Hormonal and Neural Signals Involved in Digestion

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<td><strong>GASTRIC ANTRAL PEPTIDE</strong></td>
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<td>Small intestinal enteroendocrine cells (I cells)</td>
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<td>Vagus nerve</td>
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<td>Multiple nerve</td>
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Signs and Symptoms of GI Disorders

- Some terms to know the definitions of…
  - Anorexia
  - Nausea
  - Vomiting (emesis)
    - Character is important (yellow/green, brown, coffee grounds, bloody (hematemesis))
  - Dysphagia
  - Belching/flatulence
  - Diarrhea (Thinner, more frequent bowel movements)
    - Dysentery (low-volume, bloody, painful)
  - Constipation and Impaction

Causes of gastrointestinal bleeding

Important terms associated with GI bleeding:
- Hematemesis
- Hematochezia
- Melena
- Occult Bleeding (test?)

**EVERY instance of GI bleeding should get immediate attention and be considered as a potential malignancy.

Two types of GI bleeding classified according to source:
- **Upper GI**: Everything from the 1st few cm of the duodenum to the esophagus
- **Lower GI**: Below the 1st few cm of duodenum
Interruptions of Peristalsis

- **Ileus**
  - Lack of peristalsis (intestinal paralysis)
  - Associated with many conditions, e.g. post-op, intra-abdominal inflammation, intestinal ischemia, spinal cord injury, hypokalemia

- **Mechanical Obstruction**
  - Adhesions (surgery, infection)
  - Intussusception (telescoping)
  - Volvulus (twisting)
  - Hernia
    - Incarcerated hernias
    - Strangulated hernias


Normal Esophagus

Diseases of the Esophagus

- **Atresia**
  - Absence or narrowing, with or without obstruction
  - Most common congenital defect
  - May accompany tracheoesophageal fistula

- **Achalasia**
  - Spasm of LES
  - Disappearance of autonomic ganglion cells
  - Autoimmune, immune reaction to viruses
  - Slowly progressive dysphagia and esophageal pain
Diseases of the Esophagus

• Hiatal hernia
  – Protrusion of part of stomach through esophageal hiatus
  – May cause GERD especially lying down

• Mallory-Weiss Syndrome
  – Tears or lacerations
  – Due to frequent vomiting/retching, e.g., in bulimia

• Esophageal varices
  – Dilated veins, varices (sing. Varix)
  – Almost always from cirrhosis of liver

Diseases of the Esophagus

• Esophagitis
  – Inflammation of esophagus
  – Painful swallowing (odynophagia)
  – Alcohol, smoking, reflux
  – When infectious, usually opportunistic

• Gastroesophageal reflux disease (GERD)
  – Incompetence of LES
  – Many causes
  – Heartburn (subternal pain) most common
  – When chronic, may cause Barrett esophagus

Barrett’s Esophagus

Carcinoma of the Esophagus

Squamous cell carcinoma (50%)
- Arise from esophageal epithelium
- Usually mid-upper esophagus
- Risk factors:
  - Male, African American
  - Heavy tobacco use; alcohol
  - Low fiber, high fat diet (a.k.a. US)

Esophageal Adenocarcinoma (50%)
- Usually lower esophagus (at GE junction)
- Risk factors:
  - Male, Caucasian
  - Reflux, e.g., Barrett’s
  - Obese

Figure from: https://gi.jhsph.org/

Disorders of the Stomach

Acute nonerosive gastritis

Acute erosive gastritis

Ulcers due to:
- Stress: Curling
  - Brain trauma: Cushing

Chronic stress ulcers (90% due to H. pylori; some autoimmune)

Autoimmune gastritis – ab against parietal cells (no IF -> pernicious anemia

Zollinger-Ellison Syndrome – Pancreatic tumor secreting gastrin -> ulcerogenic

Chronic peptic ulcer of stomach

- Dark, altered blood in base of ulcer
- Incision through ulcer base reveals muscular wall of stomach

A: Stomach
B: Sharp edge of ulcer
Disorders of the Stomach

- Gastric adenocarcinoma (almost all):
  - Arise from gastric epithelium
  - Risk factors:
    - H. pylori
    - Smoked, pickled salt-preserved foods
    - Nitrates (preserved meat)
    - Low fiber, high fat diet (a.k.a. US)

Primary Gastrointestinal Lymphomas:
- Stomach most common site (60%)
- B or T cell tumors
- Originate in MALT
- Risk factors:
  - H. pylori
  - Malabsorption syndromes
  - Immunodeficiency

Infectious Diseases of Small and Large Bowel

- Acute gastroenteritis
  - Inflammation of the stomach (fewer), or small/large bowel (more)
  - Viruses and bacteria
    - Usually produce only mild mucosal inflammation
  - Protozoa and Parasites
    - More typical in developing nations
    - Associated with more severe, chronic disease
- Viral Gastroenteritis (main cause of acute gastroenteritis in US)
  - Rotavirus – leading cause of diarrhea in small children (daycare)
  - Norovirus (Norwalk) – older children/adults in close quarters where food is prepared for groups (think Norwegian CRUISE LINE)

Malabsorption Syndromes

- Malabsorption
  - Poor digestion or absorption of dietary substances
  - Excess fecal excretion of nutrients (along with minerals and water)
  - Effect of syndrome depends on which phase of digestion/absorption is affected:
    - Luminal phase (within lumen of intestine)
      - Lack of pancreatic enzymes (e.g., cystic fibrosis)
      - Hepatobiliary disease (bile) → steatorrhea
      - Change in acid/base balance or microflora ecosystem
    - Epithelial phase
      - Disturbance of mucosal enzymes, e.g., lactase
      - Inflammation
      - Immune reaction to dietary content, e.g., gluten
    - Lymphatic phase
      - Blockage of lymphatic ducts (affects fat absorption, mainly)
Malabsorption Syndromes

- Major effects of malabsorption syndromes
  - Hematopoietic (Vit B12, folic acid, vit K)
  - Musculoskeletal
  - Hormonal
  - Skin
  - Nerve
- Examples:
  - CHO Intolerance - Lactose intolerance
  - Celiac sprue – Immune sensitivity to gluten (barley, rye, oats, wheat)
  - Bacterial overgrowth syndrome
  - Short bowel syndrome
  - Chronic diseases

Inflammatory Bowel Disease

- Difficult to define in terms of pathology
- Also called spastic colon, irritable colon, nervous colon
- No consistent anatomical/pathological lesions; it is a functional disorder
  - Typically teens or young adults
  - Abdominal pain, bloating, diarrhea, altered bowel habits
  - Psychological problems are common
  - Unlike IBD, weight loss, bleeding and vomiting do NOT occur.

Irritable Bowel Syndrome (IBS)

- Difficult to define in terms of pathology
- Also called spastic colon, irritable colon, nervous colon
- No consistent anatomical/pathological lesions; it is a functional disorder
  - Typically teens or young adults
  - Abdominal pain, bloating, diarrhea, altered bowel habits
  - Psychological problems are common
  - Unlike IBD, weight loss, bleeding and vomiting do NOT occur.
Neoplasms of the Large and Small Bowel

• Overview
  – Far greater number of neoplasms occur in large intestine than small intestine
  – Colon cancer is 2nd leading cause of cancer death in US
  – Early detection is critical since
    • Many benign lesions can be found early
    • Most colon CA arise from pre-malignant lesions called adenomatous polyps at least 10-15 years before becoming malignant
    • Iron deficiency in adult males and post-menopausal females should always lead to investigation for intestinal CA.

Neoplasms of the Large and Small Bowel

• Neoplasms of the intestine fall into several major groups
  1. Non-neoplastic polyps (NOT pre-malignant)
     • Hamartomatous; hyperplastic
  2. Adenomatous polyps (Pre-malignant)
     • Tubular adenomas; Villous adenomas; Tubulovillous
  3. Familial Adenomatous Polyposis (always leads to colon CA)
  4. Colon cancer
  5. Other tumors of the GI tract
     • Carcinoid; gastrointestinal stromal tumors (GIST)

Neoplasms of the Large and Small Bowel

• Non-neoplastic polyps (NOT pre-malignant)
  – The term ‘polyp’ refers to the shape of a growth – which may or may not be a neoplasm
  – They are classified as based on two major criteria
    • Stalk (pedunculated) or no stalk (sessile)
    • Non-neoplastic or Neoplastic (Benign or Malignant)
  – Types
    • Hamartomatous polyps
      – Non-neoplastic, disorganized tissue (a hamartoma)
      – Familial connection
      – Usually in children (Peutz-Jeghers syndrome)
    • Hyperplastic polyps
      – Epithelial cell accumulation in mucosa (usually elderly)
      – Common
      – Not premalignant
Neoplasms of the Large and Small Bowel

• Adenomatous polyps (colonic adenomas)
  – Premalignant neoplasms of colon epithelium
  – High-fat, low-fiber diet has strong association
  – Males affected more often; over 65
  – About half in rectosigmoid colon (detected easily)
  – 10-15 years required for malignant transformation


Neoplasms of the Large and Small Bowel

• Familial Adenomatous Polyposis (always leads to colon CA)
  – Autosomal dominant defect in APC gene (a tumor suppressor gene)
  – *Left untreated 100% will develop into cancer, many before the age of 30
  – Darkly pigmented retina, osteomas of mandible and long bones, extra teeth, benign skin tumors and cysts
  – Total colectomy is Tx


Neoplasms of the Large and Small Bowel

• Colon cancer
  – 2nd leading cause of cancer death in US
  – Almost all are adenocarcinomas (gland-forming)
  – Early lesions are asymptomatic
  – Like adenomatous polyps, about half found in rectosigmoid colon
  – Invade colon wall directly and then metastasize (lymph nodes, liver (how?), lungs, and bones)
  – Screening via: FOBT (not very sensitive) and sigmoidoscopy

Colonic Diverticulosis

- Diverticulum – blind pouch with mouth opening onto the lumen of a space, e.g., colon
- Diverticulitis – inflammation of a diverticulum
- Acquired diverticula are more common than congenital

Diseases of the Appendix and Peritoneum

- Appendicitis
  - Acute inflammation of the appendix
  - Most common cause of acute abdominal pain – teens/YA most often
  - Several causes
    - Obstruction of lumen (hyperplasia of MALT in mucosa)
    - Fecalith, intestinal parasitic worms, foreign body
  - Classic appendicitis
    - Epigastric or periumbilical pain
    - Nausea, vomiting, anorexia
    - RLQ pain and low-grade fever common

Figure from: McConnell, The Nature of Disease, 2nd ed., LWW, 2014