

GI (Part I & Part II) Review of A & P

Purpose of GI tract: to supply nutrients for use at the cellular level, meet nutritional needs, eliminate waste

Process of GI System

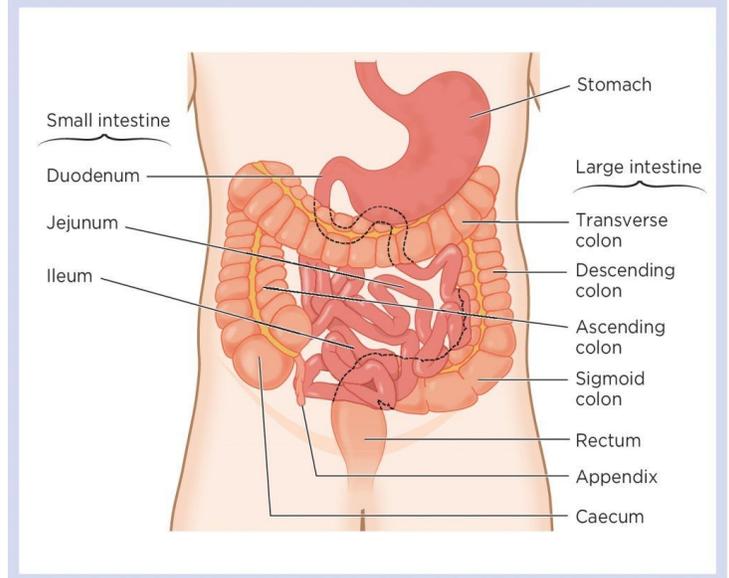
Ingestion: taking in food

Digestion: breaking down to molecules for absorption

Absorption: transfer from GI tract to circulation to liver

Elimination: excretion of waste products of digestion

Fig 1. **Anatomy of the small and large intestines**



Layers of the GI tract

Mucosa: innermost layer. *Protects, secretes, absorbs.*

Submucosa: contains blood & lymph vessels. *Transports nutrients.*

Muscularis or muscular layer: smooth muscle fibers arranged in circular & longitudinal groups. *Motility*

Serosa or serous layer: outer covering. *Protection*

Peritoneum: lines walls of entire abdominal cavity & forms the peritoneal cavity.

Two folds of peritoneum: *Mesentery* (blood & lymph) & *Omentum* (fat covering for protection).

Blood supply to GI tract

Aorta to celiac artery and superior and inferior mesenteric arteries

Superior and inferior mesenteric arteries supply small and large intestines

Venous blood draining GI tract empties into portal vein & carries nutrient rich blood to liver.

25–30% of total cardiac output

Secretions of GI tract

Mucous: from mouth to anus. *Protects and lubricates.*

Digestive secretions: enzymes, hormones, digestive juices, bile, pancreatic juices. **Breaks down foods for absorption.**

Motility of GI tract: wavelike movements called *peristalsis*. (*Stimulus is expansion of lumen of tract by food*).

Gastrocolic and **Duodenocolic Reflex** – *leads to urge to defecate after eating.*

Bacteria: normal component of GI Tract. *Essential for function & major component of colon.*

Innervation

Sympathetic: inhibits or decreases digestive actions. *Slows down motility.*

Parasympathetic impulses: increases frequency, strength, & velocity of GI contractions. *Speeds up motility.*

Ingestion: intake, mastication (chewing), deglutition (swallowing)

Mouth

Functions:

1. **Mastication** - mechanically reduces size of food particles & mixes with saliva
 - *Protects esophagus from trauma by ↓ size of particles.*
2. **Speech**
3. **Expression**
4. **Taste**

Salivary glands: *parotid, submaxillary, sublingual*

Salivary secretions: 1000-1500cc saliva produced daily

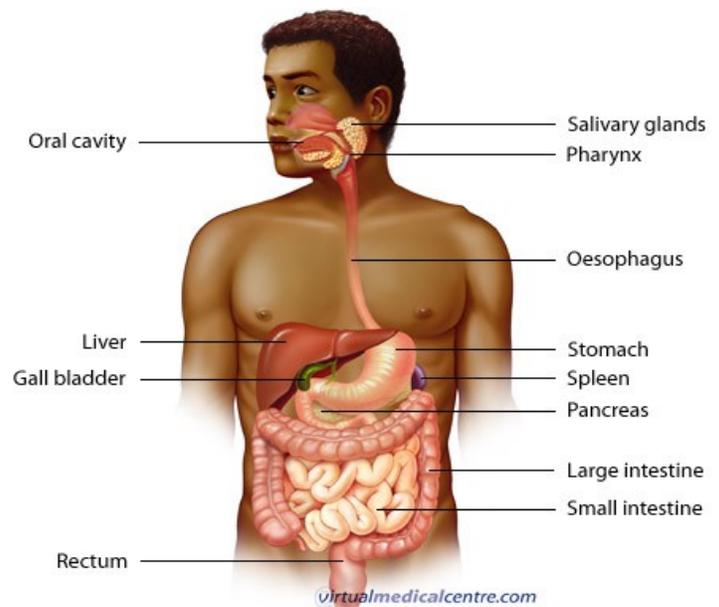
Amylase: begins digestion of starches

Pharynx: Nasopharynx, Oropharynx, Laryngopharynx

- *Pharyngeal muscles regulate swallowing.*

Act of Swallowing = **Deglutition.**

- *Initiated voluntary (force food into pharynx)*
- *Involuntary (swallowing reflex)*
- *3rd stage (transported by peristalsis to stomach.)*



The Esophagus: *transports food to stomach*

Penetrates diaphragm thru *esophageal hiatus*

Upper esophageal sphincter (UES) (pharyngo-esophageal sphincter)

Lower esophageal sphincter (LES) (gastroesophageal sphincter) – *prevents acid reflux into esophagus.*

The Stomach: *mixes food with gastric secretions*

Stores food until it can pass into small intestines

Empties content at rate which digestion can occur

LES: between esophagus and stomach

Pyloric Sphincter: between stomach & duodenum

Gastric Secretions: *chemical liquefaction of ingested food*

Gastrin stimulates secretions of parietal & chief cells

Parietal cells: secrete HCL & intrinsic factor

Chief cells: produce pepsinogen→pepsin→protein digestion.

Mucous neck cells: secrete alkaline mucus to lubricate & protect stomach from self-digestion.

Pyloric glands: secretes mucus

Gastric emptying: *chyme composition affects emptying rate*

Controlled by nerve impulses, chyme, & hormonal effects

Vagal stimulation increases emptying rate, excessive distention and exercise decrease rate

Fats & duodenal chyme (high acid) = activate the enterogastric reflex = ***inhibits gastric motility & secretion.***

Allows pancreatic juices time to neutralize in duodenum.

Small Intestine: *major site for digestion & absorption*

Major nutrients absorbed in small intestines

Villi: increase surface area, enhance absorption of nutrients

Duodenum & jejunum: carbohydrates, amino acids, lipids, iron, calcium

Ileum: water (8 liters/day), electrolytes, bile salts, vitamins

Large Intestines: *absorption of water & electrolytes*

Stores feces until elimination occurs

Mass movements-strong peristaltic actions occur when colon becomes filled

Peristalsis breaks chyme into large pockets (haustra), extracts water, chyme becomes solid feces.

Rectum

Connects sigmoid colon & anus

Storage & expulsion of stool

Anorectal (dentate) line divides rectal innervation, blood supply, and lymph drainage

2 sphincters:

- ***Internal*** – involuntary control. Autonomic nerves make area insensitive.
- ***External*** – voluntary control. Somatic nerves make area very sensitive.

Defecation Reflex: feces moves into rectum...stretches muscles & causes distention...activates

Parasympathetic nervous system...relaxes sphincters...constricts muscles...forces feces out

Chronic Constipation occurs when Defecation Reflex is ignored or inhibited regularly.

Major Functions of Liver

Bile production & secretion

Carbohydrate metabolism

Protein metabolism

Formation of clotting factors

Fat metabolism

Vitamin & mineral storage

Filtration/Detoxification

Blood storage

Liver Anatomy

Lobule: liver's functional units are hepatocytes (primary liver cells)

Kupffer Cells: reticuloendothelial cells provide crucial filtering system (part of immune system)

- ***Phagocytically destroy old RBCs & remove bacteria from blood***

Portal vein & hepatic artery supply blood to liver.

25-30% cardiac output, resulting in 1500 cc blood flowing through liver each minute.

Portal vein: supplies 75% of blood to liver

Hepatic artery: supplies other 25% as oxygenated blood.

Blood returns to inferior vena cava via hepatic veins.

Pancreas

Exocrine- functions as part of GI system.

500-1000cc of pancreatic juice/day to aid in digestion

Alkaline pH -8.30 to neutralize acid chyme.

Enters duodenum via pancreatic duct to common bile duct

Gall Bladder & Biliary Tract

Gallbladder stores and concentrates bile made in the liver – ***bile emulsifies fats.***

Common bile duct carries bile & empties into duodenum at **Ampulla of Vater.**

Sphincter of Oddi: ***controls flow of bile into intestines***

Food ingestion stimulates secretion of cholecystokinin-pancreozymin from duodenum - stimulates GB

Secretin released - stimulates liver to produce more bile

Bilirubin is a pigment derived from breakdown of hemoglobin – main component of bile

In intestine, bilirubin is converted to urobilinogen by bacterial action

Excreted in feces, giving brown color

1% reabsorbed by blood & excreted via kidneys, giving urine yellowish color

GI Assessment

Health History establishes timeframe and baselines – *question changes in appetite, weight, and stool patterns*

- Chief Complaint/present illness
- Age, gender, culture
- Past medical history
- Family history
- Psychosocial history
- Eating habits

Abdominal Pain

Characteristics

Question relationship to food, alcohol, medications

Relief measures

Abdominal Assessment

4 quadrants
Sequence very important

Inspection:

- At eye level (*may need to stoop down at the side of the bed*)
- Note patient's position of comfort
- Note contour – convex vs. concave
- Cullen's sign – bluish around umbilicus
- Note any pulsations
- Measure abdominal girth (fluid, distention)

Auscultation:

- Listen in each quadrant until hear bowel sounds – high pitched gurgles every 5-15 seconds normal
- Turn off NG tube before auscultate – remember to turn back on!!

Percuss:

- Detect fluid/solid or air
- Tympanic sound is normal (air)

Palpate:

- RNs do light palpation only
- Board-like abdomen or muscle guarding
- Subcutaneous emphysema – air under skin leaking from bowel
- Rebound tenderness (Blumberg's Sign) – *pain on rebound classic sign of peritonitis*
- McBurney's Point – 1/3 distance between umbilicus and iliac crest. *Pain = appendicitis*
- DO NOT palpate any pulsations!

Diagnostic Studies:

- CBC
- WBCs
- PT
- Electrolytes
- Liver function studies (LFTs)
- Oncofetal Antigens: CEA and CA 19-9
- Stool analysis – consistency, color, blood, pus, fatty content
- Stool culture: detects bacteria
- Ova & parasite (O&P) = detects parasites or their eggs-hookworm, tape worm, pin worm
- Fecal Occult Blood Test (hemocult)
- Gastric Analysis: provides information about secretory function of mucosa

Other Diagnostic Studies:

- Paracentesis: void prior to procedure

- Esophageal manometry: evaluates quality of esophageal peristalsis
- Acid perfusion or Bernstein test: used to differentiate esophageal pain from angina
- GI Cocktail: **combination of an antacid, liquid anesthetic & anticholinergic**- determines a diagnosis between GERD and Heart issue.

Radiology Testing

- Plain film of abdomen
- CXR: gallstones frequently picked up on chest x-ray.
- CAT Scan/MRI
- Upper GI Series/Barium swallow
- Lower GI series/Barium enema
- Abdominal Angiogram: catheter inserted into blood vessel & dye injected to provide information about arterial, capillary, +/-or venous network of major abdominal organs.

Endoscopy

- EDG
- Colonoscopy: examination of large bowel for polyps, tumors, ulcerative colitis. **Bowel prep before.**
- Sigmoidoscopy
- ERCP: Endoscopic retrograde cholangiopancreatography.
- MRCP - Magnetic resonance cholangiopancreatography

Nuclear Imaging Scans – radioactive contrast dye

- HIDA: evaluates hepatobiliary function, gallbladder
- Bleeding Scan: used in non-urgent situations to identify GI bleeding sites.

Others

Ultrasounds

Pill Cam

Liver Biopsy – needle inserted through abdominal wall into liver, sample removed for microscopic exam

Potential complications:

- hemorrhage (check PTT prior to)
- chemical peritonitis from bile leak into abdomen
- pneumothorax: improper placement of needle into thoracic cavity

Nursing – position patient on right side for 2 hours after procedure, monitor for hemorrhage.

Community Resources: specialized nursing, home health care, local and national support groups.

Geriatric Considerations:

- decreased functional ability of GI tract
- anorexia
- decreased drug metabolism