Chapter 17: Abdomen
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Abdomen
- Abdominal exam is performed
  - As part of the comprehensive physical examination
  - When patient presents with signs or symptoms of an abdominal disease process
  - When the patient presents with signs or symptoms of musculoskeletal disease that may be referred from a visceral source

Abdomen
- It involves the core examination skills in a particular sequence
  - Inspection
  - Auscultation
  - Percussion
  - Palpation
- Why this order?
  - It's not the same as you used in the thorax examination

Anatomy and Physiology
- Houses multiple major organs
- The peritoneum, a serous membrane, lines the cavity and forms a protective cover for many of the abdominal structures
  - Double folds of the peritoneum around the stomach constitute the greater and lesser omentum
- The mesentery, a fan-shaped fold of the peritoneum, covers most of the small intestine and anchors it to the posterior abdominal wall

Alimentary Tract
- A 27-foot tube from mouth to anus
- Parts
  - Esophagus: 10 inches long
  - Stomach
  - Small intestine: 21 feet long
  - Large intestine (colon): 4.5 to 5 feet long
Alimentary Tract

- Functions
  - Ingest and digest food
  - Absorb nutrients, electrolytes, and water
  - Excrete wastes
  - Peristalsis moves food along tract under autonomic nervous system control

Esophagus

- A 10-inch collapsible tube
- Connects pharynx to stomach
- Posterior to the trachea
- Descends
  - Through the mediastinal cavity
  - Travels through the diaphragm
  - Enters the stomach at the cardiac orifice

Stomach

- Flask-shaped, lies transversely
- In upper abdomen below diaphragm
- Three sections
  - Fundus
  - Body
  - Pylorus
- Secretes HCl and enzymes to break down fats and proteins
- Little absorption takes place in the stomach

Small Intestine

- Connects stomach to large intestine
- Three sections coiled in abdominal cavity
  - Duodenum: 12 inches
  - Openings for bile and pancreatic ducts
  - Jejunum: 8 feet
  - Ileum: 12 feet
  - Ileocecal valve between the ileum and large intestine prevents backflow
- Completes digestion through action of pancreatic enzymes, bile, and other enzymes
- Nutrients absorbed through the mucosa
- Surface area enormously increased by circular folds and villi

Large Intestine

- Connects small intestine to anus
- Four sections
  - Cecum: vermiform appendix extends from base
  - Ascending colon
  - Transverse colon
  - Descending colon
  - Sigmoid colon
  - Rectum and anal canal
- Functions
  - Water absorption
  - Lubrication of contents from large quantities of alkaline mucus that neutralize acids formed by intestinal bacteria
  - Putrefaction: live bacteria decompose undigested food, unabsorbed amino acids, cell debris, and dead bacteria

Liver

- Four lobes in right upper quadrant
- Major functions
  - Metabolize fats and carbohydrates
  - Convert amino acids to glucose
  - Synthesize fats from carbohydrates and proteins
  - Store vitamins and iron
  - Detoxify harmful substances
  - Produce antibodies and blood coagulants
  - Synthesize bile
  - Convert waste from fat to water soluble
Gallbladder

- Pear-shaped, saclike organ about 4 inches long recessed in liver
- Function
  - Gallbladder concentrates and stores bile (made up of cholesterol, bile salts, and pigments)
  - Bile is released into cystic duct (and common bile duct) and maintains alkaline pH of small intestine to permit emulsification of fats for absorption

Pancreas

- Located behind and beneath stomach
- Functions
  - Produces digestive juices
  - Endocrine function produces hormones to regulate body’s level of glucose
    - Insulin (the major anabolic hormone of body)
    - Glucagon

Spleen

- Located in left upper quadrant below kidney
- Function
  - White pulp (lymphoid tissue)
    - Filters blood
    - Produces lymphocytes and monocytes
  - Red pulp
    - Allows for storage and release of blood

Kidneys, Ureters, and Bladder

- Kidneys, ureters, and bladder
  - Kidneys located bilaterally in retroperitoneum and connected to bladder via ureters
  - Functions
    - Rids body of water-soluble waste
    - Produces (endocrine) renin, erythropoietin, and biologically active vitamin D
    - Synthesizes prostaglandins

Musculature and Connective Tissues

- Form and protect the abdominal cavity
  - Rectus abdominis
  - Internal and external obliques
  - Linea alba (contains umbilicus)
  - Inguinal ligament (Poupart ligament)

Vasculature

- Descending aorta
  - Branches
    - Iliac arteries (two), formed from division at about the umbilicus
    - Splenic artery
    - Renal arteries
Infants

- Pancreatic buds, liver, and gallbladder all begin to form during week 4 of gestation
  - Intestine already exists as a single tube
- Meconium, an end product of fetal metabolism, is produced at about 17 weeks
- By 36 to 38 weeks’ gestation, the gastrointestinal tract is capable of adapting to extrauterine life

Infants

- Elasticity, musculature, and control mechanisms continue to develop, reaching adult levels of function at 2 to 3 years of age
- Liver is very large at birth
  - Metabolic and glycogen storage organ
  - Remains the heaviest organ in the body
- Pancreatic islet cells are developed by 12 weeks’ gestation and begin producing insulin
- Spleen is active in blood formation during fetal development and the first year of life.
  - Afterward, the spleen aids in the destruction of blood cells and functions as a lymphatic organ for immunological response.

Infants

- Nephrogenesis begins during the second embryologic month.
  - By 12 weeks, the kidney is able to produce urine.
  - Development of new nephrons ceases by 36 weeks of gestation.
  - After birth, the kidney increases in size because of enlargement of the existing nephrons and adjoining tubules.

Pregnant Women

- Abdominal wall muscles stretch and lose tone
- Organs are displaced and affect functions:
  - Heartburn results from alkaline reflux from duodenal contents into stomach
  - Gallstones may result from gallbladder changes that produce cholesterol crystals
  - Urinary stasis and urgency may occur
  - Constipation or flatus is more common
  - Hemorrhoids may develop later in pregnancy

Older Adults

- Functional abilities of GI tract are affected.
  - Motility slows.
  - Secretion and absorption may slow.
  - Changes may impair digestive ability and may result in food intolerances in the older adult.
- The liver loses some ability to metabolize certain drugs.
- There may be an increase of biliary lipids resulting in the formation of gallstones.
- The pancreas has no significant physiologic changes.
Preparation

- Good light
- Full exposure of abdomen
- Warm hands
- Short fingernails
- Empty bladder (decreases guarding)
- Pillow under the head
- Arms at the sides
- Knees flexed (may need a pillow for support)
- Drape the patient for comfort (temperature)

Landmarks

- The abdomen can be divided into either:
  - Four quadrants: RUQ, LUQ, RLQ, LLQ
  - Dividing lines between the xiphoid and superior pubis, and through the umbilicus
- Nine regions:
  - 1. Epigastric, 2. Umbilical, 3. Hypogastric (pubic), 4. and 5. right and left hypochondriac, 6. and 7. right and left lumbar, 8. and 9. right and left inguinal
  - Dividing lines: the lowest edge of costal margin and the iliac crests and two at the midclavicular lines

Inspection

- Surface characteristics
  - Skin
  - Venous return
  - Lesions and scars
  - Tautness and striae
- Contour
  - Contour (abdominal profile from the rib margin to the pubis, viewed on the horizontal plane)
  - Symmetry
  - Surface motion

Inspection of the Abdomen

- Surface characteristics
  - Skin color, skin lesions or moles, bruises, striae, ascites, umbilical hernia, scars (adhesions)
- Contour
  - Symmetry, surface motion, location of the umbilicus, distention, bulges
  - Ask the patient to breath in and hold; the contour should remain symmetrical, but could emphasize bulges or distention with the compression of tissue
  - Next, ask the patient to raise his head off the pillow (half sit-up); contraction of the rectus abdominus produces muscle prominence; hernias or masses may appear
  - Hernias may appear at surgical incisions and at the umbilicus (protrusion of the navel)
  - Common in pregnancy, obesity, ascites, or long-standing COPD

- Movement
  - Smooth, even movement should occur with respiration
  - Limited movement may indicate peritonitis
  - Surface motion from peristalsis, seen as a rippling movement across a section of the abdomen, may be seen in thin individuals, but can be a sign of intestinal obstruction
  - Marked pulsations may occur as the result of increased pulse pressure or abdominal aortic aneurysm
    - We see the abdominal aortic pulsation in most individuals, no matter the body habitus
How do you differentiate a minor umbilical hernia from an "outie" belly button?

Auscultation

- Bowel sounds
  - Place the warmed diaphragm on the abdomen and hold in place with light pressure so the stethoscope doesn’t move across the skin with the movement of respiration
  - A cold stethoscope may cause contraction of the abdominal muscles
  - Frequency
  - Character
    - Usually heard as clicks and gurgles that occur irregularly and range from 5 to 35 per minute
    - Generalized so most often they can be assessed adequately by listening in a few places
    - Loud prolonged gurgles are called borborygmi (stomach growling)

Auscultation

- Friction rubs
  - High-pitched sounds that are heard in association with respiration
  - Use the diaphragm of the stethoscope
  - Rare in the abdomen
  - Indicate inflammation of the peritoneal surface of the organ from tumor, infection, or infarct
  - Liver and spleen
Auscultation

- **Bruit**
  - Harsh or musical intermittent auscultatory sounds that may reflect blood flow turbulence and indicate vascular disease
  - Heard best with the bell of the stethoscope
  - Well localized
  - Epigastric region and over the aortic, renal, and iliac arteries
  - For the average size adult, auscultate with the bell:
    - Three sites from xiphoid to umbilicus for the aorta
    - Three sites down each iliac artery
    - Once on each side of the abdominal aorta, halfway between the xiphoid and umbilicus, for the renal arteries

- **Venous hum**
  - Soft, low-pitched, and continuous sound heard best with the bell of the stethoscope
  - Occurs with increased collateral circulation between portal and systemic venous systems
  - Epigastric region and around the umbilicus

Percussion

- Used to:
  - Assess the size and density of organs
  - Detect the presence of fluid (ascites)
  - Detect the presence of air (gastric distention)
  - Detect the presence of fluid-filled or solid masses
- Percuss all regions of the abdomen for a sense of overall tympany and dullness
- Where should you expect to hear dullness?

Percussion of the abdomen

- Percussion is used in combination with palpation and is used to confirm palpatory findings
- Tympany is the predominant sound in abdominal percussion because of the air in the stomach and intestines
- Dullness is heard over organs and solid masses

Percussion of the intestines/bowel

- Percussion of the intestines is best accomplished by systematically percussing in all 9 regions (2-3 sites per region)
- In interpreting the sounds, it helps to anticipate the expected sound from the structure
- For example, the small intestines (central) will have greater tympany than the large intestines
- The ascending and transverse colons typically have a mixture of fecal material and bowel gas
- The descending colon and sigmoid colon typically have more solid fecal material; therefore more dullness is expected

Gastric bubble percussion

- The gastric air bubble (meganblase) should percuss as a deeper tympany at the left anterior rib cage and the epigastric region
- (Performed with bowel percussion; not a separate examination)
Liver percussion
- Beginning in an area of tympany, percuss the liver at the right midclavicular line in the RUQ and move superiorly.
- Remember that the posterior aspect of the lung field is quite low (T10), but the anterior aspect is high (5th-6th rib).
- You will usually percuss the lower border of the liver around the inferior costal margin or slightly below.
- If the liver percusses more than 1 inch below the costal margin, consider hepatomegaly or downward displacement of the liver due to a depressed diaphragm.

Liver percussion
- To find the superior border of the liver, start again at the midclavicular line, in an area of lung tympany (3rd-4th intercostal space).
- Percuss inferiorly until the note becomes dull.
- The upper border usually begins at the 5th-7th intercostal space.
- A superior liver border below this area may indicate liver atrophy or downward displacement of the liver by lung disease.
- A superior liver border above this area may indicate upward displacement due to abdominal mass or hepatomegaly.

Liver percussion
- To estimate the liver size, measure between the superior and inferior marks.
- The usual size is 6 to 12 cm (2.5-4.5 inches).
- This is only a gross estimate.
- Pleural effusion and lung consolidation can obscure the superior liver border.
- Gas in the ascending and transverse colon can obscure the inferior liver border.

Additional/alternate maneuvers
- Liver descent: ask the patient to take a deep breath and hold it while you again percuss upward from the abdomen; the inferior border should move 2 to 3 cm downward.
- Axillary percussion: for females, or if enlargement is suspected, percuss in the right midaxillary line; dullness should be noted at the 5th-7th intercostal space (for superior border).

Spleen percussion
- Percuss the spleen just posterior to the midaxillary line on the left, again beginning in an area of tympany.
- Dullness should be heard at the 6th-10th intercostal spaces.
- A larger area of dullness suggests splenomegaly; however, a full stomach or intestines could give false-positive findings.
- Finally, percuss at the lowest costal margin with inspiration and with expiration.
- The area should remain tympanic.

Palpation
- Light palpation (about 1 cm depth)
  - Light, systematic palpation of all nine regions.
  - Initially avoid any areas that have already been identified as problem spots—why?
- Moderate palpation (about 2-3 cm depth)
  - Moderate pressure as an intermediate step to gradually approach deep palpation.
- Deep palpation (about 4 cm or deeper, depending on what the anatomy allows)
  - Necessary to thoroughly delineate abdominal organs and to detect less obvious masses.
Palpation
- **Purpose:** Palpation is used to detect organomegaly, muscles spasm, fluid collection, painful areas, masses, adhesions
- Just like inspection, auscultation, and percussion, make sure the patient is relaxed with the knees flexed
- **Caveat:** Some people (especially children) are ticklish and the key is to use distraction; palpate and percuss over the patient's hands and/or place the non-palpating hand over a less sensitive body part

**Light palpation**
- You always begin with light palpation
- Never go right to deep palpation
- Begin with light, systemic palpation of all 9 regions
- Initially, you should avoid the areas that were identified in the history as problematic—why?
- Begin with your palm on the patient, fingers together
- Depress the abdominal wall no more than 1cm, using light smooth, consistent motions (don’t jab at the patient)
- The abdomen should feel smooth and soft

**Light palpation**
- Light palpation helps identify muscular guarding and inflammation of the organ or peritoneum
- False-positive muscle guarding can occur with cold hands and ticklishness
- A large mass or distended structure may first be identified as an area of resistance
- If resistance is noted, palpate while the patient breathes slowly through the mouth
- If resistance remains, it is probably involuntary (indicating a mass or anomaly)

**Moderate palpation**
- Moderate palpation is mostly a transitional move to deeper palpation (2-3 cm depth)
- Tenderness not identified with light palpation may be evident with moderate palpation, saving the surprising pain response to deep palpation

**Deep palpation**
- Deep palpation is necessary to thoroughly evaluate the abdominal organs and to detect less obvious masses
- Again, use the palm of the hand with fingers together and palpate all 9 regions
- You often will be able to feel the borders of the rectus abdominus, colon, aorta
- False-positive pain may occur in the healthy patient over the cecum, sigmoid, aorta, and xiphoid process (and other bony prominences, esp. floating ribs)

**Deep palpation of masses**
- Palpate for masses and assess:
  - Location
  - Size
  - Shape
  - Consistency
  - Tenderness
  - Pulsation
  - Mobility
  - Movement with respiration
Masses

- **False-positive masses:**
  - Feces in the colon (should be soft, boggy, and eventually move through remaining colon)
  - Lateral borders of rectus abdominus
  - Uterus
  - Aorta
  - Common iliac arteries

Umbilical ring

- Palpate the umbilicus and surrounding area
- The umbilicus should be round, firm, and free of bulges and masses
- Softness of the center could indicate an umbilical hernia

Bimanual technique

- If adipose deposition or muscle mass prevents deep palpation, you can use bimanual palpation to exert pressure over the abdominal structures
- Okay to use bimanual palpation for all patients, just don’t exert excessive pressure on thin patients or children

Liver palpation

- **You may not be able to feel the liver in many individuals**
- In thinner individuals, you may feel the inferior margin
- If the liver is palpated, it should feel smooth, firm, regular; should be nontender
- Palpate for nodules, tenderness, irregularity
- Repeat palpation across the medial to lateral margins

Liver palpation: fist (pain) percussion/liver punch

- **When tenderness cannot be palpated, you may use fist percussion (indirect)**
- Place the palm over the lower right rib cage
- Strike the hand with the fist of the other hand
- A healthy liver is not tender to fist percussion (but not all unhealthy livers are tender)
- This should be performed after palpation (even though it is a percussive force), as it is intended to evaluate for pain (as invasive as palpation due to pain)
<table>
<thead>
<tr>
<th>Gallbladder palpation</th>
<th>Murphy’s sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Palpate below the liver margin at the lateral border of the rectus abdominus (medial portion of the liver)</td>
<td>● If cholecystitis is suspected (gallbladder “attack”), you may perform Murphy’s test</td>
</tr>
<tr>
<td>● Most healthy gallbladders are not palpable</td>
<td>● During deep palpation of the gallbladder region, ask the patient to take in a deep breath</td>
</tr>
<tr>
<td>● A tender gallbladder indicates cholecystitis</td>
<td>● As the inflamed gallbladder wall moves closer to the peritoneum and palpating hands, the patient will experience pain and <strong>halt inspiration</strong> (positive sign)</td>
</tr>
<tr>
<td>● A nontender but palpable gallbladder indicates obstruction of the duct (stones) or cholecystolithiasis</td>
<td></td>
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<thead>
<tr>
<th>Spleen palpation</th>
<th>Spleen palpation (alternate)</th>
</tr>
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<tbody>
<tr>
<td>● Stand to the patient’s right</td>
<td>● Repeat palpation of the spleen with the patient in a right lateral decubitus position with knees flexed</td>
</tr>
<tr>
<td>● Reach across the patient to the left side with your left hand and place it beneath the patient at the left costovertebral margin, pulling upward</td>
<td>● This moves the spleen more anteriorly and to the right</td>
</tr>
<tr>
<td>● Place the palm of the right hand on the abdomen below the left costal margin (just like liver palpation, but at the <strong>MIDAXILLARY LINE</strong>)</td>
<td></td>
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<tr>
<td>● Press your fingertips inward as the patient inhales deeply</td>
<td></td>
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<tr>
<td>● The spleen should move inferiorly, but is <strong>usually not palpable in adults</strong></td>
<td></td>
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<table>
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<tr>
<th>Right kidney palpation</th>
<th>Left kidney palpation</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Stand on the right side of the patient, placing the one hand at the flank and the other at the anterior costal margin</td>
<td>● With the patient supine, stand on the right side</td>
</tr>
<tr>
<td>● Perform the same moves as with the left kidney</td>
<td>● Reach across the patient (as with spleen) with your left hand and place underneath the patient at the flank</td>
</tr>
<tr>
<td>● The right kidney tends to be more palpable than the left—why?</td>
<td>● Place your right hand at the anterior costal margin and press deeply (retroperitoneal)</td>
</tr>
<tr>
<td>● If it is palpable, it should be firm, smooth, nontender</td>
<td>● As the patient inhales deeply, you may feel the lower pole of the kidney</td>
</tr>
<tr>
<td>● By contrast, the liver margin is sharper than the renal margins</td>
<td>● The left kidney is <strong>usually</strong> not palpable</td>
</tr>
</tbody>
</table>
Kidney palpation/kidney punch
- Kidney (percussion) is best accomplished first with the patient seated (do with lumbar exam)
- Place the palm of one hand at the posterior inferior costal margin
- Strike your hand with the fist of the other as you did for liver percussion
- Repeat at the opposite posterior inferior costal margin
- Normally, the patient feels a “thud” which does not produce pain
- Direct percussion may also be used

Additional Procedures

- Ascites assessment
  - Pathologic increase in fluid in the peritoneal cavity
  - Percuss for:
    - Dullness and resonance
    - Shifting dullness
    - Fluid wave

Additional Procedures

- Pain assessment
  - Abdominal pain is a common concern
  - How bad is the pain?
  - Has there been recent trauma?
  - Pain so severe that the patient is unwilling to move
  - Accompanied by nausea and vomiting
  - Marked by areas of localized tenderness
  - Facial expression during palpation

Common Causes of Abdominal Pain
- Appendicitis
- Peritonitis
- Cholecystitis
- Pancreatitis
- Salpingitis
- Pelvic inflammatory disease
- Diverticulitis
- Perforated gastric or duodenal ulcer
- Intestinal obstruction
- Leaking abdominal aneurysm
- Biliary stones, colic
- Renal calculi
- Ectopic pregnancy
- Ruptured ovarian cyst
- Splenic rupture

Abdominal Signs Associated with Common Abdominal Conditions: 17-6
### Table 17-6: Abdominal Signs
#### Appendicitis
- Are these signs specific to the condition they evaluate?
- Aaron: Pain in the heart or stomach region upon palpation of McBurney’s point
- Blumberg: Rebound tenderness
- Heel Strike (anvil test): Strike the bottom of the foot
- Markle (heel jar): Drop body weight quickly from toes to heels
- McBurney: Sharp pain and/or rebound tenderness
- Rovsing: Right lower quadrant pain worsened by left lower quadrant palpation
- Not included in the table, but within the text:
  - Iliopsoas test: flex the thigh against downward resistance
  - Obturator test: thigh and knee flexed, lateral rotation of the leg

#### Peritoneal Irritation
- Ballance: Fixed dullness to percussion in the left flank and dullness in the right flank that disappears with patient position changes
- Blumberg: Rebound tenderness
- Heel Strike (anvil test): Strike the bottom of the foot
- Markle (heel jar): Drop body weight quickly from toes to heels
- McBurney: Rebound tenderness (not listed in table)
- Rovsing: Right lower quadrant pain worsened by left lower quadrant palpation

#### Hemoperitoneum
- Cullen: Ecchymosis around the umbilicus
- Grey Turner: Ecchymosis of the flanks

#### Pancreatitis
- Cullen: Ecchymosis around the umbilicus
- Grey Turner: Ecchymosis of the flanks

#### Ectopic Pregnancy
- Cullen: Ecchymosis around the umbilicus
- Kehr: Abdominal pain radiating to the left shoulder

#### Splenic Rupture
- Kehr: Abdominal pain radiating to the left shoulder
Table 17-6: Abdominal Signs

Renal Calculi

- Are these signs specific to the condition they evaluate?
- Kehr: Abdominal pain radiating to the left shoulder
- Kidney Punch: Posterior costovertebral tenderness with provocation (not listed in table)

Cholecystitis

- Are these signs specific to the condition they evaluate?
- Murphy: Abrupt cessation of inspiration with deep palpation of gallbladder
  - Classic referral location for cholecystitis?

Intussusception

- Are these signs specific to the condition they evaluate?
- Dance: Absence of bowel sounds in right lower quadrant

Older Adults

- Techniques of examination are the same as those used for younger adults.
- Abdominal wall of the older adult becomes thinner and less firm.
- Abdominal contour is often rounded as a result of loss of muscle tone.
- Use judgment in determining whether a patient is able to assume a particular position.

- Decreased intestinal motility associated with aging
  - Constipation
  - Bloating
  - Fecal impaction (so more extensive areas of dullness to percussion and palpable pseudomasses
- Bowel obstruction
- Gastrointestinal cancers
- Pain perception may be altered as part of the aging process

Abnormalities
Esophagus

- The esophagus is a collapsible tube (contrast with the trachea) about 10 inches long, connecting the pharynx and stomach
- It passes through the diaphragm through the cardiac sphincter
- It passes posterior to the trachea and anterior to the spine

What kind of study is this?

What's happening here?
GERD

- Gastroesophageal reflux disease occurs with relaxation or incompetence of the lower esophagus
- The reflux causes a backflush of stomach acid, leading to symptoms of heartburn or acid indigestion
- The symptoms are described as burning chest pain, localized behind the sternum, sometimes moving up to the neck and throat

Causes of GERD (1 of 4 slides)

- Malfunction of the lower esophageal sphincter (LES) muscles, leading to diminished sphincter tone, caused by:
  - The nervous system
  - Medications
- Abnormalities in the esophagus
  - Motility abnormalities (peristalsis): cause or effect?
  - Adult-ringed esophagus

Causes of GERD (2 of 4 slides)

- Impaired Stomach Function: abnormal nerve or muscle function causes impaired motility, leading to delayed stomach emptying and increased pressure
- Those with Type 1 diabetes often develop a condition called gastroparesis
- This condition occurs in at least 20% of patients with long-standing diabetes
- It is characterized by delayed stomach emptying

Causes of GERD (3 of 4 slides)

- Asthma
  - More than 50% of asthmatic sufferers have GERD
  - It is debated which causes which
    - Some believe that coughing accompanies asthmatic attacks, leading to pressure changes in the chest, triggering reflux; also, some meds used to relax the bronchioles can relax the LES muscles
    - Some believe that since GERD has been associated with several other respiratory problems, it may be a cause of asthma, rather than a result of asthma

Causes of GERD (4 of 4 slides)

- Hiatal Hernia (discussed later)
- Drugs (OTC and prescription):
  - NSAIDS (regular use for 6 months or more)
  - Calcium channel blockers, anticholinergics, Beta adrenergics, Dopamine, Biphosphonates, Sedatives, Antibiotics, Potassium, Iron supplements
- What's the problem with swallowing pills?

GERD Complications

- Are the symptoms of GERD that bad? It's just “heartburn”, right?
- Infants and children can have symptoms of vomiting, leading to weight loss and fatigue
- Dysphagia can develop, as well as a change in the voice characteristic (hoarseness)
- GERD can also lead to respiratory complications from aspiration and bleeding
- GERD can also change the cells of the esophagus
Esophagus abnormalities

- Barrett’s esophagus: Normally, the esophagus is lined with squamous epithelium; Barrett’s esophagus is a condition in which the normal epithelium is replaced by columnar epithelium called specialized intestinal metaplasia.
- Most people with Barrett’s esophagus have a hiatal hernia, but not everyone with a hiatal hernia has a Barrett’s esophagus.

Normal tissue of the esophagus

Barrett’s esophagus

What’s happening here?

Hiatal hernia
2 types of hiatal hernias

- Paraesophageal (Hiatal) Hernia
- Gastric/sliding hernia

Hiatal Hernia

- There are two types of hiatal hernias: paraesophageal and gastric/sliding
- Sliding hiatal hernias are overwhelmingly more common
- The condition is VERY common, and occurs most frequently in women and older adults
- It is associated with obesity, pregnancy, ascites, and tight clothing or belts
- Muscle and diaphragmatic weakness are contributing factors

In the US: Hiatal hernias are more common in Western countries. The frequency of hiatus hernia increases with age, from 10% in patients younger than 40 years to 70% in patients older than 70 years.

Internationally: Burkitt et al suggest that the Western, fiber-depleted diet leads to a state of chronic constipation and straining during bowel movement, which could explain the higher incidence of this condition in Western countries.

Hiatal Hernia; Qureshi; 2/28/06; emedicine.com

Hiatal Hernia

- Patients complain of epigastric pain and/or heartburn that worsens with lying down and is relieved by sitting up or with antacids
- Patients also complain of water brash, which is a filling of the mouth with fluid, sometimes with changing positions, and of dysphagia
- The hernia can become incarcerated, which is a surgical emergency
- Incarceration symptoms included sudden onset vomiting, pain, and complete dysphagia

Hiatal Hernia; Qureshi; 2/28/06; emedicine.com
Alimentary Tract

- Diverticular disease  
  - Saclike mucosal outpouchings through colonic muscle  
- Colon cancer  
  - May involve the rectum, sigmoid, proximal, and descending colon

Stomach cancer

- There are several types of gastric cancer  
- 95% of all gastric cancers are adenocarcinomas  
- The other 5% are:  
  - Sarcomas  
  - Lymphomas  
  - Squamous cell carcinoma  
  - Neuroendocrine tumors (carcinoid tumors)

Risk Factors for Stomach Cancer

- By Mayo Clinic  
  - A diet high in salty and smoked foods  
  - A diet low in fruits and vegetables  
  - Eating foods contaminated with aflatoxin fungus  
  - Family history of stomach cancer  
  - Infection with Helicobacter pylori  
  - Long-term stomach inflammation (chronic gastritis)  
  - Pernicious anemia  
  - Smoking  
  - Stomach polyps

Gastric cancer symptoms

- Indigestion  
- Heartburn  
- Abdominal pain  
- Nausea and vomiting  
- Bowel ailments  
- Bloating  
- Fatigue  
  - People often ignore the symptoms of gastric cancer because they associate them with other stomach maladies

- Also, because these symptoms are usually mild, early diagnosis is rare  
- Only 10 to 20 percent of gastric cancers are diagnosed before spreading to other areas of the body  
- If treated early, gastric cancer has a good cure rate  
- However, the prognosis worldwide is generally poor, with only about 2 in 10 of those affected surviving for five years after diagnosis (much better survival rate in US)
Inflammatory bowel disease

- Ulcerative colitis and Crohn’s disease are idiopathic chronic inflammatory diseases of the GI tract
- They have much in common, but the differences in histological changes are marked

Ulcerative colitis (UC)

- Epidemiology:
  - Much more common in developed countries
  - Prevalence is greater than 70/100,000
  - Bimodal distribution, with peaks at 20-40 and 60-80 years of age
  - More common in women
  - Most common in Caucasians, particularly Jews
  - 10% increase in families with history of UC or CD, but no clear HLA or Mendelian inheritance
  - An association between ankylosing spondylitis and UC is seen

Etiology and pathogenesis

- The primary cause is unknown
- May result from an abnormally prolonged inflammatory host response
- Genetic and/or environmental factors
- Dietary or microbiological product in the lumen
- Postulated etiological factors:
  - Infection
  - Psychosocial factors
  - Immunological disorders
  - Increased inflammatory mediator production
  - Defective mucus

Pathology of UC

- The disease usually begins in the rectum, and either stays there or proceeds proximally
- Occasionally, the distal terminal ileum is involved (backwash ileitis) is involved
- Diffuse inflammation of affected mucosa with hyperemia, granularity, and surface pus and blood occur
- In severe cases, this leads to ulceration
- The ulcerations heal by granulation to form multiple pseudopolyps
Microscopically, acute and chronic inflammatory cells infiltrate the lamina propria and crypts. Goblet cells lose their mucus. The mucosa is hyperemic and edematous with ulceration. Biopsies of long-standing UC show dysplastic changes in which epithelial cell nuclei are enlarged, crowded, and lose polarity. Consequently, dysplasia may lead to carcinoma.

Clinical features
- The onset of UC is usually gradual.
- Severity varies with activity and extent of disease.
- The history is chronic, with relapses and remissions over many years.
- Between attacks, there are usually no symptoms.

Factors that precede a relapse
- Emotional stress.
- Co-current infection.
- Acute gastroenteritis.
- Treatment with drugs (antibiotics and NSAIDS).
- Discontinuation of prophylactic treatments.

Clinical Features of Active UC
- Proctitis: rectal bleeding and mucus discharge.
- Proctosigmoiditis: rectal bleeding and mucus discharge, with diarrhea, urgency, abdominal pain; may be malaise.
- Extensive colitis: profuse, frequent diarrhea with blood and mucus, fever, malaise, anorexia, weight loss; patient is thin, anemic, fluid-depleted, febrile, and tachycardic.

Local complications of UC
- Toxic megacolon: not common; patient has tachycardia, fever, pain, abdominal distention, tenderness, loss of bowel sounds.
- Colonic perforation: occurs with very active UC; corticosteroids often mask symptoms, leading to peritonitis.
- Hemorrhage: rare.
- Carcinoma: increased in patients with UC for more than 10 years; cumulative risk is 20% at 30 years; childhood onset and continuous relapses also increase carcinoma risks.

Systemic complications of UC
- GI: diarrhea, rectal bleeding and pus, weight loss, malaise, growth retardation.
- Skin: erythema nodosum, pyoderma gangrenes.
- Eyes: episcleritis, uveitis.
- Mouth: aphthous ulceration.
- Joints: enteropathic arthropathy, sacroilitis, AS.
- Liver: fatty changes, hepatitis, amyloid deposits.
- Biliary tract: sclerosing cholangitis, bile duct CA.
- Lungs: fibrosing alveolitis.
- Kidneys: uric acid stones, amyloid.
- Blood: arterial and venous thrombosis.
Differential diagnoses

- Inflammation: ulcerative colitis, Crohn’s disease, Behcet’s disease
- Infection: Campylobacter, Salmonella, shigella, E. coli, Staph. Aureus, Schistosoma, TB
- Iatrogenic: irradiation, drugs (NSAIDS)

Investigation

- Hematology: complete blood count (CBC), erythrocyte sedimentation rate (ESR)
- Biochemistry: serum albumin is often low
- Microbiology: stools show WBC and RBC
- Plain film: altered bowel gas patterns
- Barium enema: shows ulcerations, granulation with loss of haustra
- Sigmoidoscopy: inflamed rectal mucosa
- Colonoscopy: helps define extent of disease (ileum?); helps distinguish UC from CD with biopsies; screens for CA

Management

- The aim of all care is to induce and maintain remission
- High fiber diets, bulking agents
- Corticosteroids
- IV fluids
- Antibiotics
- Hematinic agents
- Surgery

Preventive treatments

- Surveillance colonoscopy with multiple biopsies to look for dysplasia every 1-2 years
- Colectomy if histology changes are noted

Prognosis

- Most people with UC experience recurrent episodes of acute colitis, but mortality rate is similar to general population
- The main risks are for those with severe acute colitis attacks and colonic cancer with chronic UC
Crohn Disease (CD)

- **Epidemiology:**
  - Like UC, CD is most common in developed countries
  - Prevalence is 50/100,000
  - Unlike UC, the incidence of CD has risen rapidly and continuously since 1960
  - Bimodal peak of occurrence at 20-30 years and elderly
  - More common in women
  - Most common in Caucasians, particularly Jews
  - 10% increase with first degree relatives and with AS

Etiology and pathogenesis

- Like UC, the cause of CD is unknown
- Possible factors:
  - Infection: resembles intestinal TB
  - Immunological: may be impaired
  - Diet: found more in those that eat refined carbohydrates, particularly sugar, but could be a secondary phenomenon
  - Smoking: patients with CD are more likely to smoke

Pathology

- Crohn disease can affect any part of the gut, most frequently the anus, ileocecum, small bowel, and colon
- Typically, there are discontinuously affected gut segments (**skip lesions**)
- The first abnormality is aphthoid ulceration, which progresses to deep fissuring ulcers with cobblestoning, fibrosis, stricturing, and fistulation
- Histologically, there is transmural chronic inflammatory cell infiltration with ulceration, abscesses, granulomas

Clinical features

- Clinical features vary depending upon site of disease (versus UC)
- The history is usually chronic with relapses and remissions
- Common symptoms are:
  - Diarrhea
  - Weight loss
  - Abdominal pain
  - Fever

- With small bowel disease, steatorrhea is common
- With large bowel disease, rectal bleeding is common
- Chronic perianal symptoms are common
- Examination may show malabsorption, perianal disease (skin tags, fissures, fistulae, abscesses), abdominal mass, digital clubbing

Local complications

- Strictures: commonly present with obstruction and malabsorption
- Perforations: common, produce abscesses
- Abscess and fistula: usually form close to inflamed bowel and later discharge through fistulae into the skin, GI, bladder, vagina
- Hemorrhage: usually minor from inflamed mucosa
- Toxic megacolon: rarer in CD than UC
- Carcinoma: small bowel and colorectal CA are slightly more common among people with CD than in general population
Systemic complications

- GI: diarrhea, abdominal pain, steatorrhea, rectal bleeding, perianal disease, weight loss, fever, growth retardation, malabsorption
- Skin, eyes, and mouth: erythema nodosum, episcleritis, uveitis, aphthous ulceration
- Joints: enteropathic arthropathy, sacroilitis, AS, clubbing
- Liver: fatty changes, hepatitis, cirrhosis, amyloid
- Biliary tract: gallstones, sclerosing cholangitis, bile duct CA
- Kidneys: oxalate stones, uric acid stones, amyloid
- Blood: arterial and venous thrombosis

Differential diagnoses

- Same as differentials for UC
- CD more likely to have a right-sided abdominal mass than UC
  - Other causes of ileocecal mass differentials:
    - Crohn’s disease, appendix mass, lymphoma, TB, yersiniosis, amoebiasis, actinomycosis
- CD may have masses at other sites: Ovarian, tubal, renal

Investigation

- Similar to those for UC, but also include small bowel radiology and tests for malabsorption

Management

- Treatment is again aimed at reducing relapses
- Unlike UC, prophylactic therapy is not as well-established
- Support groups
- Nutritional support

Prognosis

- Most patients experience recurrent morbidity throughout their lives from CD and its treatment
- The risk of death is 2 times that of general population

Nutritional support

- Diet: avoid high-residue foods (corn, uncooked vegetables)
- Drugs: therapies for diarrhea, corticosteroids
- Surgery: about 80% of patients with CD require surgery eventually, and 50% of these will need a second operation within 15 years
- Because CD tends to recur, surgical removal is as conservative as possible
Hepatobiliary System

- Hepatitis
  - Inflammatory process characterized by diffuse or patchy hepatocellular necrosis
- Cirrhosis
  - Diffuse hepatic process characterized by fibrosis and alteration of normal liver architecture into structurally abnormal nodules
Hepatobiliary System
- Primary hepatocellular carcinoma
  - Frequently arises in the setting of cirrhosis, approximately 20 to 30 years after liver injury or disease onset
  - About 25% have no prior risk factors for cirrhosis
- Cholelithiasis
  - Stone formation in the gallbladder occurs when certain substances reach a high concentration in bile and produce crystals

Hepatobiliary System
- Cholecystitis
  - Inflammatory process of the gallbladder most commonly due to obstruction of the cystic duct from cholelithiasis; may be either acute or chronic
- Nonalcoholic fatty liver disease (NAFLD)
  - Spectrum of hepatic disorders not associated with excessive alcohol intake ranging from steatosis to cirrhosis and hepatocellular carcinoma

Pancreas
- Acute pancreatitis
  - Acute inflammatory process in which release of pancreatic enzymes results in glandular autodigestion
- Chronic pancreatitis
  - Chronic inflammatory process of the pancreas, characterized by irreversible morphologic changes

Spleen
- Spleen laceration/rupture
  - Most commonly injured organ in abdominal trauma because of its anatomic location
  - Mechanism of injury can be either blunt or penetrating but is more often blunt (e.g., from motor vehicle accidents)

Kidney
- Acute glomerulonephritis
  - Inflammation of the capillary loops of the renal glomeruli
- Hydronephrosis
  - Dilation of the renal pelvis and calyces due to an obstruction of urine flow anywhere from the urethral meatus to the kidneys
- Pyelonephritis
  - Infection of the kidney and renal pelvis

Kidney
- Renal abscess
  - Localized infection within the medulla or cortex of the kidney
- Renal calculi
  - Stones formed in the pelvis of the kidney from a physiochemical process associated with obstruction and infections in the urinary tract
- Acute renal failure
  - Sudden impairment of renal function over hours to days resulting in an acute uremic episode
Infants

- Intussusception
  - Prolapse, or telescoping, of one segment of intestine into another causes intestinal obstruction
- Pyloric stenosis
  - Hypertrophy of the circular muscle of the pylorus leads to obstruction of the pyloric sphincter
- Meconium ileus
  - Distal intestinal obstruction caused by thick inspissated impacted meconium in the lower intestine

Pyloric stenosis in infants

- Infantile pyloric stenosis occurs in neonates; it is acquired in the early stages of life; it was at one time thought to be a purely congenital condition.
- The neonate vomits large quantities of curdled and unpleasant smelling milk. The vomit is forcefully ejected, justifying the adjective "projectile".
- Careful examination reveals the distended stomach and a smooth ovoid mass just below the right costal margin, which is the hypertrophied pylorus.

Pyloric stenosis symptoms

- Vomiting
  - Usually mild at first, becoming progressively more forceful within one half hour of feeding
  - Projectile vomiting
- Infant appears constantly hungry
- Watery green stools
- Wave-like motion of the abdomen shortly after feeding
- Belching before vomiting occurs
- Dehydration (becoming more profound with the severity of the vomiting)
- Failure to gain weight or weight loss
- Abdominal fullness very shortly after meals
- Abdominal pain

Pyloric stenosis in adults

- An adult with pyloric stenosis presents with vomiting which is usually large in volume, not bile-stained and, if the condition is long-standing, not acidic because gastric acid secretion is reduced.
- The stomach contents are not digested and the patient may recognize food that was eaten 24 or 48 hours previously. Apart from the epigastric distension, visible gastric peristalsis and a succussion splash, there may be no other abnormal physical signs.
Infants

- Biliary atresia
  - Congenital obstruction or absence of some or all of the bile duct system resulting in bile flow obstruction
  - Most have complete absence of the entire extrahepatic biliary tree
- Meckel diverticulum
  - Outpouching of the ileum that varies in size from a small appendiceal process to a segment of bowel several inches long, often in the proximity of the ileocecal valve

Infants

- Necrotizing enterocolitis
  - Inflammatory disease of the gastrointestinal mucosa associated with prematurity and immaturity of the gastrointestinal tract

Children

- Neuroblastoma
  - Common solid malignancy of embryonal origin in the peripheral sympathetic nervous system
- Wilms tumor (nephroblastoma)
  - Most common intraabdominal tumor of childhood; usually appears at 2 to 3 years of age

Children

- Hirschsprung disease (congenital aganglionic megacolon)
  - Primary absence of parasympathetic ganglion cells in a segment of the colon that interrupts intestinal motility
- Hemolytic uremic syndrome (HUS)
  - Triad of microangiopathic hemolytic anemia, thrombocytopenia, and uremia

Older Adults

- Fecal incontinence
  - Inability to control bowel movements leading to leakage of stool
  - Associated with three major causes
    - Fecal impaction
    - Underlying disease
    - Neurogenic disorders