower abdomen surgery
    - Tumors
      - ~20%
      - Metastatic peritoneal implants from intra abdominal 1ary
      - Extrinsic compression: cecum and asc colon
    - Hernias
      - ~ 10%, ventral and inguinal more commonly
      - External
      - Internal
    - Abscesses

Small Bowel Obstruction

- Causes
  - Bowel wall: tumors
  - Intra luminal
    - Gallstones
    - Enterolith
    - Bezoar



Small Bowel Obstruction

- Pathophysiology
  - Initial increase in motility and contractility (both above and below point of obstruction – diarrhea)
  - Followed by fatigue and dilation of the bowel
    - Accumulation of water and electrolytes in the lumen and wall – third spacing – dehydration
    - Balance between electrolyte/water dysfunction depends on the site and duration of the obstruction
    - Increase in intra abdominal pressure
    - Increase in bowel wall tension – decrease in blood flow (specially in close-loop)
    - Ischemia – perforation – peritonitis
    - Also ↑ in bacterial counts in the SB – translocation

Small Bowel Obstruction

- Clinical Manifestation and Diagnosis
  - Colicky abdominal pain, N/V, distention, no feces or flatus – depend on site of obstruction
  - Typical pain: 4-5 min paroxysms; less frequent with distal obstruction
  - Possibly diarrhea
  - Physical exam
    - Dehydration: tachycardia, hypotension, etc
    - Fever: ? Complication
    - Abdominal distention; notice surgical scars
    - Rule out hernias
    - Mild abdominal pain: o/w peritonitis/complication
    - Rectal exam: masses, blood

Small Bowel Obstruction

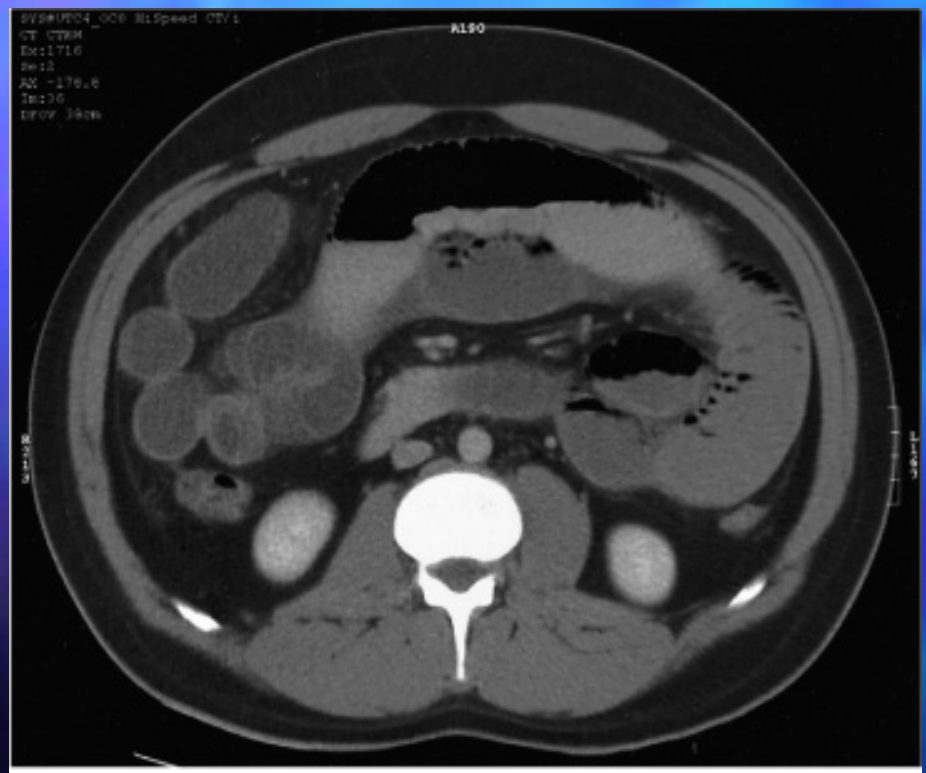
- Clinical Manifestation and Diagnosis
  - Radiology
    - AAS:
      - 60% accuracy
      - Air-fluid levels (stepwise pattern)
      - Dilated loops
      - Cause of obstruction: gallstones, FB

Small Bowel Obstruction

Small Bowel Obstruction

- Clinical Manifestation and Diagnosis
  - Radiology
    - AAS
    - CT:
      - Good for
        - High grade of complete obstructions
        - Determining point of osbtruction
        - Dx of complications
      - Worse than AAS for PSBO

Small Bowel Obstruction



Small Bowel Obstruction

- Clinical Manifestation and Diagnosis
  - Radiology
    - AAS
    - CT
    - Barium studies: enteroclysis (air and contrast in duodenum using tube + fluoroscopy) – for low grade, intermittent SBO

Small Bowel Obstruction

- Clinical Manifestation and Diagnosis
  - Laboratory
    - Not helpful for diagnosis
    - Assessment of dehydration/electrolytes

Small Bowel Obstruction

- Clinical Manifestation and Diagnosis
  - Strangulating obstruction
    - Closed-loop obstruction
    - Vascular compromise – infarction
    - Difficult to differentiate from simple SBO clinically
      - Fever, tachycardia, leukocytosis
      - Constant non cramping pain
    - CT diagnosis late stages only
    - ? Lactic acid, CPK-BB, intestinal fatty acid binding protein

Small Bowel Obstruction

- Treatment
  - Fluid resuscitation
  - Tube decompression
    - NGT
    - Cantor or Baker long intestinal tubes: no benefit
  - Resolution of 60-85% of PSBO with above

Small Bowel Obstruction

- Treatment
  - Operative management
    - Treat cause
    - Reverse obstruction
      - Tumor: ? Resection x bypass
      - Crohn's disease: strictureplasty
      - Abscesses: ? CT guided drainage
      - Radiation enteropathy: non op tx, steroids, ? Resection x bypass

Small Bowel Obstruction

- Treatment
  - Operative management
    - Treat complications
      - Assessment of bowel viability:
        - Place on warm saline wet sponge for 15-20 min and assess for color and peristalsis
        - Doppler probe or fluorescein: no advantage over clinical judgement
        - Second look
    - ? Laparoscopy
      - Mild abdominal distention
      - Proximal obstruction
      - Partial obstruction
      - Anticipated single band obstruction

Small Bowel Obstruction

- Acute post operative obstruction
  - Difficult diagnosis
  - Rule out or treat medical causes (hypo K)
  - X rays are usually not helpful
  - CT and enteroclysis
  - Conservative management for PSBO
  - Operative management for CSBO

Ileus

- Intestinal distention and slowing/absence of passage of luminal contents without demonstrable mechanical obstruction
- Causes
  - Post laparotomy
  - Metabolic and electrolyte derangements
  - Drugs: opiates, anticholinergics, psychotropics, etc
  - Intra abdominal inflammation
  - Retroperitoneal hemorrhage or inflammation
  - Intestinal ischemia
  - Systemic sepsis

Ileus

- Presentation is similar to mechanical SBO, but usually without the colicky abdominal pain
- ? Radiologic studies to distinguish from SBO ?
- Treatment:
  - Supportive
  - ? Drugs
    - Block sympathetic: guanethidine
    - Stimulate parasympathetic: neostigmine
    - Cholecystokinin, erythromycin
    - Cisapride

Inflammatory Diseases: Crohn's

- Morgagni 1761; Dalziel 1913; Crohn 1932
- Most common primary surgical disease of the SB
- ↑ in North America and Northern Europe
- Bimodal distribution
- Equal genders and black x whites, ↑ in smokers
- ↑ in Jews; strong familial association
- ? Infectious / immunologic etiology

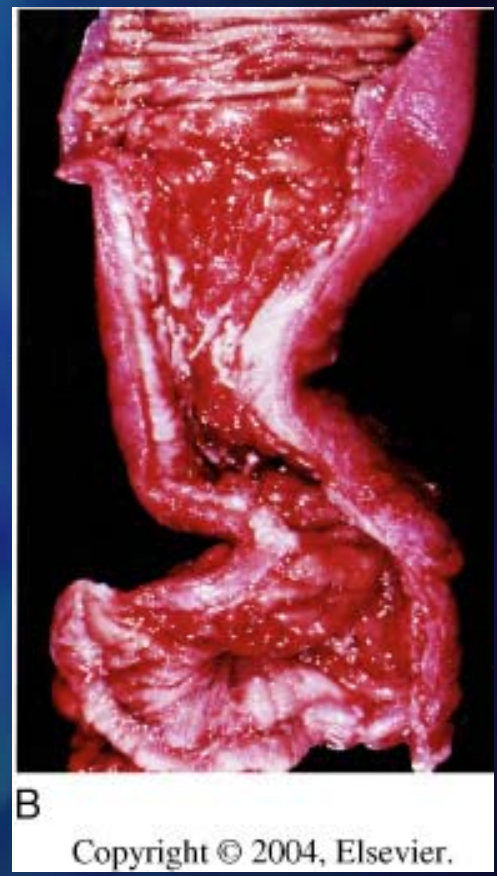
Inflammatory Diseases: Crohn's

- 30% in small bowel only
- 55% in SB and colon
- From mouth to anus
- Segmental lesions
- Rectal sparing
- Perianal/rectal involvement in ~ 1/3 of pts

Inflammatory Diseases: Crohn's

- Growth of mesenteric fat around bowel wall
- Total thickness wall compromise
- Cobblestone appearance from islands of normal mucosa
- Non caseating granulomas (late)

A



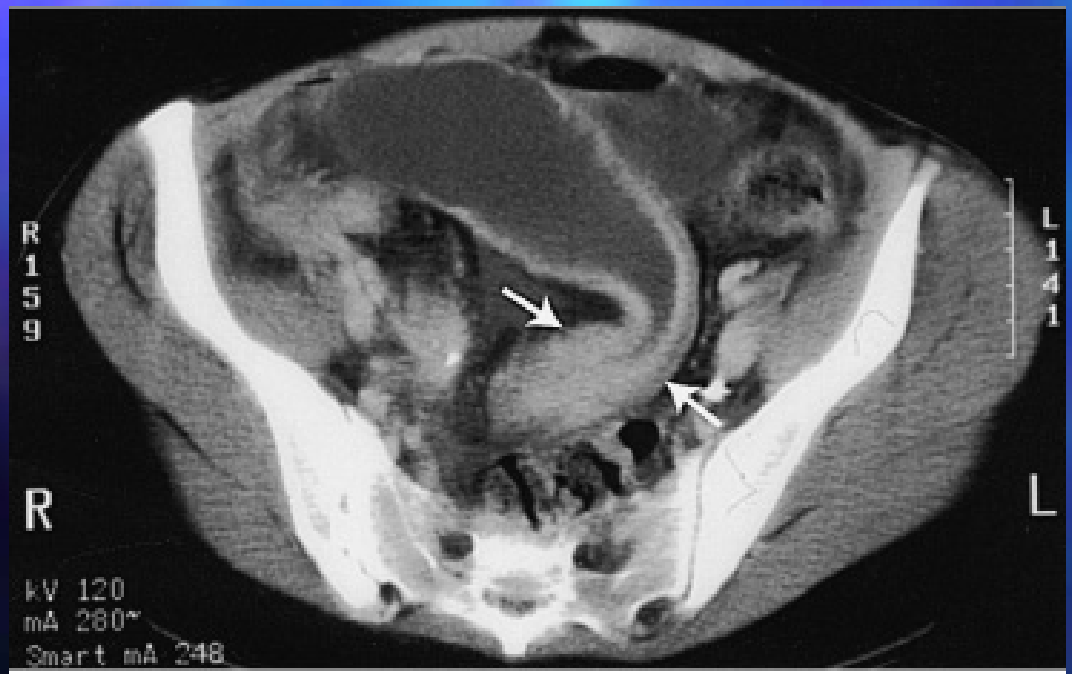
B

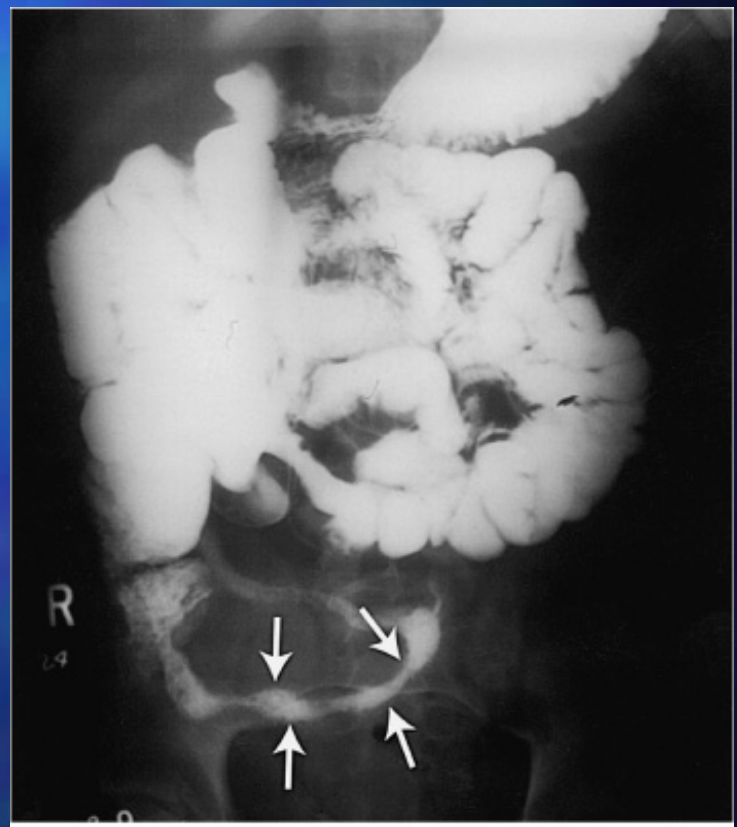
Inflammatory Diseases: Crohn's

- Clinical manifestations
  - Intermittent colicky lower abdominal pain
  - Diarrhea: rarely with mucus or blood
  - Weight loss
  - Low grade fever
  - Malaise
  - Other non specific s/s
  - Extra intestinal manifestations: skin, eyes, joints, etc

Inflammatory Diseases: Crohn's

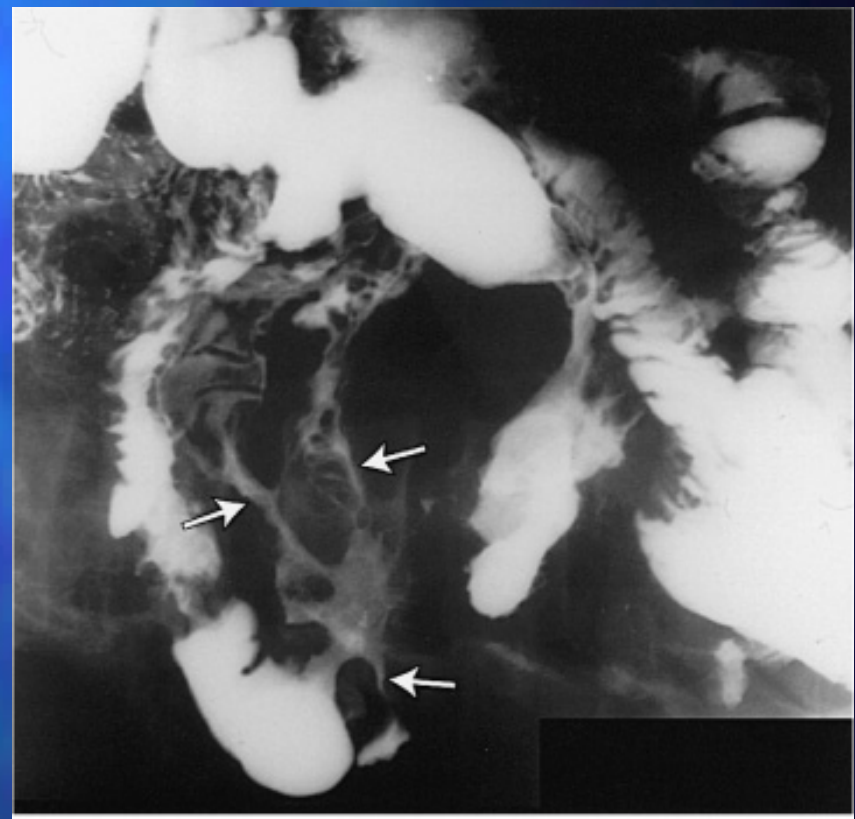
- Intestinal complications
  - Obstruction
    - Chronic fibrosing lesions





Inflammatory Diseases: Crohn's

- Intestinal complications
  - Perforation
    - Free perforations (rare)
    - Fistulas (more common): vagina, bladder, intestines, etc
    - Abscesses



Inflammatory Diseases: Crohn's

- Intestinal complications
  - Cancer predisposition: SB and colon
    - 100x for adeno Ca of SB
    - At sites of chronic disease, more common in the ileum
    - Poor prognosis, late diagnosis

Inflammatory Diseases: Crohn's

- Surgical Management
  - Majority will need surgery at some point: > 20y of disease = 78%
  - Indications are limited to complications
    - Obstruction
    - Perforation, fistula, abscess
    - GI bleeding
    - Cancer
    - Perianal disease
  - Resection of the complicated segment only – ignore gross disease
  - ? Laparascopic surgery

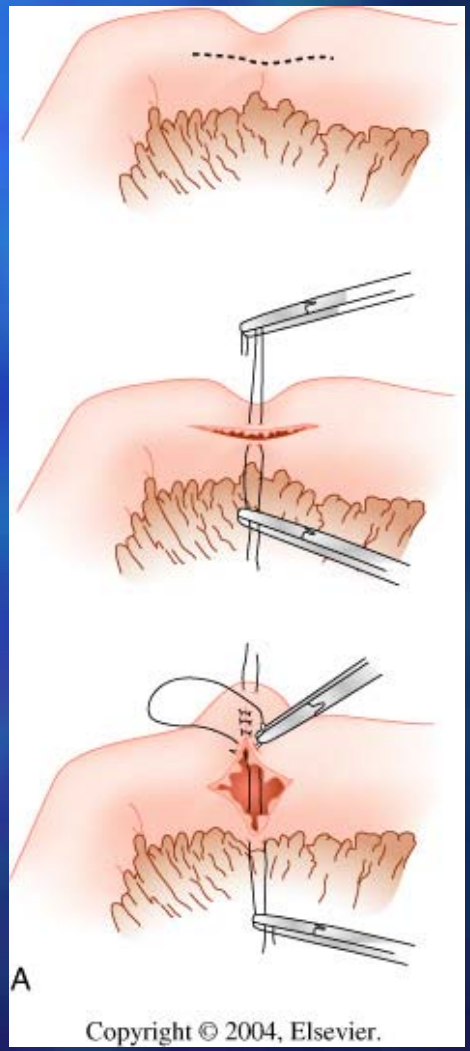
Inflammatory Diseases: Crohn's

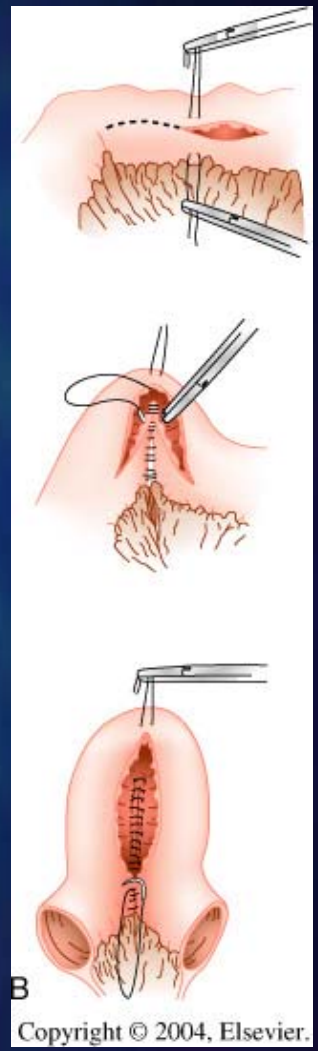
- Surgical Management
  - Ileitis
    - Dif dx with acute appendicitis
    - Self limited
    - Causes
      - Early crohn's (but most often NOT)
      - Campylobacter
      - Yersinia
    - Appendectomy *

Inflammatory Diseases: Crohn's

- Surgical Management
  - Obstruction
    - Most common surgical indication
    - Often partial – non operative management
    - Surgical indication
      - Complete obstruction
      - Failure of non operative treatment
    - Procedure of choice: segmental resection with re anastomosis
    - Cecectomy if cecum is involved with terminal ileum
    - In selected patients: strictureplasty
      - Previous resections
      - Multiple short segments of narrowing
      - Fibrous obstruction instead of acute inflammation
      - It has similar complication/recurrence rates to resection

Inflammatory Diseases: Crohn's





Inflammatory Diseases: Crohn's

- Surgical Management
  - Fistula
    - Common complication
    - Entero-enteral fistula is not a surgical indication
    - Enterocutaneous fistulas
      - Usually after abscess drainage; rarely spontaneous
      - Excision of the fistula tract with the diseased segment(s) of SB + reanastomosis
      - If other organ involved: simple closure of defect in that organ

Inflammatory Diseases: Crohn's

- Surgical Management
  - Free perforation
    - Rare
    - Resection of involved segment of SB
    - Reanastomosis (if minimal contamination); enterostomies if diffuse peritonitis
  - GI bleeding
    - Life threatening bleed is rare; anemia is common
    - More common in colon than SB
    - ? Arteriography pre operatively
    - Resection of the bleeding segment

Inflammatory Diseases: Crohn's

- Surgical Management
  - Cancer
    - Increased incidence (SB and colon)
    - Worse prognosis than cancer with no Crohn's – delayed diagnosis
    - Oncologic resection with appropriate margins
  - Duodenal disease
    - 2 - 4% of crohn's patients
    - Medical treatment is the rule; surgery indication is uncommon
    - Most common indication is obstruction
    - Procedure of choice is bypass instead of resection
    - Selected patients may benefit from strictureplasty

Inflam. Diseases: Typhoid Enteritis

- Developing countries, poor areas
- 500 cases / year in the US
- Children and young adults
- Acute systemic infection by Salmonella typhosa
- Ingestion of bacilli – penetration of SB mucosa
- Hyperplasia of the RES: LN, liver, spleen
- Hyperplasia of Peyer patches in distal ileum
  - Bleeding
  - Perforation

Inflam. Diseases: Typhoid Enteritis

- Diagnosis
  - Isolating organism from
    - blood (90% sensitive in the 1st week)
    - Bone marrow
    - Stool cultures
  - High titers of agglutinins against O and H antigens
  - PCR assays are still experimental

Inflam. Diseases: Typhoid Enteritis

- Treatment
  - Uncomplicated: atbx (chloramphenicol, ampicillin, amoxicillin, TMP-SMZ, 3rd generation cephalosporins)
  - Complicated
    - Hemorrhage
      - 20% in some series, probably lower
      - Surgery for uncontrollable bleeding is rare
    - Peyer patches perforation
      - ~ 2%
      - Usually single perforation in the distal ileum
      - Simple closure is the treatment of choice
      - If multiple perforations (1/4): resection + reanastomosis

Neoplasms

- Extremely rare, despite 80% of total length and 90% of total mucosal area
- Men = women
- Only 5% of all Gi tumors
- Only 1-2% of all malignant GI tumors
- Why?
  - Rapid transit of luminal contents
  - High turnover of cells minimizing carcinogenic exposure
  - High level of IgA
  - Low bacterial count

Neoplasms

- Mean age of presentation
  - 62 yo for benign tumors
  - 57 yo for malignant tumors
- New Zealand and Hawaii
- Benign lesions are usually diagnosed in autopsy
  - Leiomyomas
  - Adenomas
- Malignant lesions
  - Adenocarcinoma: proximal SB
  - Carcinoid tumor: distal SB

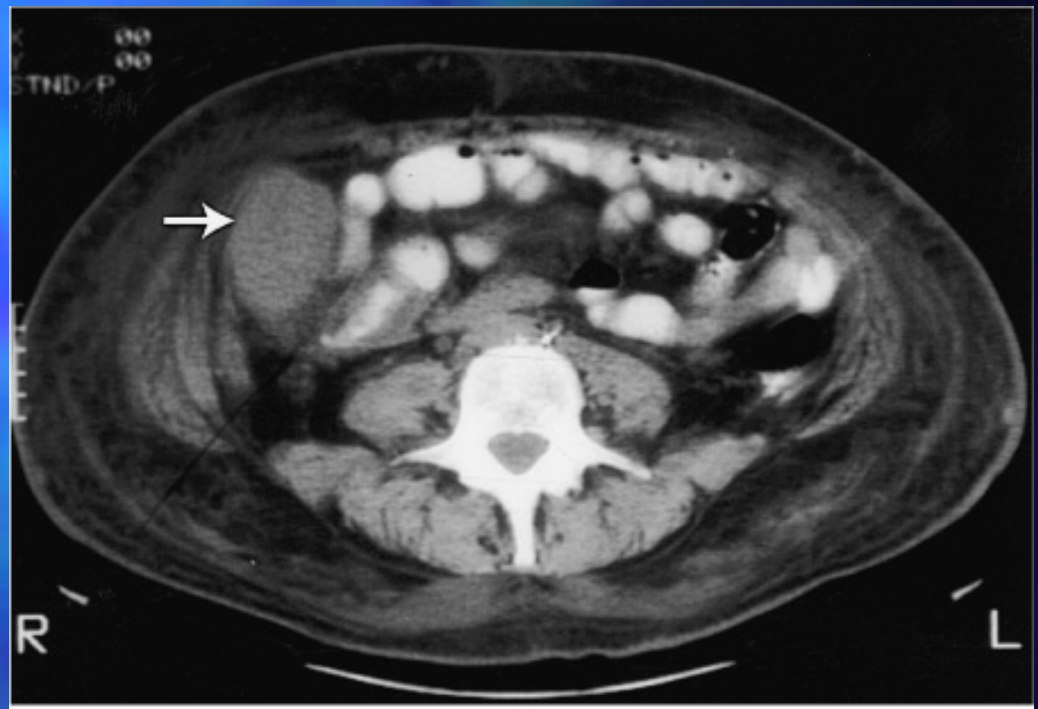
Neoplasms

- Risks for malignant tumors
  - Familial adenomatous polyposis
  - Lynch
  - Peutz-Jeghers syndrome
  - Crohn's disease
  - Celiac sprue
  - Biliary diversion
  - ? Smoking
  - ? Alcohol heavy consumption
  - ? Red meat or salt-cured foods

Neoplasms

- Diagnosis
  - Only 20 – 50% correct pre operative diagnosis
  - UGI series with SB follow-through: 50-70% accuracy
  - Enteroclysis: 90% accuracy
  - Flexible endoscopy: duodenal lesions
  - Colonoscopy: terminal ileum lesions
  - ? Push enteroscopy
  - ? Swallowed radiotelemetry capsules
  - CT:
    - Useful for extraluminal tumors, such as GISTs
    - Staging

Neoplasms



Adeno Ca causing typical “apple core” lesion

Benign Neoplasms

- Most common
  - Benign GISTs: the most common to be symptomatic
    - Leiomyomas
      - The most common
      - Men = women
      - May grow intramuraly and cause obstruction
      - Arise from intestinal pace maker cell (of Cajal) – mesodermal
      - Bleeding is the most common surgical indication
  - Adenomas: the most common in autopsies
    - 15%
    - 20% duodenum; 30% jejunum; 50% ileum
    - Malignant potential: 35 – 55%

Benign Neoplasms

- Most common
  - Lipomas
    - Most common in the ileum
    - Grow in the submucosa
    - 6^{th}, 7^{th} decades of life
    - Women > men
    - No malignant potential
  - Hamartomas
    - Peutz-Jeghers syndrome: mucocutaneous melanotic pigmentation and GI polyps
  - Hemangiomas

Benign Neoplasms

- Presentation
  - Vast majority is asymptomatic
  - Symptoms are vague and nonspecific
    - Dull abdominal pain, often intermittent and colicky
    - Dyspepsia, anorexia, malaise
  - Obstruction: most frequently by intussusception
  - Hemorrhage: usually occult; life-threatening is rare

Benign Neoplasms

- Treatment: surgical
  - Segmental resection + reanastomosis
  - Small lesions may be resected by enterotomy
  - Search entire SB for other lesions

Malignant Neoplasms

- Most common
  - #1 Adenocarcinomas
  - #2 Carcinoid tumors
  - #3 Malignant GISTs
  - #4 Lymphomas
- Presentation
  - Almost always produce symptoms
  - Pain and weight loss
  - Obstruction 15 – 35%
  - Diarrhea
  - GI bleed
  - Palpable mass 10 -20%
  - Perforation 10%

Malignant Neoplasms: Pathology

- Adenocarcinomas
  - ~ 50%
  - Peak in the 7th decade of life
  - Slight male predominance
  - Majority is located in duodenum and prox jej
  - With Crohn's: younger and 70% in the ileum
  - Vague s/s
  - Late presentation; poor prognosis

Malignant Neoplasms: Pathology

- Malignant GISTs
  - ~ 20%
  - More common in jejunum and ileum
  - 5th and 6th decades of life
  - Male > female
  - Usually large tumors (>5 cm 80%)
  - Grow extra muraly
  - Tend to invade locally and extend to adjacent organs

Malignant Neoplasms: Pathology

- Lymphomas
  - 7 – 25% of all SB malignant tumors – adults
  - Most common SB cancer in children
  - 1ary or systemic disease
  - Usually large at the time of diagnosis
  - Perforation may occur in up to 25%

Malignant Neoplasms: Pathology

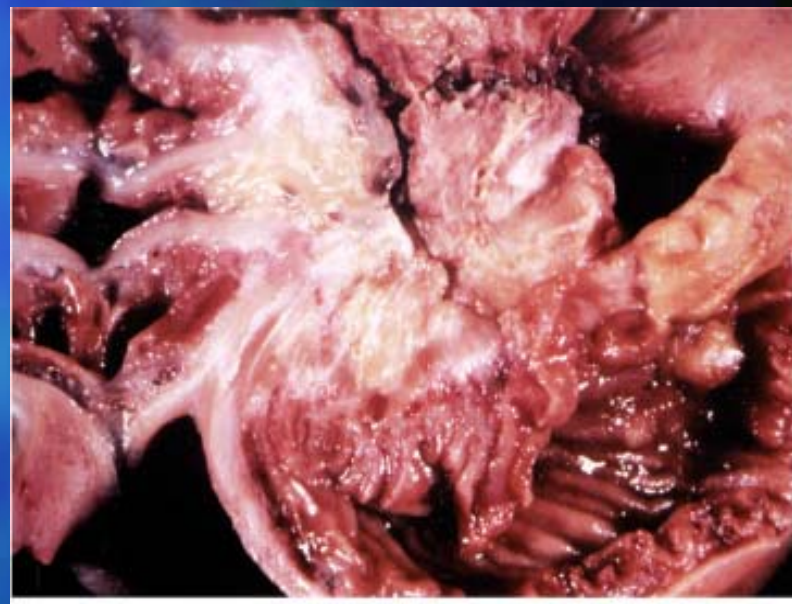
- Treatment
  - Wide resection including LNs (except GISTs)
  - Adjuvant therapy
    - Radiation/chemo: lymphomas only and ? GISTs
  - Palliation
    - Resection to prevent complications
    - Bypass
    - Resection of metastases or organs is not indicated
  - Prognosis
    - Only ½ operated are found to be resectable
    - 1/3 have distant metastases at operation
    - 5 year survival: 25% overall (AdenoCa 15-20%)

Malignant Neoplasms: Pathology

- Carcinoid tumors
  - From enterochromaffin cells
  - 5th decade of life
  - Appendix, SB, bronchi, rectum, etc
  - In SB: almost always in the distal 2 feet of ileum
  - 70 – 80% are asymptomatic, found incidentally
  - More metastases in SB tumors – more aggressive than in the appendix
  - Multicentric in the SB: 20 – 30%
  - Synchronous adenoCA (↑ in colon): 10 – 20%
  - MEN I: 10%

Malignant Neoplasms: Pathology

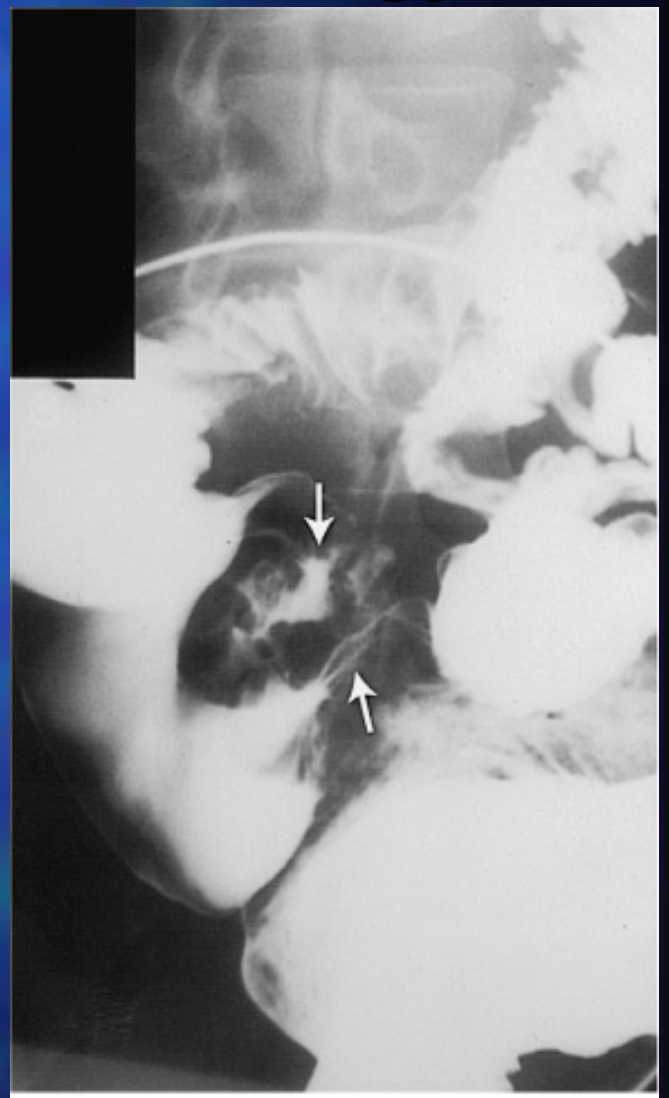
- Carcinoid tumors
  - Presentation
    - Uncomplicated
      - Abdominal pain
      - Obstruction – intussusception
      - Diarrhea (psbo), weight loss
    - Malignant carcinoid syndrome
      - < 10%
      - Vasomotor, cardiac and GI s/s
        - Flushing 80%, diarrhea 76%, hepatomegaly 71%
        - Right heart valvular disease 41-70%, asthma 25%
      - Serotonin, 5 hydroxytryptophan, histamine, dopamine, etc
      - Massive hepatic replacement by disease



A

Malignant Neoplasms: Pathology

- Carcinoid tumors
  - Diagnosis
    - 24h urine: ↑ 5-hydroxyindoleacetic acid
    - Provocative test with pentagastrin: reproduce symptoms
    - Barium studies: multiple filling defects
    - Angiography and high-resolution US
    - CT
    - Novel: somatostatin receptor scintigraphy using In-labeled pentetreotide (or MIBG)



Malignant Neoplasms: Pathology

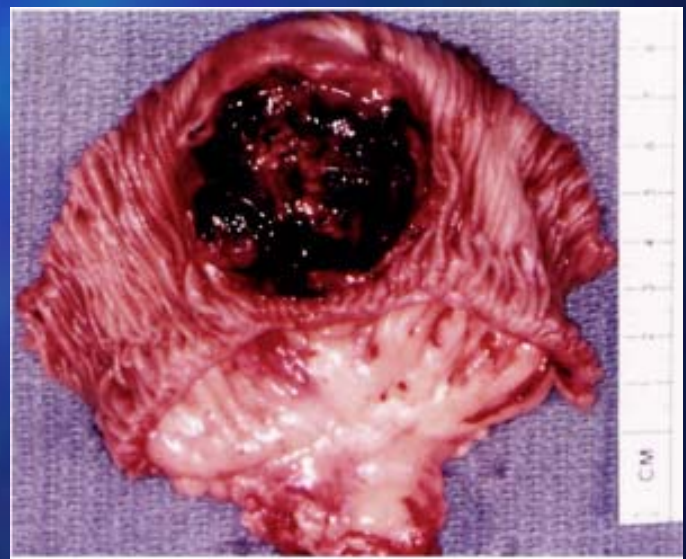
- Carcinoid tumors
  - Treatment
    - < 1cm, no metastases: segmental intestinal resection
    - O/w: wide excision of bowel and mesentery
    - Terminal ileum: right hemicolectomy
    - Duodenum: whipple
    - * remember to explore for synchronous lesions
    - * caution with anesthesia: precipitation of carcinoid crisis
      - IV octreotide, antihistamine, hydrocortisone
    - Surgical debulking is indicated; also hepatic artery ligation or embolization and ? Liver transplantation

Malignant Neoplasms: Pathology

- Carcinoid tumors
  - Treatment
    - Medical therapy: relief of symptoms
      - Somatostatin
      - Interferon alpha
      - Serotonin receptor antagonists:
        - Methysergide no longer used (retroperitoneal fibrosis)
        - Ketanserin, cyproheptadine
      - Chemotherapy
      - ? Receptor targeted therapy
  - Prognosis
    - Best among all SB tumors
    - 100% survival rate for localized disease
    - 65% for regional disease; 25-35% for distant metastasis

Malignant Neoplasms: Pathology

- Metastatic lesions
  - Much more common than primary tumors
  - Most common
    - Intra abdominal (#1): uterus, ovaries, gut, etc
    - Extra abdominal: #1 is melanoma (1/2 of dying from melanoma)



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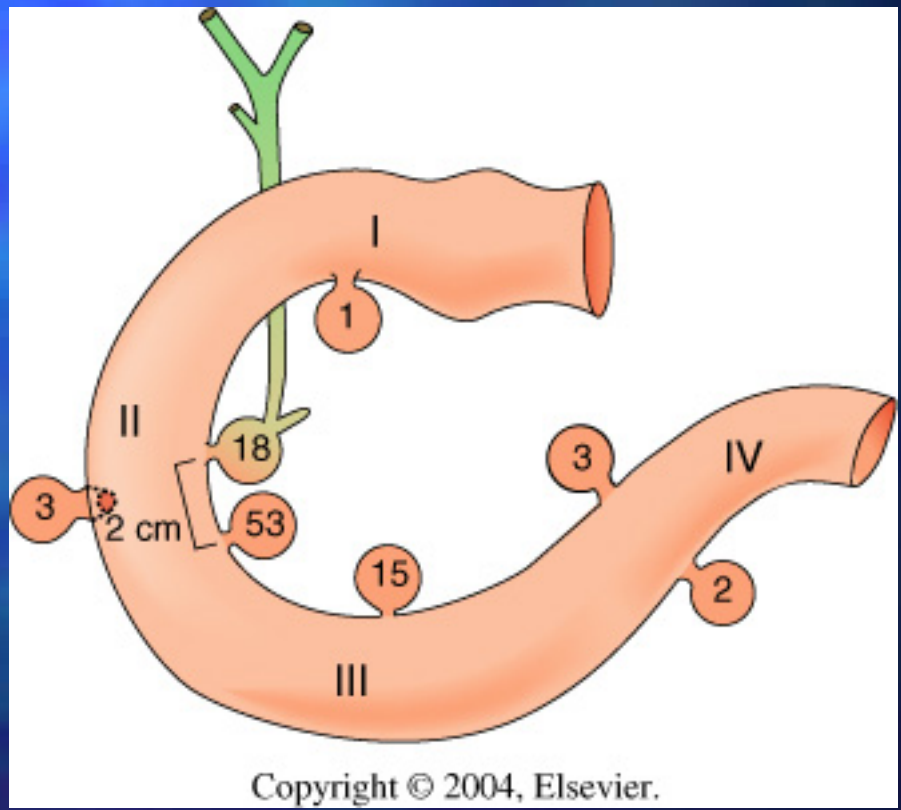
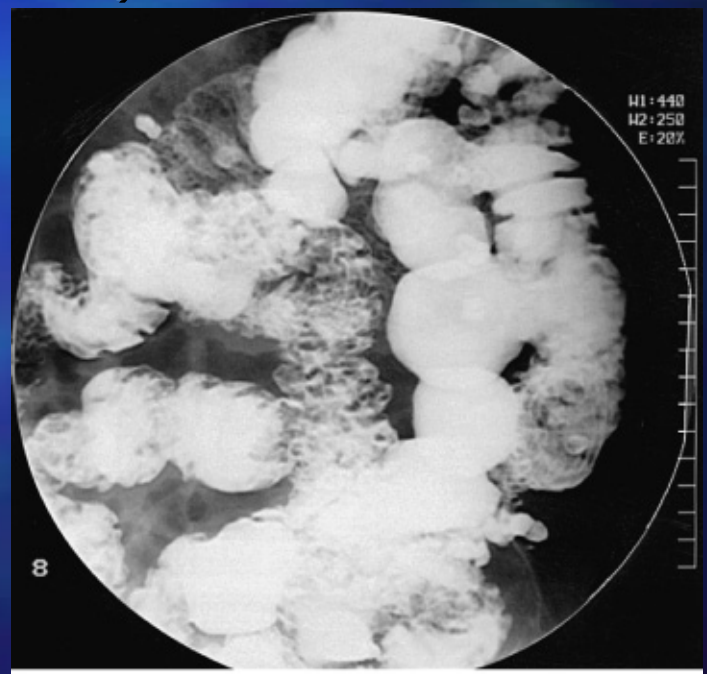
Diverticular Disease

- Common
- True or false diverticuli
- Distribution:



Diverticular Disease

- Vast majority is asymptomatic and accidentally diagnosed
- Duodenal are the most frequent
- Jej/ileal are multiple and in older patients and caused by motor dysfunction (muscle/plexus)

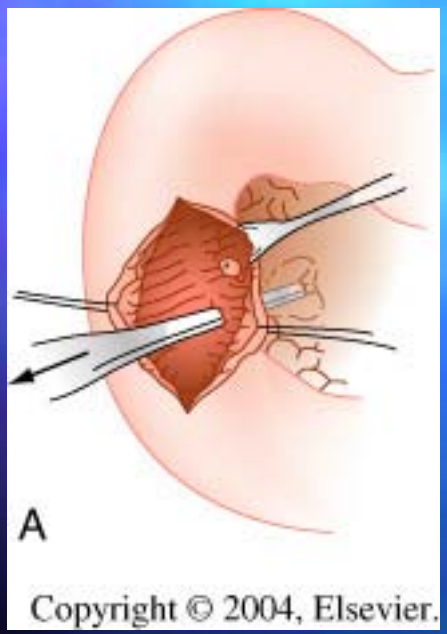


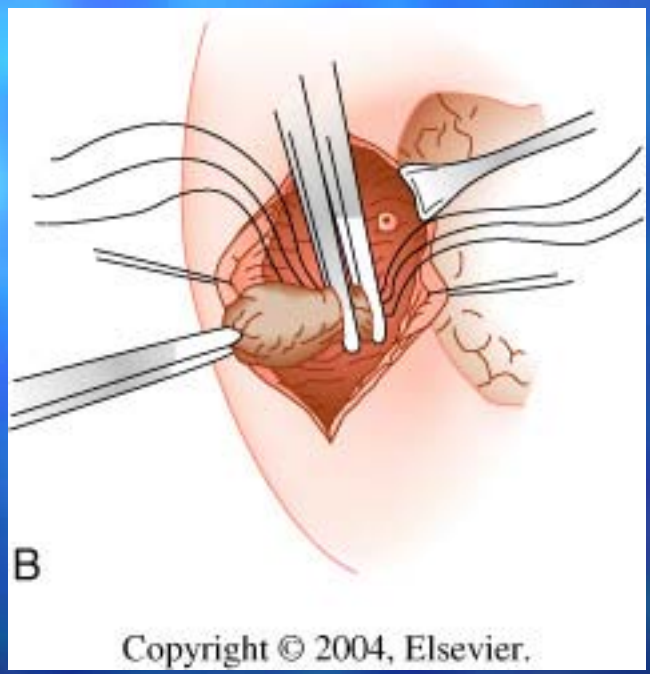
Diverticular Disease

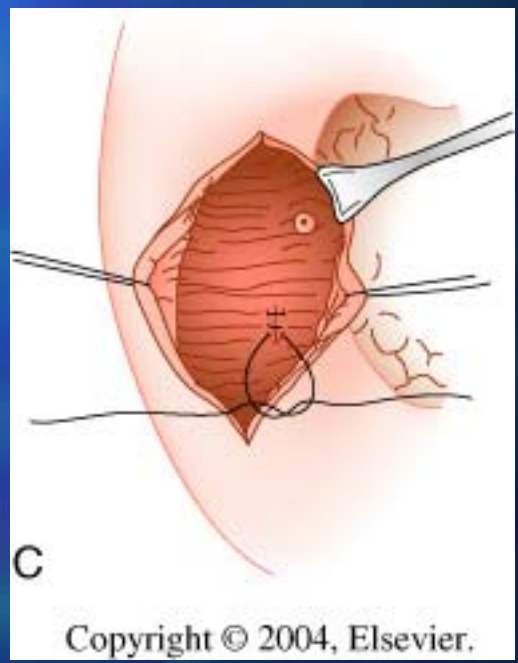
- Complications:
  - Bleeding
  - Obstruction (biliary in the duodenum)
  - Perforation
  - Blind loop syndrome
- Treatment
  - Leave them alone if found accidentally
  - Diverticulectomy
  - Segmental resection
  - Treatment of complications

Diverticular Disease

- Treatment
  - Diverticulectomy

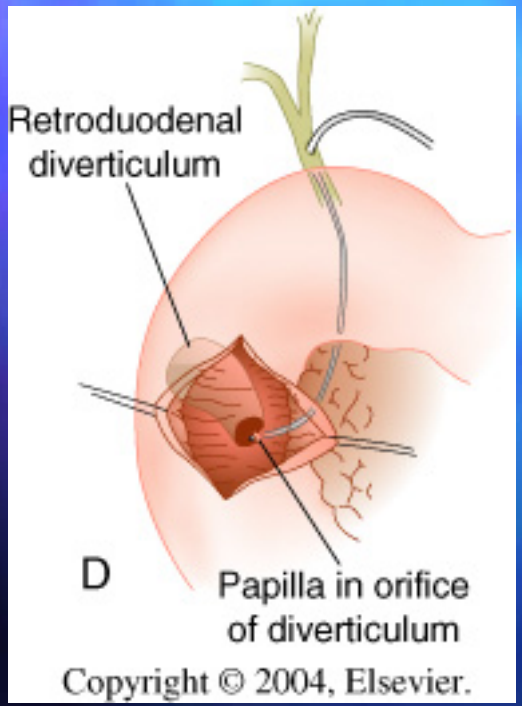


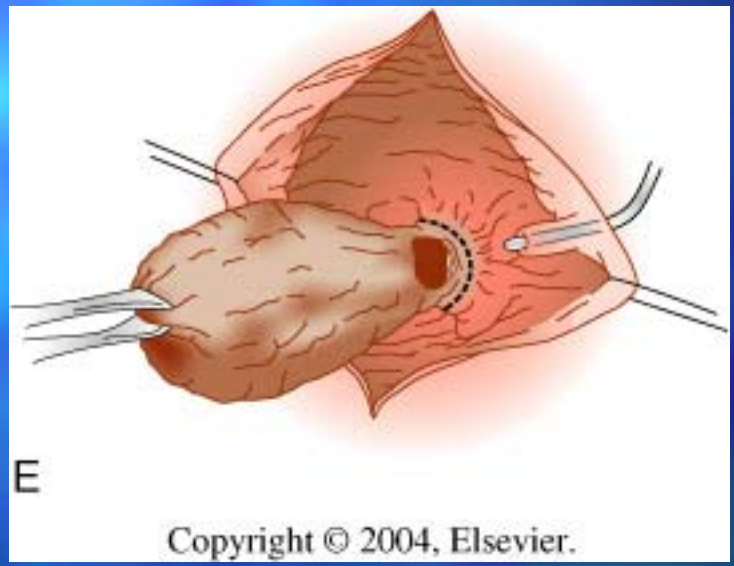


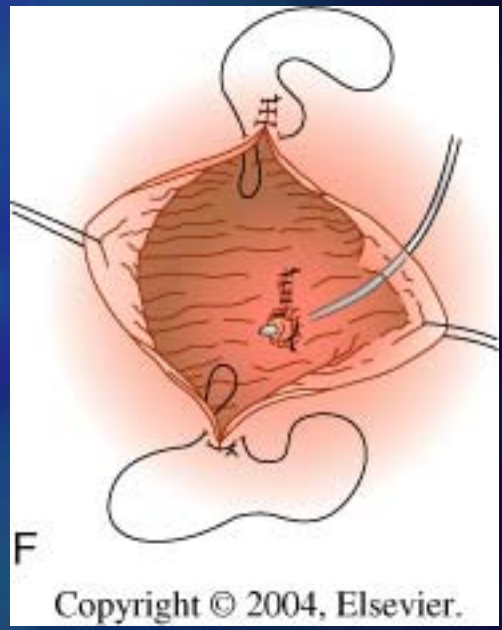


Diverticular Disease

- Treatment
  - Diverticulectomy



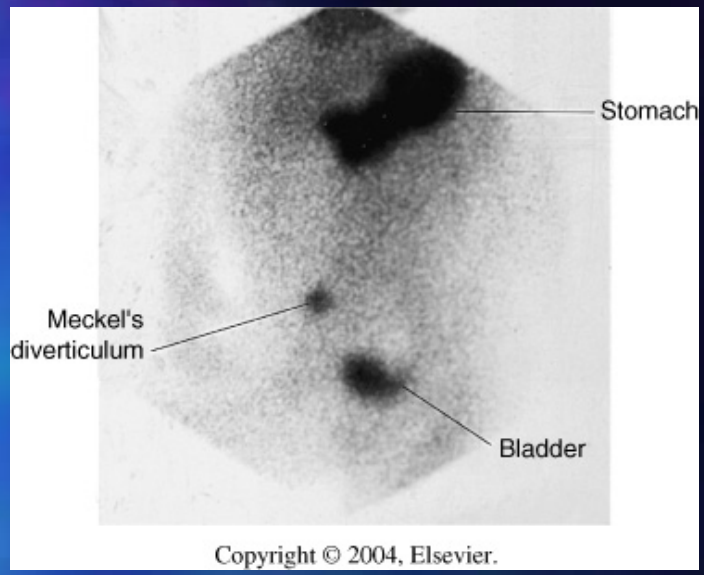




Diverticular Disease

- Meckel's diverticulum
  - 2% of population
  - 2 mucosas: pancreas and gastric
  - 2 feet of distal ileum
  - Remnant of vitelin duct – may be connected to the umbilicus
  - Most common presentation is GI bleed (< 2yo). Also obstruction (volvulus, intussusception). Diverticulitis and tumors are rare.
  - Littre's hernia

Diverticular Disease



- Meckel's diverticulum
  - Diagnosis
    - Scintigraphy with Tc99
      - Gastric mucosa
      - 85% / 95% sens/spec in pediatric group
      - Worse in adults (reduced prevalence of ectopic gastric mucosa)
      - Pentagastrin or H2R antagonists may increase sensitivity
    - Barium studies
- Treatment
  - Resection of symptomatic diverticuli
  - When bleeding: always segmental resection
  - Incidental finding: remove in children; ? Leave in adults (2% risk of complication)

Blind Loop Syndrome

- Caused by bacterial overgrowth in stagnant areas (stricture, stenosis, fistulas, diverticuli)
- Abdominal pain
- Diarrhea, steatorrhea, fat soluble vit deficiency
- Neurologic disorders (vit B12)
- Treatment
  - Vit b12
  - Broad spectrum antibiotics
  - Treat primary disorder

Radiation Enteritis

- Unusual if total dose < 4,000 cGy
- Contributors
  - Previous abdominal operations
  - Vascular disease
  - HTN, diabetes
  - Adjuvant chemotherapy
    - 5-fluorouracil
    - Doxorubicin
    - Dactinomycin
    - Methotrexate

Radiation Enteritis

- Acute: self limiting
  - Diarrhea
  - Abdominal pain
  - Malabsorption
- Late
  - Damage of small submucosal blood vessels (obliterative arteritis)
  - Strictures, SB fistulas, necrosis, perforation

Radiation Enteritis

- Prevention
  - Minimizing radiation dosage
    - Localized treatment (leave surgical markers)
    - Exclusion of SB
      - Reperitonealization
      - Omental transposition
      - Placement of absorbable mesh slings
  - Radioprotectants
    - Sucralfate
    - Superoxide dismutase
    - Vit A, E, Beta carotene
    - Amifostine (WR 2721) – the most effective

Radiation Enteritis

- Treatment
  - Directed to controlling symptoms
    - Antispasmodics
    - Analgesics
    - Antidiarrheal agents
    - ? Steroids
    - ? Diet modifications
  - Operative intervention: 2 – 3%
    - For complications: obstruction, perforation, bleeding, etc
    - Bypass or resection ?
      - > ½ of those will require a 2nd surgery
      - 25% will die