ESSENTIALS OF HUMAN DISEASE

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Chapter 17

The Gastrointestinal Tract

Learning Objectives (1 of 2)

- Identify major types of cleft lip and cleft palate deformity
- Explain pathogenesis and prevention of dental caries and periodontal disease
- Describe common congenital anomalies of the GIT, clinical manifestations, diagnosis, treatment
- Describe three most common lesions of the esophagus that lead to esophageal obstruction
- Explain pathogenesis, complications, and treatment of peptic ulcer
- Describe types and clinical manifestations of acute and chronic enteritis

Learning Objectives (2 of 2)

- Differentiate acute appendicitis and Meckel's diverticulitis in terms of pathogenesis, clinical manifestations, and treatment
- Describe pathogenesis of diverticulitis and the role of diet in its development
- Discuss causes, clinical manifestations, complications
  - Intestinal obstruction
  - Colon cancer
  - Diverticulosis

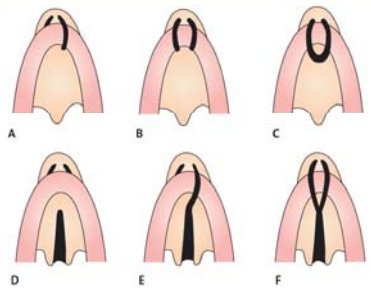
Gastrointestinal Tract

- Digestion and absorption of food
- Oral cavity
- Esophagus, stomach, small and large intestines, anus

Cleft Lip and Cleft Palate

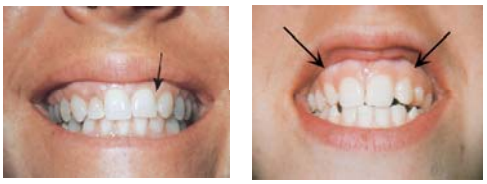
- Embryologically, face and palate formed by coalescence of cell masses that merge to form facial structures
- Palate formed by two masses of tissues that grow medially and fuse at midline to separate as nose and mouth
- Maldevelopment leads to defects
  - 1 per 1000 births
  - Multifactorial inheritance pattern
- Surgical correction (cheiloplasty)
  - Cleft lip: soon after birth
  - Cleft palate: 1 to 2 years of age followed by speech therapy to correct nasal speech

Types of cleft lip and palate abnormalities viewed from below



Abnormalities of Tooth Development

- Teeth: specialized structures that develop in tissues of the jaws
- Two sets
  - Temporary or deciduous teeth (20 teeth)
  - Permanent teeth (32 teeth)
- Missing teeth or extra teeth: common abnormality
- Enamel forms at specific times during embryologic period
- Tetracycline: administered during enamel formation causes permanent yellow-gray to brown discoloration of the crown



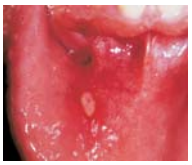
Abnormalities of Tooth Development

Dental Caries and Periodontal Disease

- Oral cavity: diverse collection of aerobic and anaerobic bacteria that mix with saliva, forming sticky film on teeth (dental plaque)
- Plaque and action of bacteria result in tooth decay (caries)
- Dental cavity: loss of tooth structure from bacterial action
- Gingivitis: inflammation of the gums due to masses of bacteria and debris accumulating around base of teeth
- Periodontal disease: inflammation extends to tissues that support teeth; forms small pockets of infection between teeth and gums
  - Two types: gingivitis and periodontitis

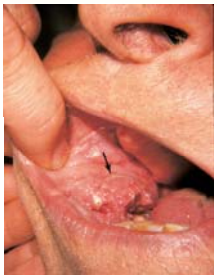
Stomatitis

- Inflammation of the oral cavity
- Causes
  - Irritants: alcohol, tobacco, hot or spicy foods
  - Infectious agents: *Herpes* virus, *Candida albicans* fungus, bacteria that cause trench mouth



Carcinoma of the Oral Cavity

- Arises from squamous epithelium
  - Lips
  - Cheek
  - Tongue
  - Palate
  - Back of throat



Esophagus (1 of 3)

- Muscular tube that extends from pharynx to stomach with sphincters at both upper and lower ends
  - Upper sphincter relaxes to allow passage of swallowed food
  - Lower (gastroesophageal or cardiac) sphincter relaxes to allow passage of food to the stomach
- Diseases
  - Failure of cardiac sphincter to function properly
  - Tears in lining of esophagus from retching and vomiting
  - At gastroesophageal junction from repetitive, intermittent, vigorous contractions that increase intraabdominal pressure
  - Esophageal obstruction from carcinoma, food impaction, or stricture

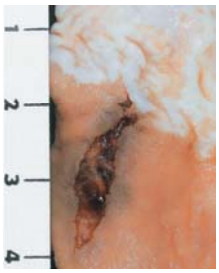
Esophagus (2 of 3)

- Symptoms
  - Difficulty swallowing (dysphagia)
  - Substernal discomfort or pain
  - Inability to swallow (complete obstruction)
  - Regurgitation of food into trachea
  - Choking and coughing
- Two major disturbances of cardiac sphincter
  - Cardiospasm: sphincter fails to open properly due to malfunction of nerve plexus; esophagus becomes dilated proximal to constricted sphincter from food retention
    - Treatment: periodic stretching of sphincter; surgery
  - Incompetent cardiac sphincter: sphincter remains open; gastric juices leak back into esophagus

Esophagus (3 of 3)

- Complications of incompetent cardiac sphincter
  - Reflux esophagitis: inflammation
  - Ulceration and scarring of squamous mucosal lining
  - Barrett's esophagus: glandular metaplasia; change from squamous to columnar epithelium; increased risk for cancer
- Esophageal obstruction
  - Carcinoma: can arise anywhere in esophagus
  - Tumor narrows lumen of esophagus, infiltrates surrounding tissue, invades trachea (tracheoesophageal fistula)
  - Food impaction: distal part
  - Stricture: from scar tissue due to necrosis and inflammation from corrosive chemicals such as lye

Gastric mucosal tear caused by retching and vomiting



Acute Gastritis

- Inflammation of the gastric lining
- Self-limited inflammation of short duration
- May be associated with mucosal ulceration or bleeding
- Alcohol: a gastric irritant; stimulates gastric acid secretion

H. Pylori Gastritis (1 of 2)

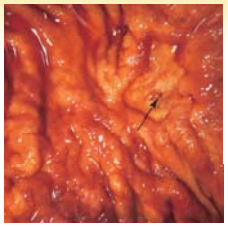
- Small, curved, gram-negative organisms that colonize surface of gastric mucosa
- Grow within layer of mucus covering epithelial cells
- Produce urease that decomposes urea, a product of protein metabolism, into ammonia
- Ammonia neutralizes gastric acid allowing organisms to flourish; organisms also produce enzymes that break down mucus layer

H. Pylori Gastritis (2 of 2)

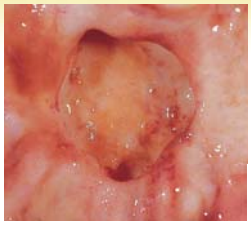
- Common infection that increases with age (50% by age 50)
- Spreads via person-to-person through close contact and fecal-oral route
- Increased risk of gastric carcinoma: intestinal metaplasia
- Increased risk of malignant lymphoma (mucosa-associated lymphoid tissue, MALT)

Peptic Ulcer

- Pathogenesis
  - Digestion of mucosa due to increased acid secretions and digestive enzymes (gastric acid and pepsin)
  - *Helicobacter pylori* injures mucosa directly or through increased acid secretion by gastric mucosa
  - Common sites: distal stomach or proximal duodenum
- Complications: hemorrhage, perforation, peritonitis, obstruction from scarring
- Treatment
  - Antacids: block acid secretion by gastric epithelial cells
  - Antibiotic therapy: against *H. pylori*
  - Surgery if medical therapy fails



Gastric ulcer, eroded a blood vessel at base of ulcer causing profuse bleeding

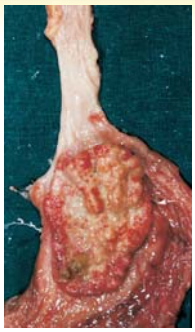


Large, chronic duodenal ulcer

Carcinoma of the Stomach

- Manifestations
  - Vague upper abdominal discomfort
  - Iron-deficiency anemia (chronic blood loss from ulcerated surface of tumor)
- Diagnosis: biopsy by means of gastroscopy
- Treatment: surgical resection of affected part, surrounding tissue and lymph nodes
- Long-term survival: relatively poor; often far-advanced at time of diagnosis

Carcinoma of the Stomach



Inflammatory Diseases of the Intestines

- Acute enteritis
  - Intestinal infections; common; of short duration
  - Nausea, vomiting, abdominal discomfort, loose stools
- Chronic enteritis: less common, more difficult to treat
- Regional enteritis or Crohn's disease: distal ileum
  - Chronic inflammation and ulceration of mucosa with thickening and scarring of bowel wall
  - Inflammation may be scattered with normal intervening areas or "skip areas"
  - Treatment: drugs and possible surgical resection of affected part of bowel

Ulcerative Colitis (1 of 2)

- Ulcerative colitis: large intestines and rectum
  - Inflammation is limited to mucosa, bowel not thickened unlike in Crohn's
  - Frequently begins in rectal mucosa and spreads until entire colon is involved
- Complications
  - Bleeding; bloody diarrhea
  - Perforation: from extensive inflammation with leakage of intestinal contents into peritoneal cavity
  - Long-standing disease may develop cancer of colon and/or rectum

Ulcerative Colitis (2 of 2)

- Treatment
  - Symptomatic and supportive measures
  - Antibiotics, corticosteroids to control flare-ups
  - Immunosuppressive drugs
  - Surgical resection

Inflammatory Diseases of the Intestines (1 of 3)

- Antibiotic-associated colitis: broad-spectrum antibiotics destroy normal intestinal flora
  - Allows growth of anaerobic spore-forming bacteria, *Clostridium difficile* not inhibited by antibiotic taken
  - Organisms produce toxins causing inflammation and necrosis of colonic mucosa
  - Diarrhea, abdominal pain, fever
- Diagnosis: stool culture, toxin in stool
- Treatment: stop antibiotic treatment; give vancomycin or metronidazole
  - Drugs that decrease intestinal motility will prolong illness

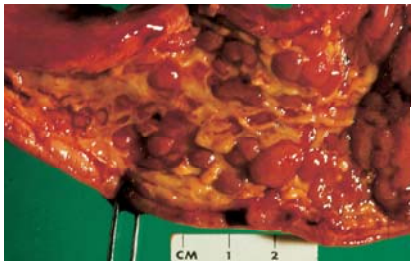
Inflammatory Diseases of the Intestines (2 of 3)

- Appendicitis: most common inflammatory lesion of the bowel
  - Narrow caliber of appendix may be plugged with fecal material
  - Secretions of appendix drain poorly, create pressure in appendiceal lumen, compressing blood supply
  - Bacteria invade appendiceal wall causing inflammation
- Manifestations
  - Generalized abdominal pain localizing in right lower quadrant; rebound tenderness; rigidity
- Treatment: surgery

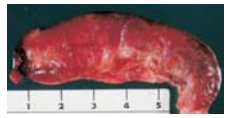
Inflammatory Diseases of the Intestines (3 of 3)

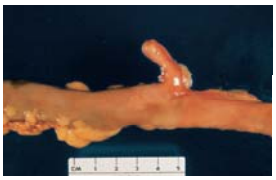
- Meckel's diverticulum
  - Outpouching at distal ileum, 12-18 inches proximal to cecum
  - From persistence of a remnant of the vitelline duct, narrow tubular channel connecting small intestine with yolk sac embryologically
  - Found in 2% of population; usually asymptomatic
- May become infected causing features and complications similar to acute appendicitis
- Lining may consist of ectopic acid-secreting gastric mucosa and may cause peptic ulcer

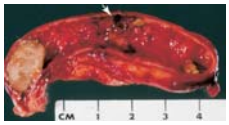
Regional enteritis, mucosa ulcerated and covered with inflammatory exudate



Inflammatory Disease Intestines







Disturbances in Bowel Function

- Food intolerance: Crampy abdominal pain, distention, flatulence, loose stools
- Lactose intolerance
  - Unable to digest lactose into glucose and galactose for absorption due to lactase deficiency
  - Enzyme abundant in infants and young children
  - Unabsorbed lactose remains in intestinal lumen and raises osmotic pressure of bowel contents
  - Fermented by bacteria in colon, yielding lactic acid that further increases intraluminal pressure
  - Common in Asians; 90% in Native Americans; 70% in Blacks

Irritable Bowel Syndrome

- Also known as spastic colitis or mucous colitis
- Episodes of crampy abdominal discomfort, loud gurgling bowel sounds, and disturbed bowel function without structural or biochemical abnormalities
- Alternating diarrhea and constipation
- Excessive mucus secreted by colonic mucosal glands
- Diagnosis: by exclusion
  - Rule out pathogenic infections, food intolerance, and inflammatory conditions
- Treatment
  - Reduce emotional tension
  - Improve intestinal motility

Intestinal Infections in Homosexual Men

- *Shigella*
- *Salmonella*
- *Entamoeba Histolytica*
- *Giardia*
- Transmission: anal-oral sexual practices
- Treatment: treat underlying cause

Obesity

- Calorie intake exceeds requirement
  - Cardiovascular disease
  - Musculoskeletal problems
  - Impaired pulmonary function
  - Operation carries high risk
  - Higher death rate from cancer
- Treatment
  - Medical management often ineffective
  - Surgical treatment: gastric bypass or adjustable gastric binding

Anorexia nervosa

- False perception of being fat despite marked weight loss
- Food intake restricted to lose weight
- Self-induced vomiting and laxatives may be used to promote weight loss
- Organ system abnormalities occur related to food restriction
- Requires psychiatric-medical treatment by persons experienced in dealing with eating disorders

Bulimia nervosa

- Binge eating followed by self-induced vomiting
- Usually weight maintained. Family and friends may not be aware of behavior
- Risk of gastric mucosa tears from retching and vomiting
- Dental problems and metabolic alkalosis from vomiting-induced loss of gastric acid
- Treatment similar to treatment of anorexia nervosa

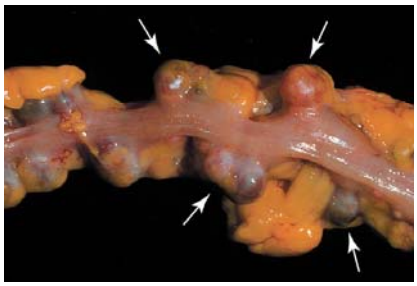
Binge eating disorders

- Characterized by binge eating without self-induced vomiting leading to weight gain
- Affects older adults and complicates problems of person trying to lose weight
- Treatment requires patient motivation, as when dealing with overeating problems

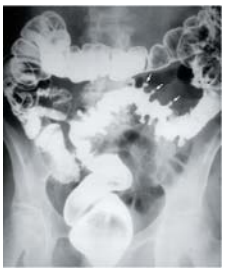
Colon Diverticulosis and Diverticulitis

- Diverticulosis: outpouchings or diverticula of colonic mucosa through weak areas in the muscular wall of large intestine
  - Low-residue diet predisposes to condition as increased intraluminal pressure must be generated to propel stools through colon
  - Acquired, usually asymptomatic, seen in older people
  - Common site: sigmoid colon
- Diverticulitis: inflammation incited by bits of fecal material trapped within outpouchings
- Complications: inflammation, perforation, bleeding, scarring, abscess

Diverticulosis of colon. Exterior of colon, illustrating several diverticula projecting through the wall of the colon.



Diverticula of colon demonstrated by injection of barlum contrast material into colon (barium enema)



Intestinal Obstructions (1 of 5)

- Conditions blocking normal passage of intestinal contents
- Always considered as a serious condition
- Severity depends on location of obstruction, completeness, interference with blood supply
- High intestinal obstruction
  - Severe, crampy abdominal pain from vigorous peristalsis
  - Vomiting with loss of H_2O and electrolytes, may result in dehydration

Intestinal Obstructions (2 of 5)

- Low intestinal obstruction
  - Symptoms less acute
  - Mild, crampy abdominal pain
  - Moderate distention of abdomen
- Common causes of intestinal obstruction
  - Adhesions
  - Hernia
  - Tumor
  - Volvulus
  - Intussusception

Intestinal Obstructions (3 of 5)

- Adhesions
  - Adhesive bands of connective tissue
  - May cause loop of bowel to become kinked, compressed, twisted
  - Causes obstruction proximal to site of adhesion
- Hernia
  - Protrusion of loop of bowel through a small opening, usually in abdominal wall
  - Herniated loop pushes through peritoneum to form hernial sac

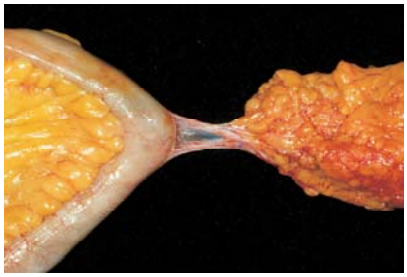
Intestinal Obstructions (4 of 5)

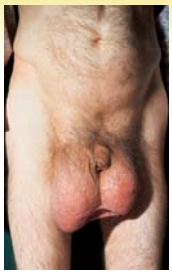
- Hernia
  - Inguinal hernia: common in men; loop of small bowel protrudes through a weak area in inguinal ring and descends downward into scrotum
  - Umbilical and femoral hernia: common in both sexes
    - Umbilical hernia: loop of bowel protrudes into umbilicus through defect in the abdominal wall
    - Femoral hernia: loop of intestine extends under inguinal ligament along course of femoral vessels into the groin

Intestinal Obstructions (5 of 5)

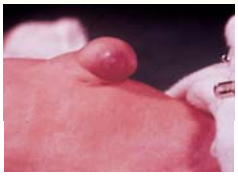
- Reducible hernia: herniated loop of bowel can be pushed back into abdominal cavity
- Incarcerated hernia: cannot be pushed back
- Strangulated hernia: loop of bowel is tightly constricted obstructing the blood supply to the herniated bowel; requires prompt surgical intervention
- Volvulus: rotary twisting of bowel impairing blood supply; common site: sigmoid colon
- Intussusception: telescoping of a segment of bowel into adjacent segment; from vigorous peristalsis or tumor
  - Common site: terminal ileum

Fibrous adhesions between a loop of small intestine and omentum



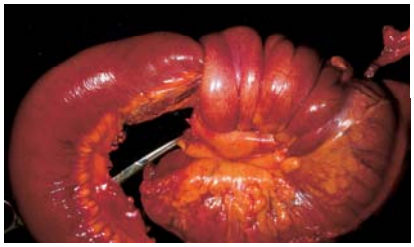


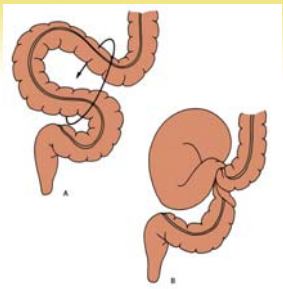
Inguinal hernia, bilateral, extending into scrotum



Umbilical hernia, infant

Intussusception resulting from a colon tumor



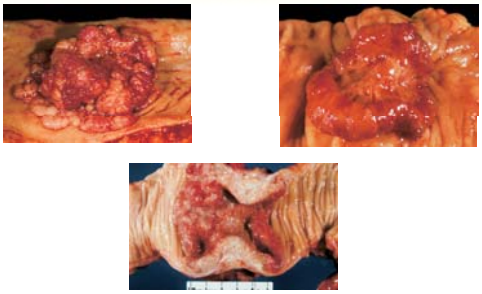


Volvulus
A. Rotary twisting of sigmoid colon on its mesentery
B. Obstruction of colon and interruption of blood supply

Tumors of the Colon

- Benign pedunculated polyps
  - Frequent
  - Tip may erode causing bleeding
  - Removed by colonoscopy
- Carcinoma
  - Cecum and right half of colon
    - Does not cause obstruction as caliber is large and bowel contents are relatively soft
    - Tumor can ulcerate, bleed; leads to chronic iron-deficiency anemia
    - Symptoms of anemia: weakness and fatigue
  - Left half of colon
    - Causes obstruction and symptoms of lower intestinal obstruction

Colon Carcinoma



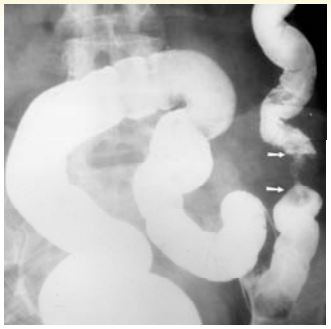
Hemorrhoids

- Varicose veins of hemorrhoidal venous plexus that drains rectum and anus
- Constipation and straining predispose to development
- Relieved by high-fiber diet rich in fruits and vegetables, stool softeners, rectal ointment, or surgery
  - Internal hemorrhoids
    - Veins of the lower rectum
    - May erode and bleed, become thrombosed, or prolapse
  - External hemorrhoids
    - Veins of anal canal and perianal skin
    - May become thrombosed, causing discomfort

Diagnosis of GI Disease

- Endoscopic procedures
  - To directly visualize and biopsy abnormal areas such as esophagus, stomach, intestines
- Radiologic examination
  - To examine areas that cannot be readily visualized
  - To evaluate motility problems
  - To visualize contours of GIT mucosa
  - To identify location and extent of disease
    - Examples: Upper gastrointestinal tract – UGI
    - Colon – BE (barium enema)

Colon carcinoma demonstrated by barium enema



Discussion

- A 45-year-old patient has a large right-sided colon carcinoma with iron deficiency anemia. The anemia is most likely due to:
  - A. Impaired absorption of nutrients due to the tumor
  - B. Chronic blood loss from ulcerated surface of the tumor
  - C. Poor appetite
  - D. Metastases to the liver
  - E. Obstruction of the colon by the tumor