Medical Nutrition Therapy for Upper Gastrointestinal Tract Disorders

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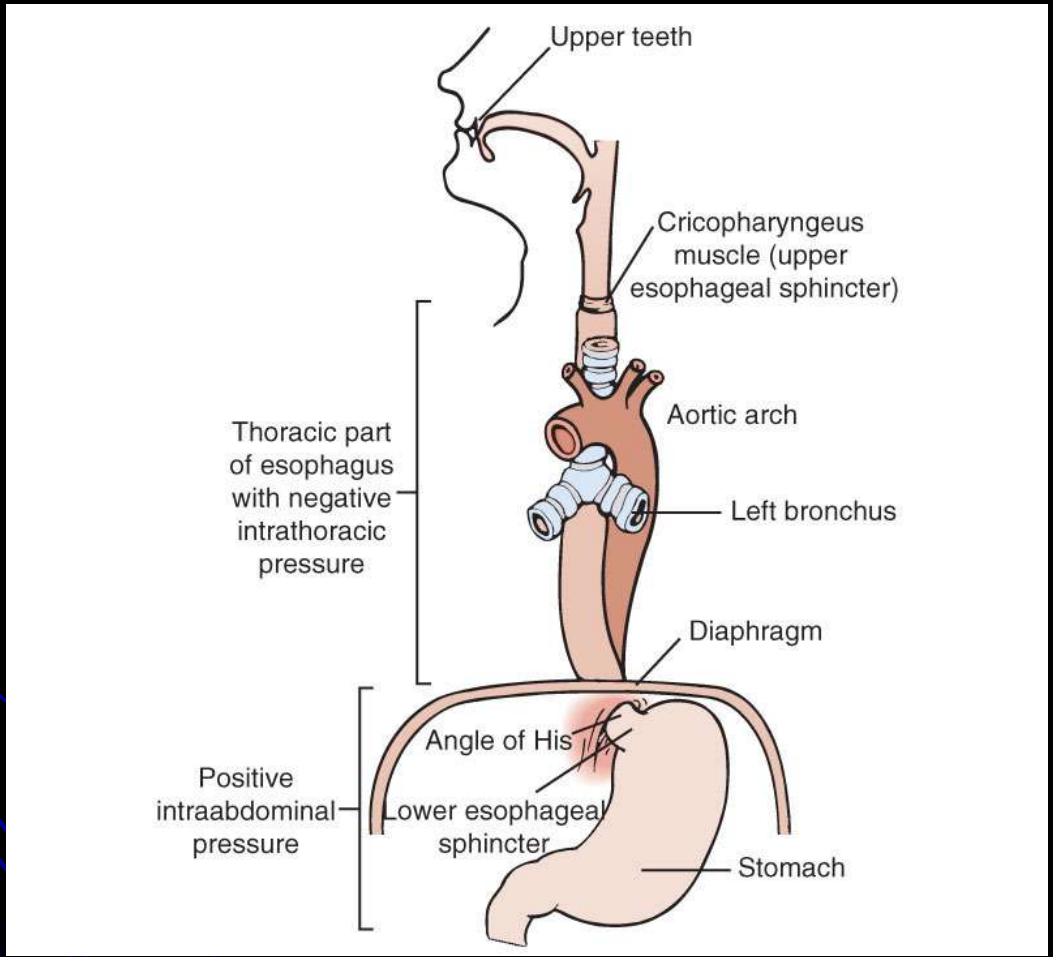
Digestive Disorders

- Common problem; more than 50 million outpatient visits per year
- Dietary habits and nutrition play key roles in prevention and treatment of diseases of the gastrointestinal tract (GIT)
- Medical nutrition therapy is necessary to prevent and treat malnutrition associated with the diseases of the GIT

Assessment Parameters

- Screening: most important indicator is unintentional weight loss
- Diet history: changes in appetite, nausea, vomiting, diarrhea, chewing and swallowing problems, food intolerances, typical intake
- Laboratory parameters: vitamin B_{12}, folate, ferritin, 25-hydroxy vitamin D

Normal Esophagus



Disorders of the Esophagus

- Gastroesophageal reflux disease (GERD)
  - Backward flow of the stomach, duodenal contents, or both into the esophagus
  - Burning sensation after meals; heartburn
  - Competency of the lower esophageal sphincter (LES)
  - Possible discomfort during and after eating; change in eating habits, especially in the evening

Esophagitis

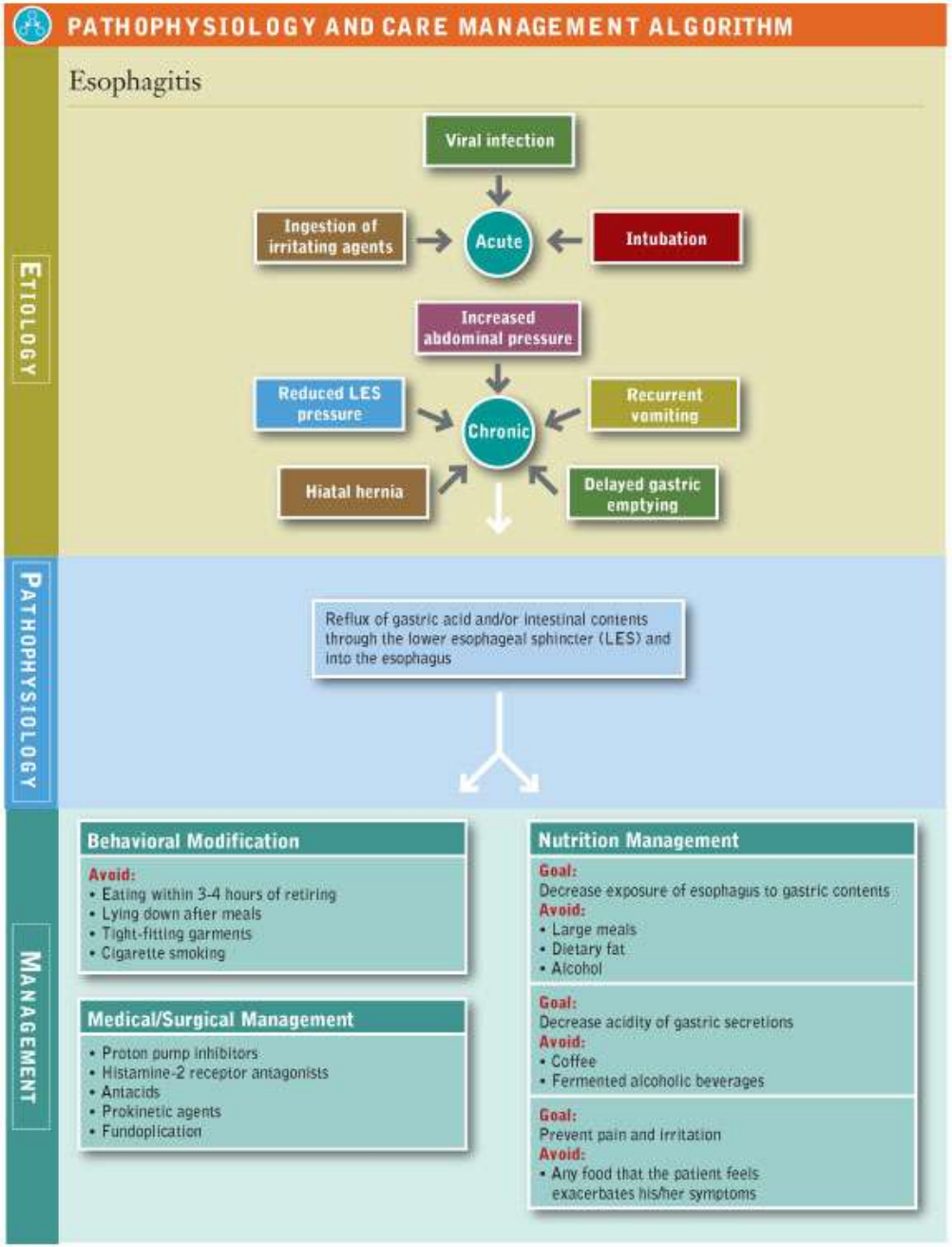
- Inflammation, ulceration, erosions, scarring
- Acute from reflux, ingestion of a corrosive agent, infection, intubation, radiation
- Chronic from prolonged contact with gastric acid or other irritant (e.g., NSAIDs)
- Barrett’s esophagus results in 5% to 15%

Barrett's Esophagus

- Precancerous condition
- Risk factors include prolonged GERD, male gender, age older than 50 years, family history
- Increasing incidence

Nutritional Care Guidelines for Patients with Reflux and Esophagitis

- Avoid large, high-fat meals.
- Avoid eating at least 3 to 4 hours before retiring.
- Avoid smoking.
- Avoid alcoholic beverages.
- Avoid caffeine-containing foods and beverages.
- Stay upright and avoid vigorous activity soon after eating.
- Avoid tight-fitting clothing, especially after a meal.
- Consume a healthy, nutritionally complete diet with adequate fiber.
- Avoid acidic and highly spiced foods when inflammation exists.
- Lose weight if overweight.

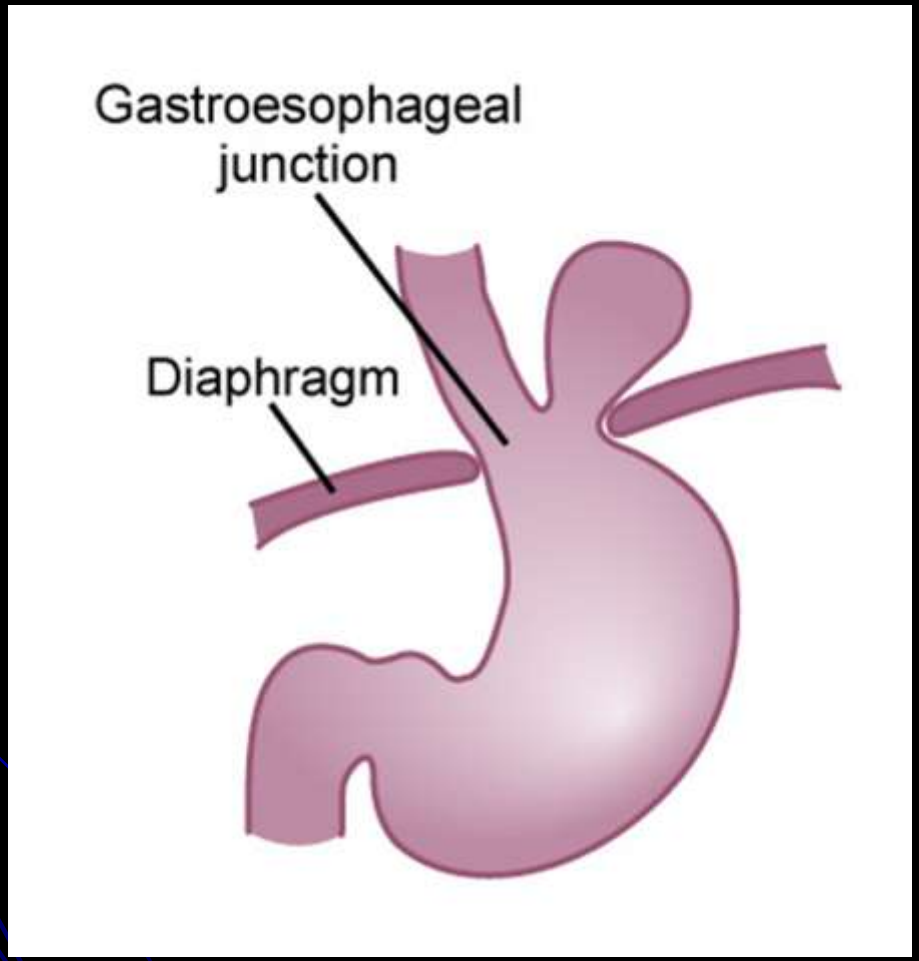


Disorders of the Esophagus (cont'd)

Hiatal hernia

- An outpouching of a portion of the stomach into the chest through the esophageal hiatus of the diaphragm
- Epigastric discomfort after large, energy-dense meals
- Medical nutrition therapy: weight reduction, decreasing meal size
- May require surgery

Hiatal Hernia



Disorders of the Esophagus (cont'd)

Cancer and surgery of the mouth or esophagus

- Existing nutritional problems and eating difficulties caused by the tumor mass, obstruction, oral infection, and ulceration
- Chewing, swallowing, salivation, and taste acuity are often affected
- Weight loss is common

Disorders of the Stomach

Indigestion or dyspepsia

- Epigastric discomfort after meals
- Abdominal pain, bloating, early satiety, nausea, and belching
- Reduce dietary fat intake, use smaller meals, eat meals with low caloric density, limit alcohol

Disorders of the Stomach (cont'd)

Gastritis

- *Helicobacter pylori*
- Infection and inflammation
- Acute gastritis: rapid onset of inflammation and symptoms
- Chronic gastritis: occurs over period of time
- Symptoms: nausea, vomiting, malaise, anorexia, hemorrhage, and epigastric pain

Disorders of the Stomach (cont'd)

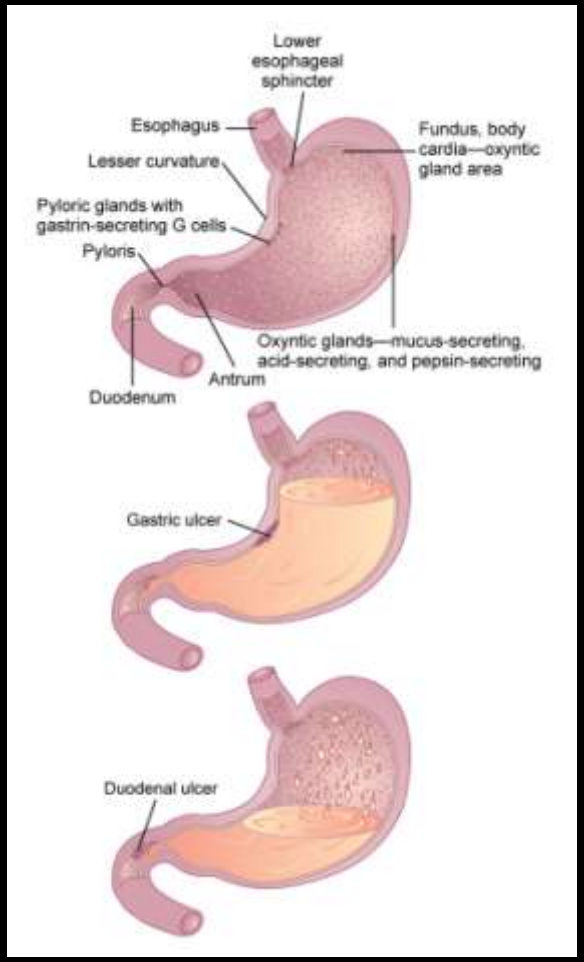
Peptic ulcer disease

- Primary causes: *H. pylori* infection, gastritis, use of NSAIDs, corticosteroids, and so-called stress ulcers
- Involves gastric and duodenal regions
- Gastric ulcers: in stomach; normal or low acid secretion
- Duodenal ulcers: in duodenum; high acid secretion

Characteristics and Comparisons Between Gastric and Duodenal Ulcers

- Gastric ulcer formation involves widespread gastritis, inflammation of oxyntic cells, and atrophy of acid- and pepsin-producing cells
- Duodenal ulcers are associated with high acid and low bicarbonate secretion
- Hemorrhage and increased mortality are associated with gastric ulcers

Gastric and Duodenal Ulcers

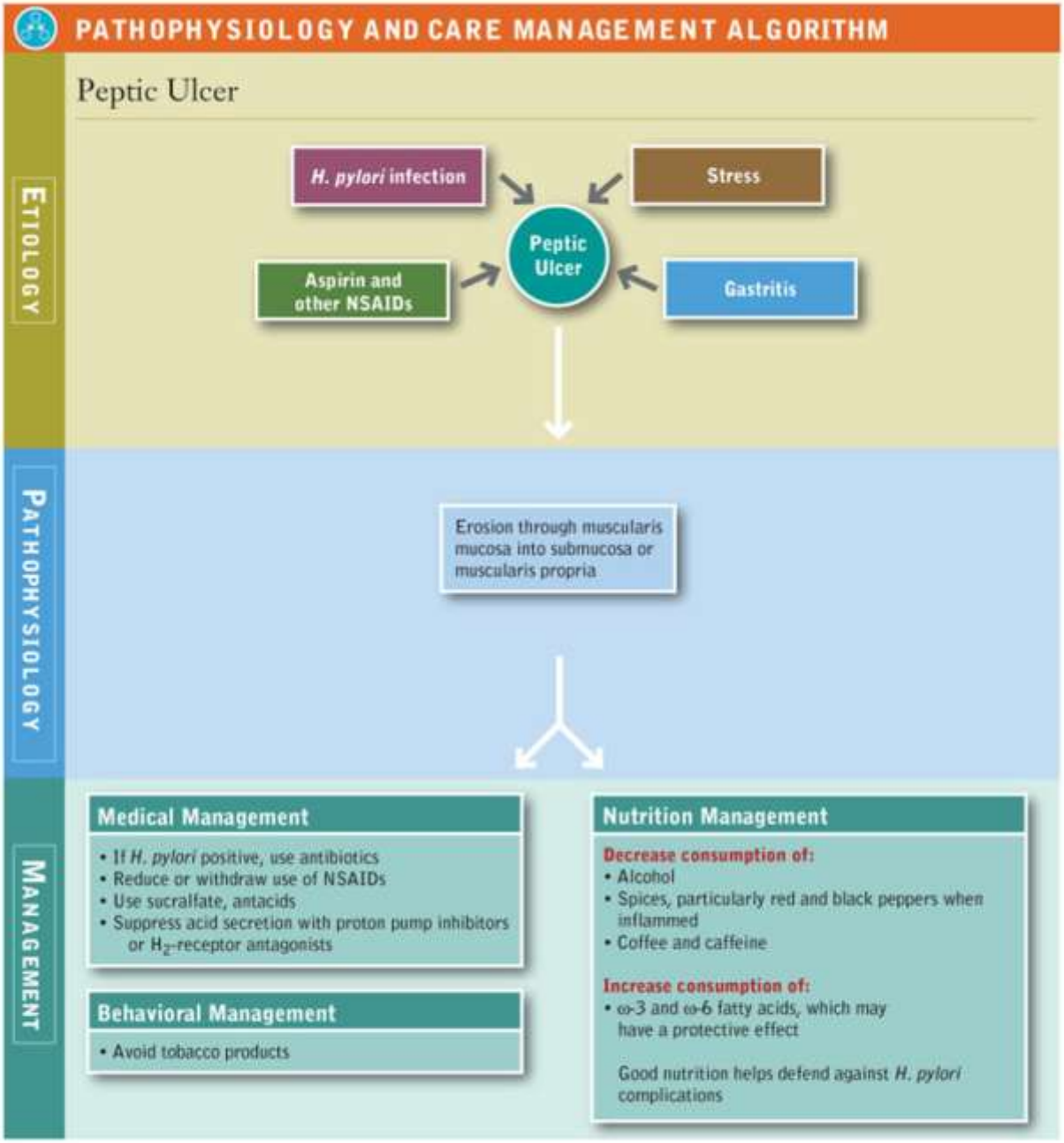


Management of Peptic Ulcers

- Antibiotics
- Acid suppression
- Surgery
- Stress reduction

Medical Nutrition Therapy for Peptic Ulcers

- Protein foods buffer gastric secretions by also stimulate gastrin, acid, and pepsin
- Moderate alcohol intake
- Usually not necessary to limit acidic foods; most foods are much less acidic than normal gastric pH of 1 to 3
- Chili, cayenne, and black pepper and caffeine may increase acid secretion
- Overall good diet; frequent small meals



Stress Ulcers

- Complication of severe burns, trauma, surgery, shock, radiation therapy, or renal failure
- Gastric ischemia, hypoperfusion, oxidative injury, reflux of bile acids or pancreatic enzymes, microbial colonization, and mucosal barrier changes are implicated
- Significant cause of morbidity in critically ill patients
- Use of antioxidant compounds show promise

Factors That Affect Gastric Acidity

Increase Gastric Acidity

Cephalic Phase of Digestion

Thought, taste, smell of food, and chewing and swallowing initiate vagal stimulation of the parietal cells in the fundic mucosa, resulting in secretion of gastric acid.

Gastric Phase of Digestion

Effect of food in the stomach:

- Distension of the fundus stimulates the parietal cells to produce acid.
- Increased alkalinity of antrum causes the release of gastrin, which stimulates gastric acid secretion.
- Distension of the antrum causes release of gastrin.
- Substances in certain foods and digestive products increase acidity (e.g., coffee, both with or without caffeine; alcohol; polypeptides and amino acids [products of protein digestion]).

Decrease Gastric Acidity

Gastric Phase of Digestion

Acidification of the antrum reduces gastrin release and thus gastric acid secretion. Food, especially protein, has an initial buffering effect.

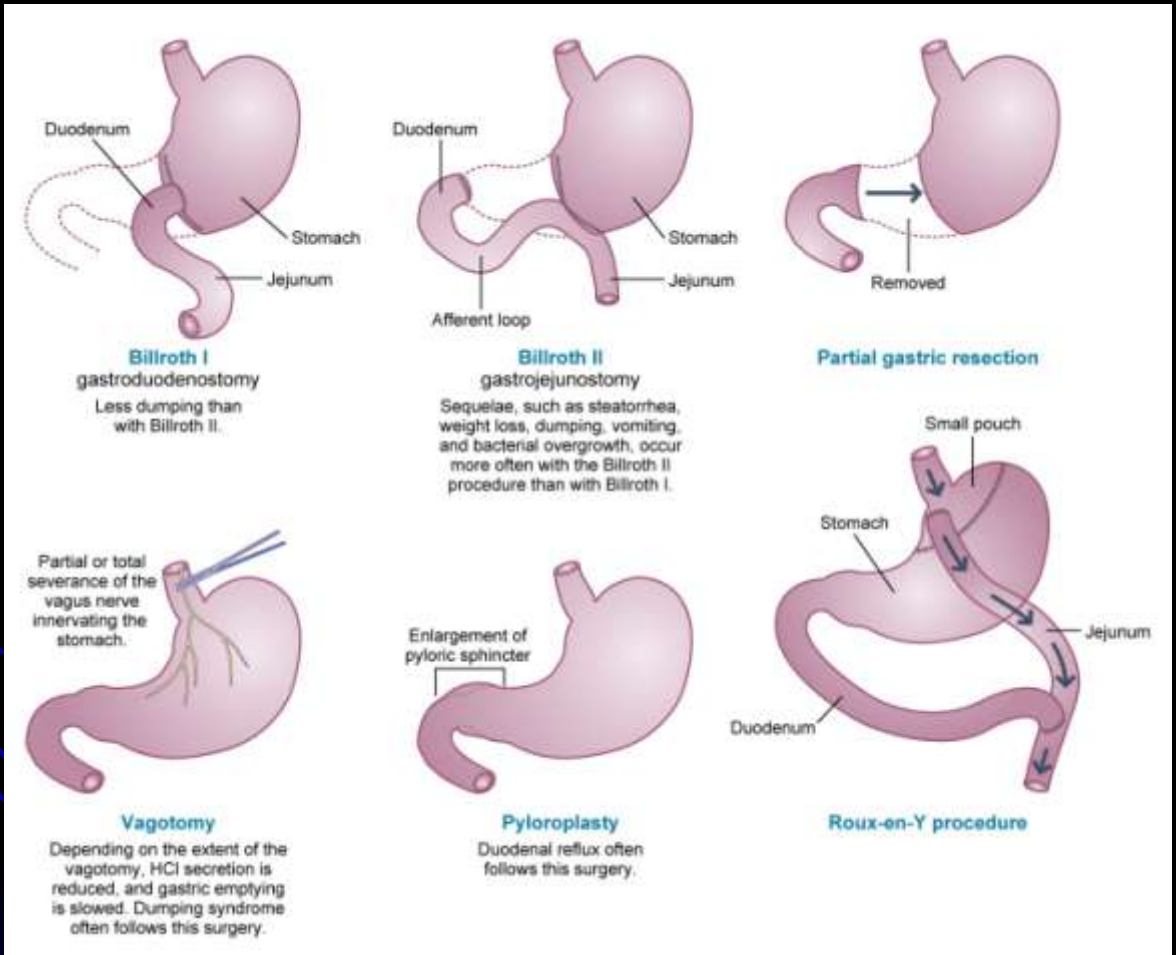
Intestinal Phase of Digestion

Fat, acid, and protein in the small intestine stimulate release of one or more GI hormones that inhibit gastric acid secretion.

Carcinoma of the Stomach

- Obstruction and mechanical interference
- Surgical resection or gastrectomy
- Prevention of GI cancers: fruits, vegetables, and selenium
- Increase risk of GI cancers: alcohol, overweight, high salted or pickled foods, inadequate micronutrients

Gastric Surgical Procedures



Dumping Syndrome

- Complex physiologic response to the rapid emptying of hypertonic contents into the duodenum and jejunum
- Dumping syndrome occurs as a result of total or subtotal gastrectomy
- Symptoms: abdominal fullness, nausea, flushing, rapid heartbeat, faintness, sweating, flatulence, abdominal cramps, diarrhea, alimentary hypoglycemia
- Often causes weight loss

Nutritional Care Guidelines for Patients with Dumping Syndrome and Alimentary Hypoglycemia

1. Small meals spread throughout the day are likely to result in improved net absorption and less dramatic fluid shifts.
2. High-protein, moderate-fat foods are recommended, with sufficient calories for weight maintenance or gain as needed. Complex carbohydrates are included as tolerated.
3. Intake of fibrous foods slows upper GI transit and increases viscosity. However, to avoid obstruction, caution should be used with large particles and fiber supplements, especially with esophageal or gastric outlet narrowing or dysmotility.
4. Lying down and avoiding activity an hour after eating may help slow gastric emptying.
5. Taking large amounts of liquids with meals is thought to hasten GI transit, but adequate amounts of liquid should be consumed throughout the day, small amounts at a time.
6. Only very small quantities of hypertonic, concentrated sweets should be ingested. These include soft drinks, juices, pies, cakes, cookies, and frozen desserts (unless made with sugar substitutes).
7. Lactose, especially in milk or ice cream, may be poorly tolerated because of rapid transit and thus may need to be avoided. Cheeses and yogurt are likely to be better tolerated.

Gastroparesis

- Delayed gastric emptying
- Complex condition associated with chemical and neurological factors
- Causes include diabetes, surgery, smooth muscle disorders, neuropathic disorders, psychological disorders, and obstruction
- 30% are idiopathic

Common Medications Used to Treat Disorders of the GIT

- Antibiotics: eradicate *H. pylori*, prevent or treat infection after abdominal wounds or surgery
- Antacids: neutralize gastric acid in acid reflux, peptic ulcer
- Proton pump inhibitors (omeprazole, lansoprazole): decrease gastric acid secretion
- Histamine-2 receptor antagonists (cimetidine, ranitidine): inhibit gastric acid secretion

Common Medications Used to Treat Disorders of the GIT (cont'd)

- Sucralfate (sulfated disaccharide): protects stomach lining and may increase mucosal resistance to acid or enzyme damage
- Metoclopramide or erythromycin to stimulate gastric emptying for gastroparesis

Medical Nutrition Therapy for Lower Gastrointestinal Tract Disorders

Common Intestinal Problems

- Intestinal gas and flatulence
- Constipation
- Diarrhea
- Steatorrhea
- Gastrointestinal strictures and obstruction

Intestinal Gas and Flatulence

- Air that is swallowed (aerophagia) and other gases are produced in the gastrointestinal tract (GIT) by digestive processes and bacteria
- Intestinal gases: nitrogen, oxygen, carbon dioxide, hydrogen, and sometimes methane
- Gas is passed by belching or flatus
- Gas production occurs in the stomach and small intestine from bacterial fermentation of carbohydrates and can result in abdominal distension and discomfort

Recommendations to Decrease Gas

- Eat slowly chew with the mouth closed
- Avoid chewing gum; avoid using straws
- Avoid high-fat meals
- Upright position during and after meals; do not remain sedentary if possible
- May need to limit lactose, sugar alcohols, and high-fructose corn syrup

Causes of Constipation: Systemic

- Side effect of medication
- Metabolic endocrine abnormalities, such as hypothyroidism, uremia, and hypercalcemia
- Spina bifida
- Parkinson’s disease
- Lack of exercise
- Ignoring the urge to defecate
- Vascular disease of the large bowel
- Systemic neuromuscular disease leading to deficiency of voluntary muscles
- Poor diet low in fiber
- Pregnancy

Causes of Constipation: Gastrointestinal

- Cancer
- Diseases of the upper GIT
- Diseases of the large bowel resulting in
  - Failure of propulsion along the colon (colonic inertia)
  - Failure of passage though anorectal structures (outlet obstruction)
- Irritable bowel syndrome
- Anal fissures or hemorrhoids
- Laxative abuse
- Patients on opioids

Medical Nutrition Therapy for Constipation

- Adequate soluble and insoluble dietary fiber
- Recommended intake is 14 g per 1000 kcal
  - About 25 g for women, 38 g for men, and 19 to 25 g for children
  - Supplements may be helpful

High-Fiber Diets

1. Increase consumption of whole-grain breads and cereals and other whole-grain products to six to 11 servings daily.
2. Increase consumption of vegetables, legumes, and fruits, nuts, and edible seeds to five to eight servings daily.
3. Consume high-fiber cereals, granolas, and legumes as needed to bring fiber intake to 25 g or more in women and 38 g or more daily in men.
4. Increase consumption of fluids to at least 2 L (or about 2 qt) daily.
5. Following these guidelines may cause an increase in stool weight, fecal water, and gas. The amount that causes clinical symptoms varies among individuals, depending on age and presence of GI disease, malnutrition, and resection of the GIT. These guidelines should be implemented slowly over a period of 1 to 2 weeks to give the GIT time to adjust and thus minimize symptoms of discomfort or gas.

Diarrhea

- Osmotic
- Secretory
- Medication induced
- Malabsorptive

Clostridium difficile

- Leading cause of nosocomial diarrhea in the United States
- Opportunistic proliferation of pathogenic organisms associated with antibiotic therapy
- Causes colitis, secretory diarrhea, severe dilation of the colon, peritonitis, and even death
- Spore forming and can be spread
- Diagnosed by stool sample
- Treatment with probiotics so far inconclusive

Medical Nutrition Therapy for Diarrhea

- Identify and treat underlying problem
- Replace fluid and electrolytes; oral glucose electrolyte solutions with potassium, soups and broths, vegetable juices, and other isotonic liquids
- Introduce starchy CHOs, low-fat meats, and small amounts of vegetables and fruits followed by lipids
- Avoid sugar alcohols, lactose, fructose
- Prebiotics and probiotics

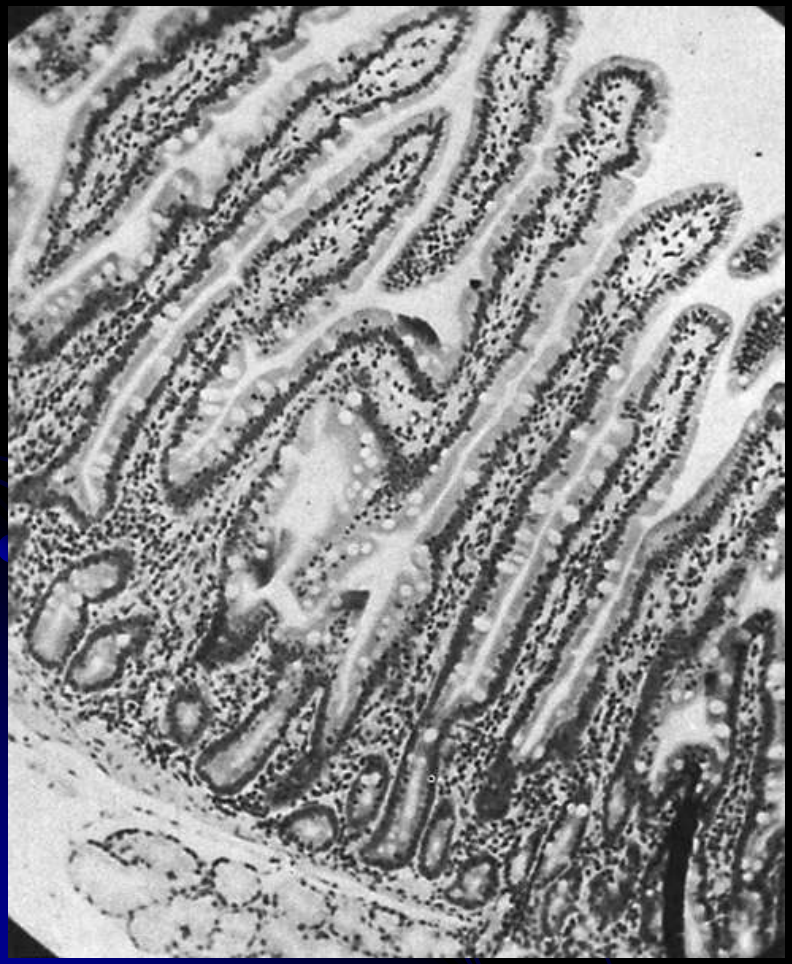
Strictures and Obstruction

- GI surgeries, IBD, peptic ulcer, radiation enteritis
- Obstructions may be partial or complete
- It is believed that fibrous foods contribute, although there are no controlled studies

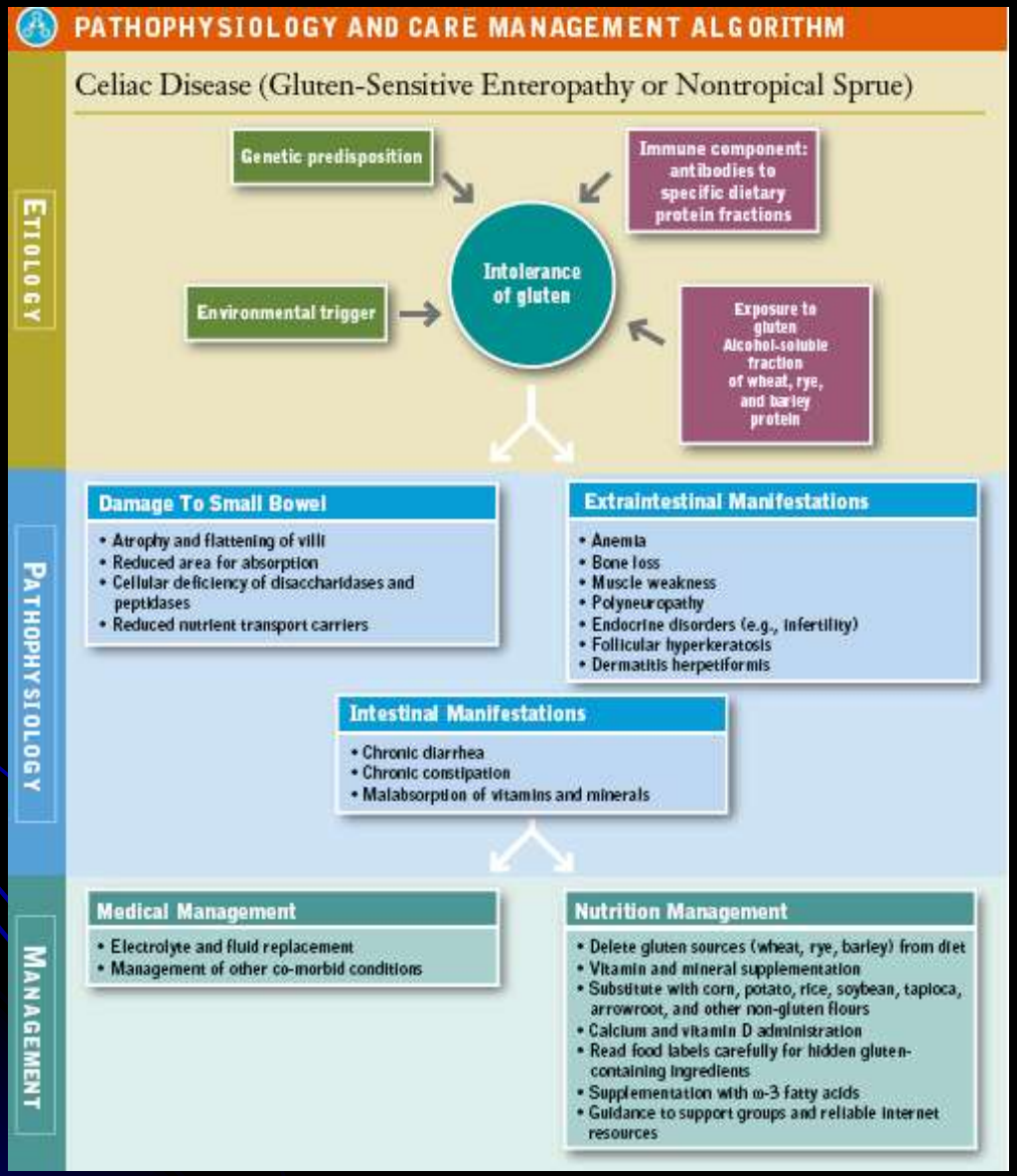
Celiac Disease: Gluten-Sensitive Enteropathy

- Adverse reaction to gluten; gliadin fraction
- Intestinal mucosa damaged
  - Malabsorption of nutrients
  - Iron deficiency
  - Osteomalacia
  - Growth failure
  - Projectile vomiting

Normal Human Duodenal Mucosa (A) and Peroral Small Bowel Biopsy Specimen (B) from a Patient with Gluten Enteropathy



Celiac Disease: Pathophysiology



Medical Nutrition Therapy for Celiac Disease

- Omit sources of gluten: wheat, rye, barley
- Label reading is critical
- Use uncontaminated corn, potato, rice, soybean, tapioca, arrowroot, amaranth, quinoa, millet, and buckwheat
- Oats are questionable
- Cross-contamination must be considered

Tropical Sprue

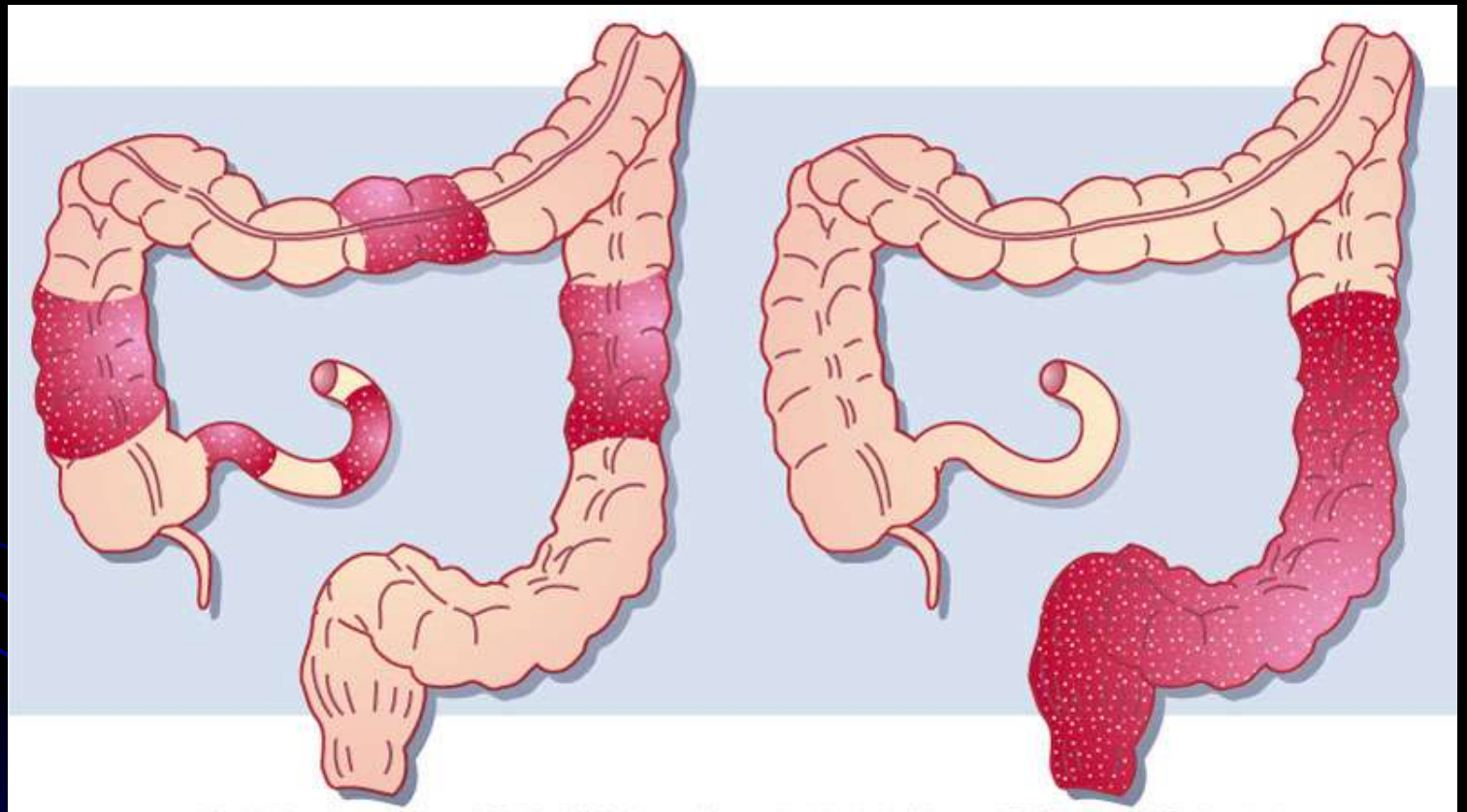
- Cause unknown; imitates celiac disease
- Results in atrophy and inflammation of villi
- Symptoms: diarrhea, anorexia, abdominal distension
- Treatment: broad-spectrum antibiotics, fluid and electrolytes, folate 5 mg/day, intramuscular vitamin B_{12} (1000 mg/mo)

Intestinal Brush Border Enzyme Deficiencies

- Lactose intolerance
- Causes: genetic or secondary deficiency of milk sugar enzyme, lactase
  - African Americans, Asians, South Americans
  - Secondary: infection, inflammatory disorders, HIV, or malnutrition
- Diagnosis: history, lactose tolerance test or breath hydrogen test
- Treatment: avoid large amounts of lactose, individual tolerance, foods made with lactase enzyme; processed dairy sometimes tolerated

Inflammatory Bowel Disease

- Crohn’s disease or ulcerative colitis
- Both cause diarrhea, fever, weight loss, anemia, food intolerances, malnutrition, growth failure, and extraintestinal manifestations (arthritic, dermatologic, and hepatic); associated with malignancy
- Crohn’s disease: may involve any part of the GIT; most in distal ileum and colon; segments of inflamed bowel; transmural
- Ulcerative colitis: is a mucosal disease of the large intestine, including the rectum

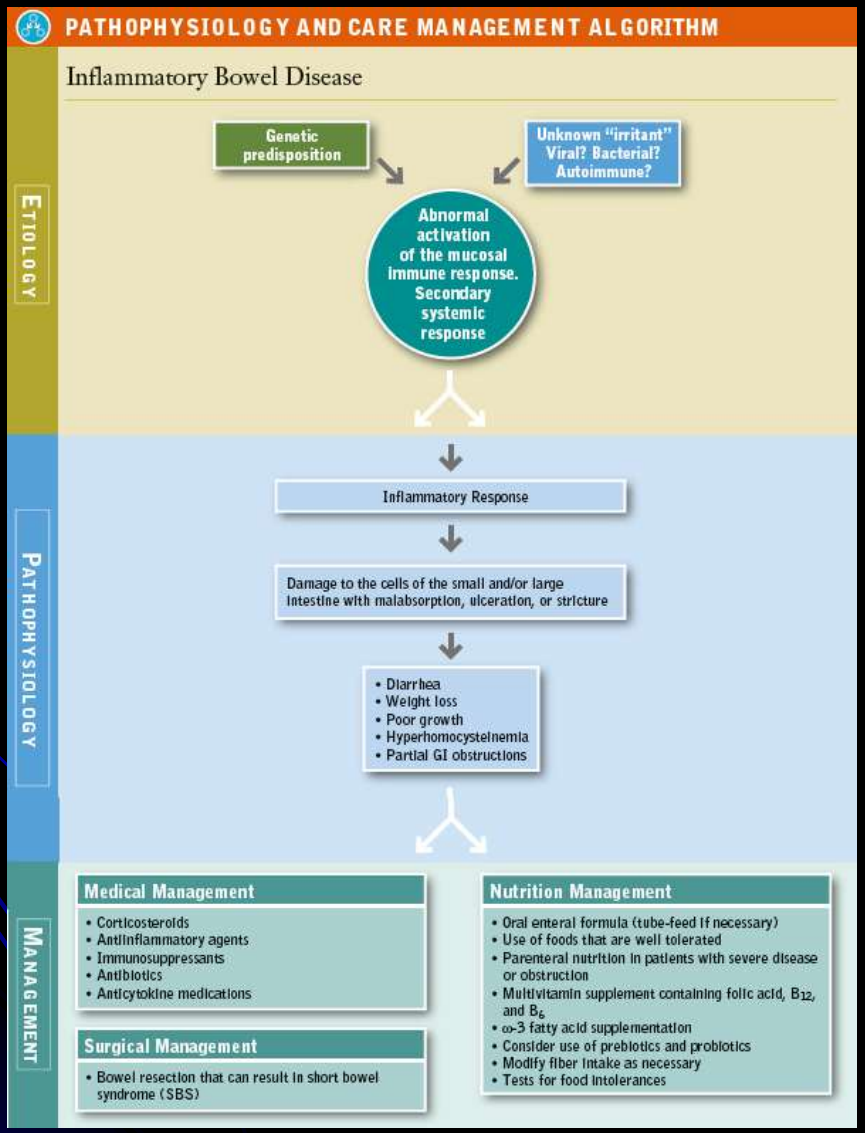


(Modified from Cotran KS, Kumar V, Robbins SI: Robbins and Cotran pathologic basis of disease, ed 7, Philadelphia, 2005, Saunders.)

Fig. 27-2. Crohn's disease *(left)* and ulcerative colitis *(right)*. Crohn's disease typically involves the small and large intestine in a segmental manner, with intervening "skip" areas; ulcerative colitis is generally a contiguous disease process that stars in the rectum and progresses in a retrograde fashion to involve varying lengths of the colon.

Crohn's disease is characterized by abscesses fistulas, fibrosis, sub mucosal thickening, localized strictures, narrowed segments of bowel, and partial or complete obstruction of the intestinal lumen. Bleeding is more common in ulcerative colitis.

Pathophysiology and Care Management for IBD



BOX 27-8

Potential Nutrition-Related Problems With Inflammatory Bowel Disease

- Anemias related to blood loss and poor food intake
- Gastrointestinal (GI) narrowing and strictures leading to bloating, nausea, bacterial overgrowth, and diarrhea
- Inflammation and surgical resections resulting in diarrhea and malabsorption of bile salts and nutrients
- Increased GI secretions with inflammation and decreased transit time leading to diarrhea and malabsorption
- Malabsorption related to abdominal pain, nausea, vomiting, bloating, diarrhea
- Food aversions or associations, anxiety, and fear of eating related to abdominal pain, bloating, nausea, or diarrhea
- Drug-nutrient interactions
- True and perceived food allergies
- Dietary restrictions, both iatrogenic and self-imposed
- Growth failure, weight loss, micronutrient deficiencies, and protein-calorie malnutrition
- Elevated serum homocysteine levels, representing depletion of B-complex vitamins, especially folate (Nakano et al., 2003)

Medical Nutrition Therapy for Inflammatory Bowel Disease

- Fears and misconceptions; individualize
- Nutrition support with parenteral or enteral nutrition to bring clinical remission
- “Complete bowel rest” using PN not necessarily required
- Enteral nutrition may temper inflammatory process and be steroid sparing and is preferred over PN
- Children benefit from enteral nutrition to maintain growth and reduce steroid dependence
- Vitamins, folate, vitamin B_6, and vitamin B_{12} may require supplementation

Disorders of the Large Intestine

1. Irritable bowel syndrome
   - Common syndrome involving abdominal discomfort and altered intestinal motility, bloating, feelings of incomplete evacuation, mucus in stool, straining or increased urgency, GI distress with psychosocial distress
   - Ensure adequate nutrient intake, tailor diet for specific pattern of IBS, management of symptoms, adequate fiber, prebiotics

Foods Containing FODMAPs, and Low FODMAP Diet Instructions

FODMAP	High FODMAP food
Fructose	Fruits: apples, pears, peaches, mango, sugar snap peas, watermelon, canned fruit in natural juice, dried fruit, fruit juice
	Sweeteners: honey, high fructose corn syrup,
Lactose	Milk (cow, goat and sheep), ice cream, soft cheeses (e.g., ricotta, cottage cheese)
Oligosaccharides (fructans or galactans)	Vegetables: artichokes, asparagus, beets, brussel sprouts, broccoli, cabbage, fennel, garlic, leeks, okra, onions, peas, shallots
	Cereals: wheat and rye (in large amounts)
	Legumes: chickpeas, lentils, kidney beans, baked beans
	Fruits: watermelon, apples, peaches, rambutan, persimmon
Polyols	Fruits: apples, apricots, cherries, longon, lychee, pears, nectarine, peaches, plums, prunes, watermelon
	Vegetables: avocado, cauliflower, mushrooms, snow peas
	Sweeteners: sorbitol, mannitol, maltitol, xylitol, and others ending in "-ol"

Low FODMAP Diet Instructions

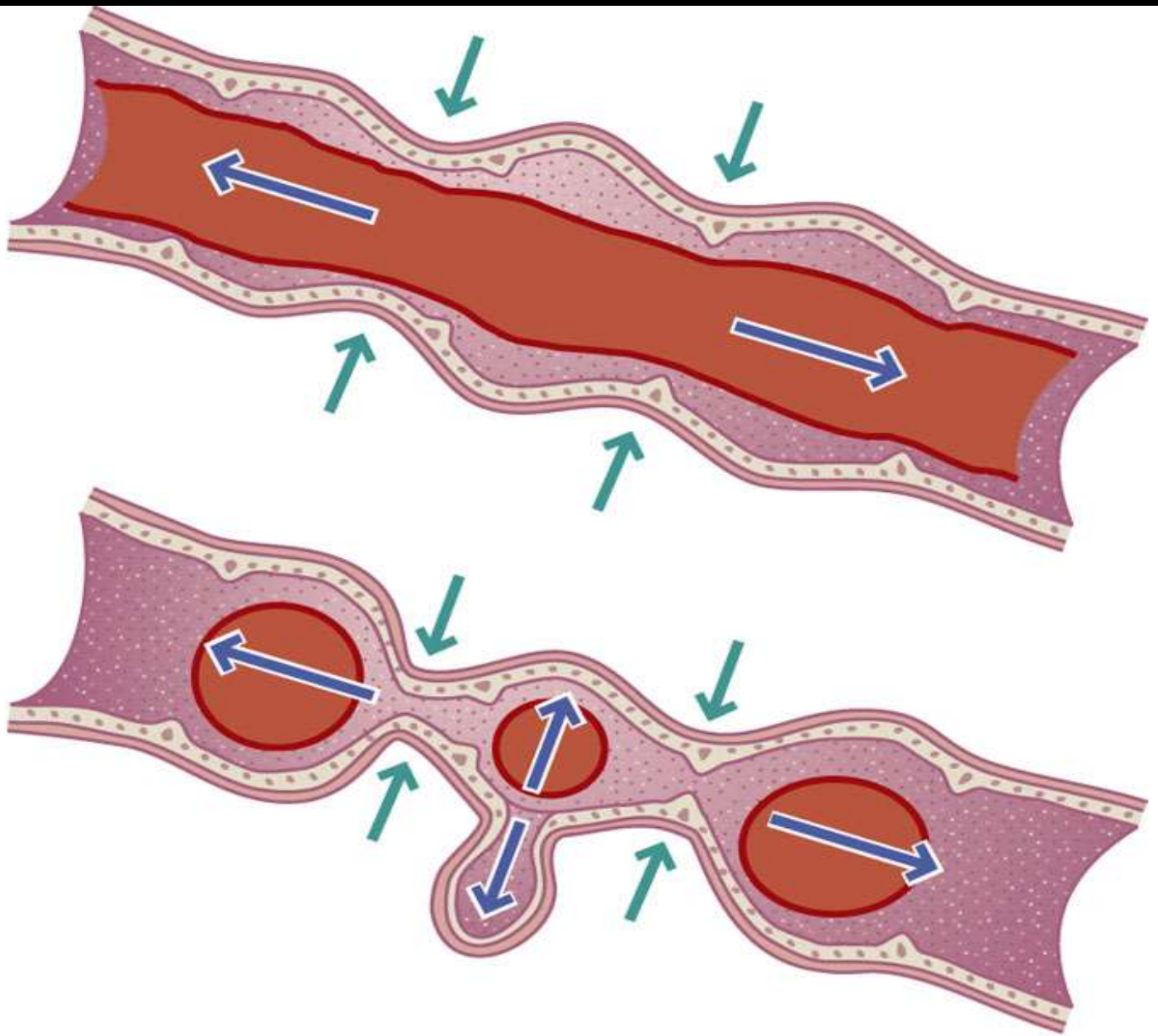
- Avoid foods that contain fructose in excess of glucose (unless fructose malabsorption is not demonstrated).
- Try ingesting a source of glucose with fructose-containing foods (i.e., sucrose contains equal amounts of glucose and fructose).
- Limit amount of fructose at any one meal.
- Avoid foods that contain significant amounts of fructans and galactans.
- Restrict lactose-containing foods (unless lactose malabsorption is not demonstrated).
- Avoid polyol-containing foods.

Adapted from Gibson PR, Shepherd SJ: Evidence-based dietary management of functional gastrointestinal symptoms: the FODMAP approach, J Gastroenterol Hepatol 25:252, 2010.

FODMAP, Fermentable oligo-, di-, and monosaccharides and polyols.

Disorders of the Large Intestine (cont'd)

2. Diverticular disease
   - Herniations of the colon, chronic diverticulosis, acute diverticulitis
   - Diverticulosis: high-fiber diet, increase gradually, supplements if necessary, adequate fluid intake
   - Diverticulitis: low-residue or elemental diet, possibly low-fat diet
     - Seeds, nuts, or skins unresolved



Disorders of the Large Intestine (cont'd)

3. Intestinal polyps and colon cancer
   - Colorectal cancer is the third most common cancer among U.S. adults

- Polyps are considered precursors of colon cancer
  - Recommend sufficient exercise, weight maintenance or reduction, modest and balanced intake of lipids, adequate micronutrients, and limited alcohol

Short Bowel Syndrome (SBS)

- Loss of 70% to 75% of the small bowel usually results in SBS:
  - 100 to 120 cm of small bowel without a colon
  - 50 cm of small bowel with the colon intact
- Causes weight loss; diarrhea; decreased transit time; malabsorption; dehydration; loss of electrolytes; hypokalemia

Short Bowel Syndrome (SBS) (cont'd)

- Removal of ileocecal valve causes more complications
- Fat malabsorption frequent
  - Steatorrhea
  - Saponify calcium, zinc, and magnesium
  - Remove ileum and lose vitamin B_{12} and bile salt absorption

Short Bowel Syndrome (SBS) (cont'd)

- Factors affecting the severity of malabsorption, number of complications, and dependence on parenteral nutrition
  - Length of remaining small intestine
  - Loss of ileum, especially distal third
  - Loss of ileocecal valve
  - Loss of colon
  - Disease in remaining segments(s) of the GIT
  - Radiation enteritis
  - Coexisting malnutrition
  - Older age
  - Surgery

Short Bowel Syndrome: Nutritional Care

- Step 1
  - Parenteral only for most patients
- Step 2
  - Gradually introduce enteral nutrition; start early
  - Glutamine, nucleotides, SCFAs, are important nutrients for the gut
  - Narcotic drugs for pain cause GI problems and should be evaluated

Short Bowel Syndrome

- Eventually, the remaining bowel increases its absorptive surface, and problems decrease; adaptation takes up to 1 year
- Nutrition support is designed to meet each patient's needs
- Intestinal transplant

Blind Loop Syndrome

- Bacterial overgrowth from stasis in the intestine, obstruction, radiation enteritis, fistula, or surgical repair
- Treatment
  - Antibiotics for bacterial overgrowth, prebiotics and probiotics
  - Limit refined carbohydrates; emphasize whole grains, vegetables, oligosaccharides; may use MCT

Fistula: Abnormal Opening Between Organs

- Causes: birth defects, trauma, inflammatory disease, malignant disease
- Treatment
  - Restore fluid and electrolyte balance
  - PN may be necessary and depends on location of the fistula
  - Enteral nutrition may be possible using predigested formulas

Ileostomy or Colostomy: Surgical Opening of Intestine to Outside

- Causes: ulcerative colitis, Crohn's disease, colon cancer, trauma
- Treatment
  - Nutrition needs vary with location and individual
  - Avoid gas- and odor-forming foods
  - Fluid and electrolyte needs
  - Vitamin B_{12} if loss of terminal ileum

Medical Nutrition Therapy for Hepatobiliary and Pancreatic Disorders

Structure of the Liver

- Largest gland in the body
- Divided into right and left lobes
- 1500 mL of blood/min circulates through the liver and exits via the hepatic veins into the inferior vena cava
- Bile is formed in the liver and exits through a system of ducts

Physiology and Functions of the Liver

- Integral to most body functions
- Performs more than 500 tasks
- You cannot survive without a liver, but only 10% to 20% of function is needed to sustain life
- The liver has the ability to regenerate

Physiology and Functions of the Liver (cont'd)

- Metabolism of macronutrients
- Activation and storage of vitamins and minerals
- Formation and excretion of bile
- Metabolism of steroids
- Conversion of ammonia to urea
- Filter and flood chamber

Diseases of the Liver

- Acute viral hepatitis
  - Hepatitis A, hepatitis B and C, hepatitis D, hepatitis E, hepatitis G and GB
- Fulminant hepatitis
- Chronic hepatitis
- Non-alcoholic steatohepatitis (NASH)
- Alcoholic liver disease
  - Hepatic steatosis, alcoholic hepatitis, alcoholic cirrhosis

Diseases of the Liver (cont'd)

- Cholestatic liver diseases
  - Primary biliary cirrhosis
  - Sclerosing cholangitis
  - Hepatic osteodystrophy
- Inherited disorders
  - Wilson's disease
- Other liver diseases

Acute Viral Hepatitis

- Widespread inflammation of the liver that is caused by hepatitis viruses A, B, C, D, and E
- Four phases of symptoms

  1. Prodromal phase (fever, arthralgia, arthritis, rash, and angioedema)

  2. Preicteric phase (malaise, fatigue, myalgia, anorexia, nausea, and vomiting)

  3. Icteric phase

  4. Convalescent phase

Fulminant Hepatitis

- Syndrome in which severe liver dysfunction is accompanied by hepatic encephalopathy
- Hepatic encephalopathy is a syndrome characterized by mental status deterioration and neuromuscular symptoms
- Cause is viral in 75% of cases

Four Stages of Hepatic Encephalopathy

Stage	Symptom
I	Mild confusion, agitation, irritability, sleep disturbance, decreased attention
II	Lethargy, disorientation, inappropriate behavior, drowsiness
III	Somnolence but arousable, incomprehensible speech, confusion, aggression when awake
IV	Coma

Chronic Hepatitis

- At least 6-month course of hepatitis
- Or biochemical and clinical evidence of liver disease with confirmatory biopsy findings of unresolving hepatic inflammation
- Nonspecific, intermittent, and mild symptoms

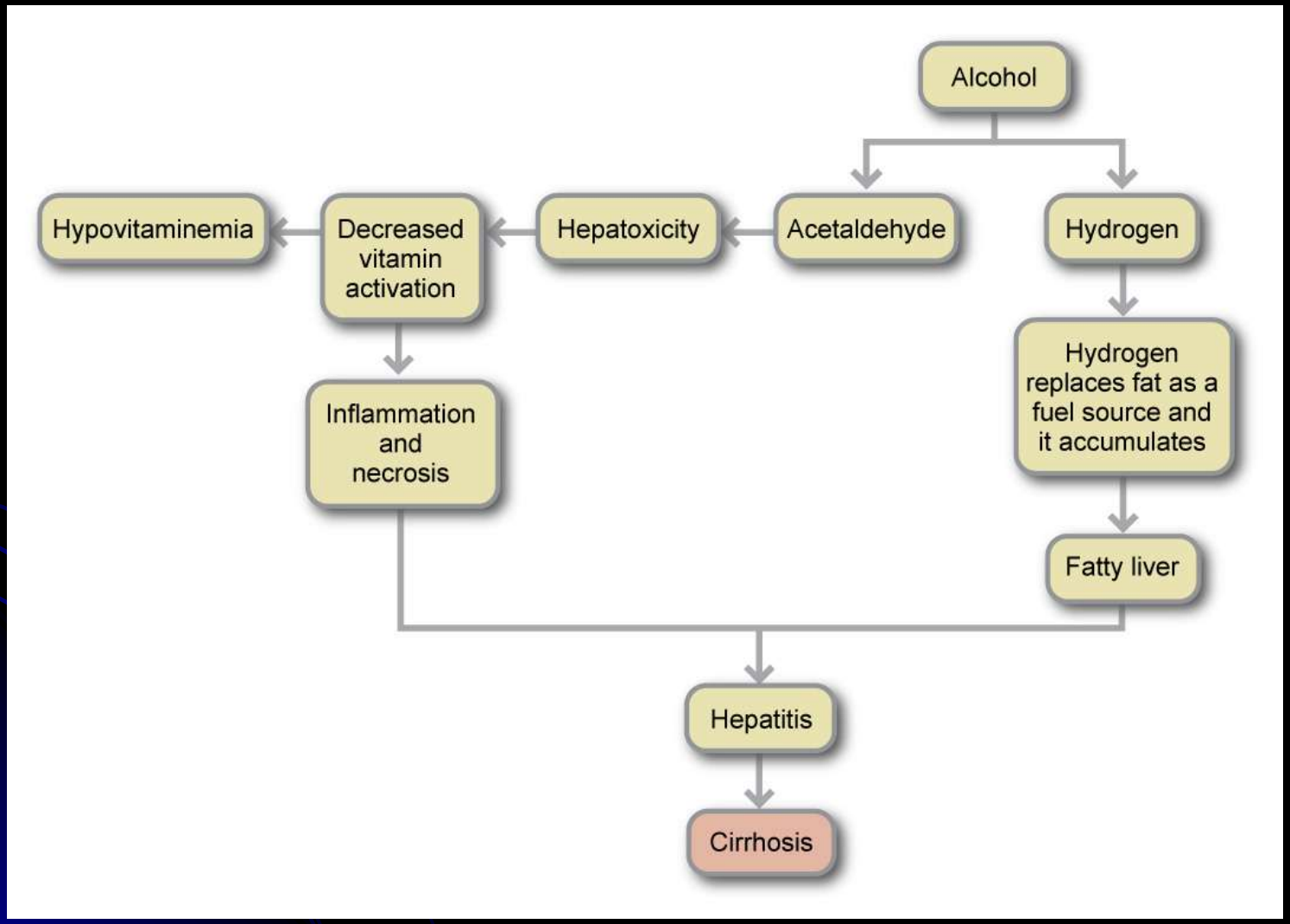
Nonalcoholic Fatty Liver Disease

- Nonalcoholic fatty liver disease (NAFLD)
- Nonalcoholic steatohepatitis (NASH)

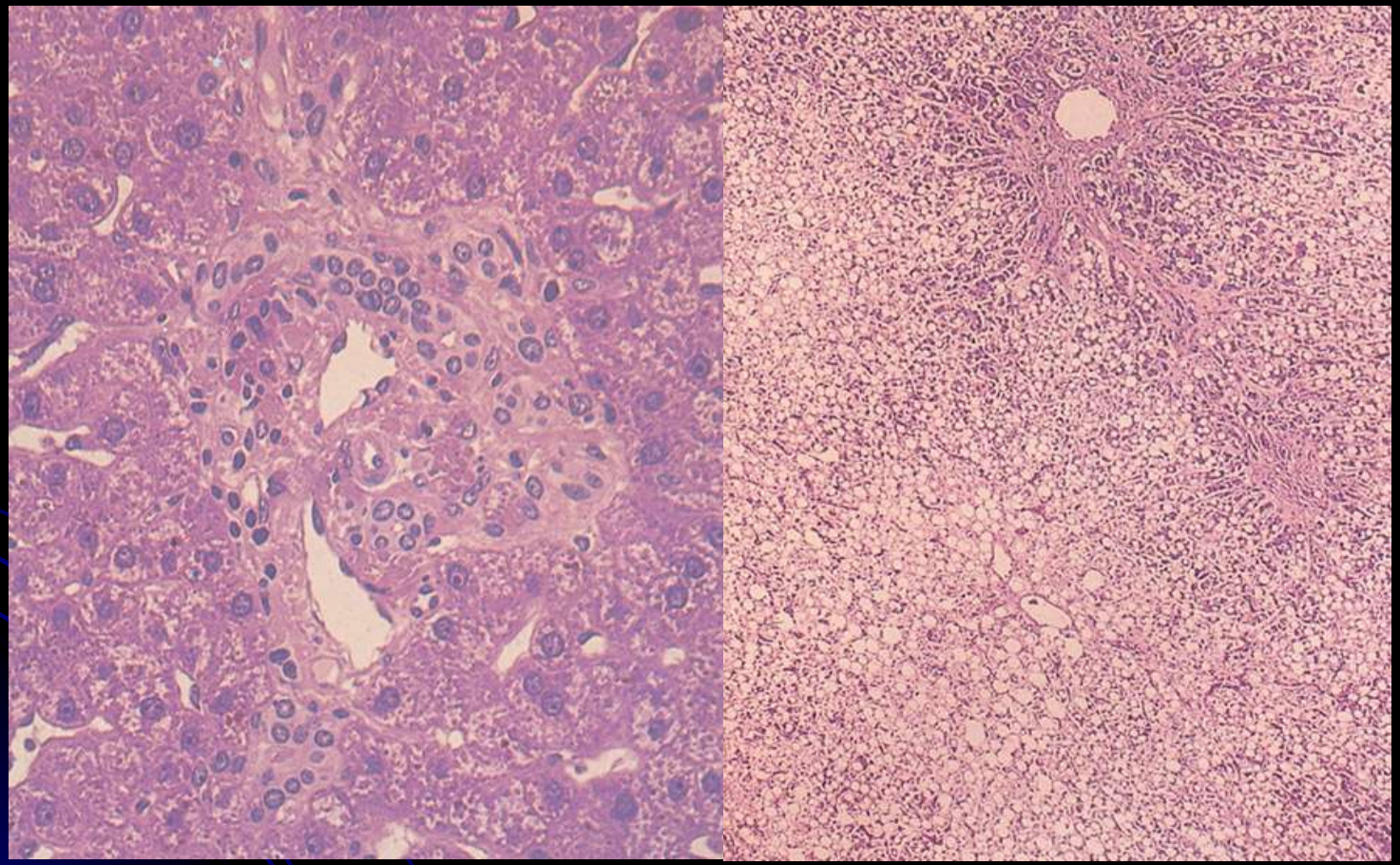
Alcoholic Liver Disease

- Disease resulting from excessive alcohol ingestion characterized by fatty liver (hepatic steatosis), hepatitis, or cirrhosis
- Most common liver disease
- Three stages: hepatic steatosis, alcoholic hepatitis, and cirrhosis
- Alcoholic cirrhosis may lead to GI bleeding, hepatic encephalopathy, portal hypertension, ascites

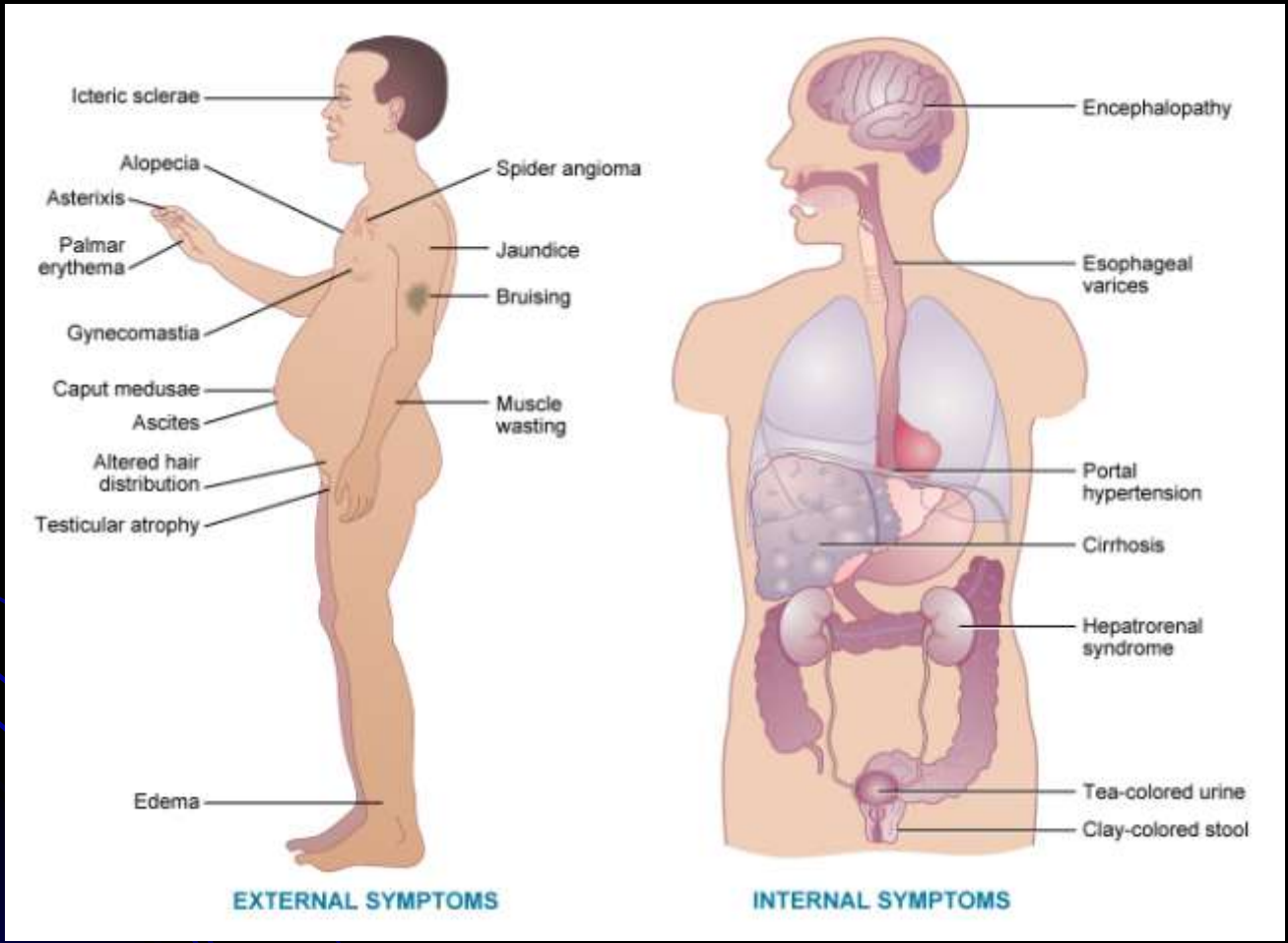
Complications of Excessive Alcohol Consumption



Hepatic Steatosis



Clinical Manifestations of Cirrhosis



Objective Nutrition Assessment Parameters for Which End-Stage Liver Disease May Influence Interpretation

- Body weight
- Anthropometric measurements
- Creatinine-height index
- Nitrogen balance studies
- 3-Methylhistidine excretion
- Visceral protein levels
- Immune function tests
- Bioelectrical impedance

SGA Parameters for Nutritional Evaluation of Liver Transplant Candidates

- History
  - Weight change (consider ascites and edema), appetite, taste changes and early satiety, dietary recall, persistent GI problems
- Physical
  - Muscle wasting, fat stores, ascites or edema
- Existing conditions
  - Other diseases, GI bleeding, renal insufficiency, infection
- Nutritional rating (based on results of above parameters)
  - Well-nourished, moderately or severely malnourished

Severe MaInutrition and Ascites in a Man with End-Stage Renal Disease

Nutrient Requirements in Cirrhosis

- Feeding problems: anorexia, nausea, dysgeusia, and other GI symptoms
- Energy
- Carbohydrate and fat
- Protein: controversial and complex
- Vitamins and minerals
- Herbal supplements

Vitamin and Mineral Deficits in Severe Hepatic Failure

- Vitamin A
- Vitamin D
- Vitamin E
- Vitamin K
- Vitamin B_6
- Vitamin B_{12}
- Folate
- Niacin
- Thiamin
- Zinc
- Magnesium
- Iron
- Potassium
- Phosphorus

Other Aspects of Cirrhosis

- Portal hypertension
  - PN if needed for at least 5 days
  - Enteral feeding contraindicated with bleeding varices
- Ascites
  - Sodium restriction
- Hyponatremia
  - Fluid restriction, moderate sodium intake

End-Stage Liver Disease: Hepatic Encephalopathy

Consider major causes of encephalopathy

- GI bleeding
- Fluid and electrolyte abnormalities
- Uremia
- Use of sedatives
- Hypo- or hyperglycemia
- Alcohol withdrawal
- Constipation
- Acidosis

End-Stage Liver Disease: Hepatic Encephalopathy (cont'd)

2. Treat underlying cause
3. Treat with medications
    - Lactulose
    - Neomycin
4. Ensure adequate diet is consumed

Medical Nutrition Therapy for End-Stage Liver Disease

- Avoid unnecessary protein restriction
- Probiotics and synbiotics
- Glucose alterations: treat as diabetes
- Fat malabsorption: use MCTs, low-fat diet
- Renal insufficiency and hepatorenal syndrome
- Osteopenia: weight maintenance, well-balanced diet, adequate protein, high calcium, adequate vitamin D, avoid alcohol

Liver Transplantation

- Established treatment for ESLD
- Malnutrition is common
- Multiple medications after transplantation have nutrition-related side effects

Medications Commonly Used after Liver Transplantation

- Azathioprine
- Antithymocyte globulin
- Basiliximab
- Cyclosporine
- Daclizumab
- Glucocorticoids
- Muromonab-CD3
- Mycophenolate mofetil
- Sirolimus
- Tacrolimus
- 15-Deoxysperagualin

Nutrition Care Guidelines for Liver Transplantation

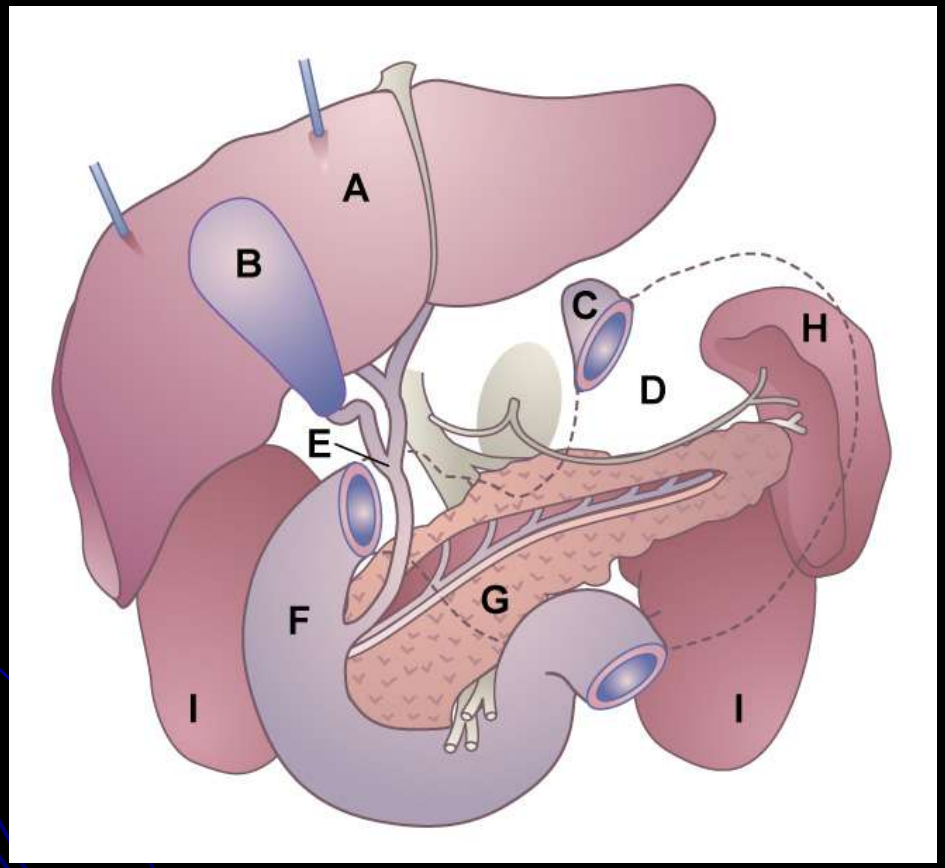
- Pretransplantation
- Immediate posttransplantation
- Long-term posttransplantation

TABLE 30-7

Nutrition Care Guidelines for Liver Transplant Patient

	Pretransplantation	Immediate Posttransplantation (First 2 Posttransplant Months)	Long-Term Posttransplantation
Calories & protein*	High calorie (basal + 20% or more) Moderate protein (1-1.5 g/kg)	Moderate calorie (basal + 15%-30%) High protein (1.2-1.75 g/kg)	Weight maintenance (basal + 10%-20%) Moderate protein (1 g/kg)
Fat	As needed	Approximately 30% of calories	Moderate fat (30% of calories)
Carbohydrate	Reduced simple carbohydrate if diabetes or obesity present	Reduced simple carbohydrate if diabetes present	Reduced simple carbohydrate, especially if diabetes or obesity present
Sodium	2 g/day	2-4 g/day (as indicated)	2-4 g/day (as indicated)
Fluid	Restrict to 1000-1500 mL/day (if hyponatremic)	As needed	As needed
Calcium	800-1200 mg/day	800-1200 mg/day	1200-1500 mg/day
Vitamins	Multivitamin/mineral supplementation to DRI levels; additional water- and fat-soluble vitamins as indicated	Multivitamin/mineral supplementation to DRI levels; additional water- and fat-soluble vitamins as indicated	Multivitamin/mineral supplementation to DRI levels

Relationship of Organs of the Upper Abdomen



Medical Nutrition Therapy for Gallbladder Diseases

- Cholelithiasis: avoid obesity and fasting; follow a low-fat diet
- Acute cholecystitis: hold feedings or PN; then low-fat diet
- Chronic cholecystitis: low-fat diet
- Acute cholangitis
- Cholestasis: occurs when no enteral feedings

Medical Nutrition Therapy for Diabetes Mellitus and Hypoglycemia of Nondiabetic Origin

Diabetes Mellitus

A group of diseases characterized by high blood glucose (BG) concentrations resulting from defects in insulin secretion, insulin action, or both

Diabetes and Prediabetes: Types

- Type 1 (formerly IDDM, type I)
- Type 2 (formerly NIDDM, type II)
- Gestational diabetes mellitus (GDM)
- Prediabetes (impaired glucose homeostasis)

Prediabetes (Impaired Glucose Homeostasis)

- Two forms; may have either or both
  - Impaired fasting glucose (IFG): fasting plasma glucose (FPG) above normal
  - Impaired glucose tolerance (IGT): plasma glucose elevated after 75-g glucose load
  - Hgb A1C

Type 1 Diabetes

- Two forms
  - Immune mediated: beta cells destroyed by autoimmune process
  - Idiopathic: cause of beta cell function loss unknown
- Symptoms: hyperglycemia, polyuria, polydipsia, weight loss, dehydration, electrolyte disturbance, and ketoacidosis
- 5% to 10% of all diagnosed diabetes

Type 2 Diabetes

- Most common form of diabetes, accounting for 90% to 95% of diagnosed cases
- Combination of insulin resistance and beta cell failure (insulin deficiency)
- Progressive disease: hyperglycemia develops gradually and may not cause the classic symptoms of type 1 diabetes

Gestational Diabetes Mellitus

- Glucose intolerance with onset or first recognition during pregnancy
- Occurs in about 7% of pregnancies
- Women with GDM have a 40% to 60% chance of developing diabetes over the next 5 to 10 years

Risk Factors for Type 2 Diabetes

- BMI >25
- Physical inactivity
- High-risk ethnic groups (African American, Latino, Native American, Asian America, Pacific Islander)
- Previous delivery of baby >9 lbs or GDM
- Hypertension
- HDL <35 mg/dL or triglycerides >250 mg/dL
- PCOS or acanthosis nigricans
- IGT or IFG
- History of vascular disease

Methods of Diagnosis

- Fasting plasma glucose (FPG)
- Casual plasma glucose (any time of day)
- Oral glucose tolerance test (OGTT)

Diagnosis of Diabetes Mellitus and Impaired Glucose Homeostasis

Diagnosis	Criteria
Diabetes	FPG ³126 mg/dL (³7.0 mmol/L)
	CPG ³200 mg/dL (³11.1 mmol/L) plus symptoms
	2hPG ³200 mg/dL (³11.1 mmol/L)
Prediabetes	
Impaired fasting glucose	FPG 100–125 mg/dL (5.6–7.0 mmol/L)
Impaired glucose tolerance	2hPG 140–199 mg/dL (7.8–11.0 mmol/L)
Normal	FPG <100 mg/dL (<5.6 mmol/L)
	2hPG <140 mg/dL (<7.8 mmol/L)

Management of Prediabetes

- Lifestyle change
  - Increase physical activity
  - Moderate weight loss
  - Education
  - Reduced fat and energy intake
  - Regular participant follow-up
  - Whole grains and dietary fiber

Management of Diabetes

- Management
  - Medical nutrition therapy
  - Physical activity
  - Monitoring
  - Medications
  - Self-management education

Diabetes: Treatment Goals

Recommendations for Glycemic Control for Adults With Diabetes

Glycemic Control	
A1C	<7.0%*
Preprandial capillary plasma glucose	90–130 mg/dL (5.0-7.2 mmol/L)
Peak postprandial capillary plasma glucose†	<180 mg/dL (<10.0 mmol/L)

Modified from American Diabetes Association: Standards of medical care in diabetes—2007, *Diabetes Care* 30:54, 2007.
*Referenced to a nondiabetic range of 4%-6% using a DCCT-based assay.
†Peak levels in patients with diabetes.

Lipid and Blood Pressure Goals for Diabetes

Recommendations for Lipid and Blood Pressure for Adults With Diabetes

Lipids	
LDL cholesterol	<100 mg/dL (<2.6 mmol/L)
HDL cholesterol	
Men	>40 mg/dL (>1.1 mmol/L)
Women	>50 mg/dL (>1.4 mmol/L)
Triglycerides	<150 mg/dL (<1.7 mmol/L)
Blood Pressure	<130/80 mm Hg

Modified from American Diabetes Association: Standards of medical care in diabetes—2007, *Diabetes Care* 30:54, 2007.
HDL, high-density lipoprotein; LDL, low-density lipoprotein.

Medical Nutrition Therapy for Diabetes

- Individualize energy needs and nutrition care based on metabolic profile, treatment goals, and changes person is willing and able to make

Goals of Medical Nutrition Therapy for Diabetes Mellitus

- Prediabetes
  - Decrease risk of diabetes and CVD by promoting healthy food choices and physical activity leading to moderate weight loss
- Diabetes
  - Achieve and maintain BG levels in normal range, low-risk lipid and lipoprotein profile, low-risk blood pressure
  - Prevent or delay chronic complications
  - Address individual nutrition needs

Goals of Medical Nutrition Therapy for Diabetes Mellitus (cont'd)

- Specific situations
  - Meet unique needs to youth with type 1 or type 2 diabetes, pregnant and lactating women, and older adults with diabetes
  - Self-management training for individuals treated with insulin or insulin secretagogues for safe exercise, prevention and treatment of hypoglycemia, and treatment of acute illness

Carbohydrate

- Low-carbohydrate diets are not recommended
- Sugars do not increase glycemia more than isocaloric amounts of starch
- Factors influencing glycemic response to foods: glycemic index (GI) and glycemic load (GL)
- Carbohydrate counting; portions of food containing 15 g carbohydrate
- Exchange lists

The Glycemic Index

- Was developed to compare the physiologic effects of carbohydrates on glucose
- Measures peak response
- Does not measure how rapidly BG rises
- GL is calculated by multiplying the GI by the amount of carbohydrates in each food

Fiber

- 25 to 30 g of fiber per day with special emphasis on soluble fiber
- Recommend same as general public
- Research on higher fiber intake for people with diabetes has been inconclusive

Sweeteners

- Sucrose restriction cannot be justified based on glycemic response; it should be substituted in a meal plan for other carbohydrate
- Reduces intake of healthy foods or increases calorie intake
- Fructose has no benefit over sucrose
- Reduced calorie sweeteners: sugar alcohols and tagatose
- Nonnutritive sweeteners: saccharin, aspartame, neotame, acesulfame potassium, and sucralose

Protein

- Does not affect blood glucose levels in well-controlled diabetes
- Does not slow absorption of carbohydrate
- Recommend usual protein intake (15%–20% of kilocalories)

Dietary Fat

- People with diabetes have similar risk to those with a history of CVD
- Recommendations
  - Total fat 25% to 35% of total kilocalories
  - Saturated fatty acids <7%
  - Minimized or eliminate *trans* fat
  - Very long omega-3 polyunsaturated fatty acids
  - Plant sterol and stanol esters; 2 to 3 g/day

Micronutrients

- No clear evidence of benefits of supplements
- High-risk groups
- Supplemental antioxidant vitamins have not been proven beneficial, and some evidence indicates that vitamins E and C and carotene are harmful
- No benefit has been shown for supplementation of chromium

Oral Glucose-Lowering Medications

- Newer glucose-lowering medications used alone or in combination
  - Insulin secretagogues: sulfonylureas promote insulin secretion by beta cells
  - Glinides: meglitinides differ from sulfonylureas in that they have shorter metabolic half-lives
  - Biguanides: metformin suppresses hepatic glucose production
  - Thiazolidinediones: TZDs or glitizones decrease insulin resistance in peripheral tissues
  - a-Glucosidase inhibitors: acarbose inhibits small bowel enzymes that digest carbohydrat

Glucose-Lowering Medications (cont'd)

- Insulin secretagogues
  - Sulfonylureas and meglitinides
  - Promote insulin secretion by beta cells
- Insulin sensitizers
  - Enhance insulin action
  - Biguanides (metformin) and TZDs
  - Require presence of exogenous or endogenous insulin
- Enzyme inhibitors (a-glucosidase inhibitors)
  - Inhibit enzymes that digest carbohydrates in the small intestine; delay carbohydrate absorption and lower postprandial glycemia
  - Acarbose (Precose) and miglitol (Glyset)

Injectable Glucose-Lowering Medications

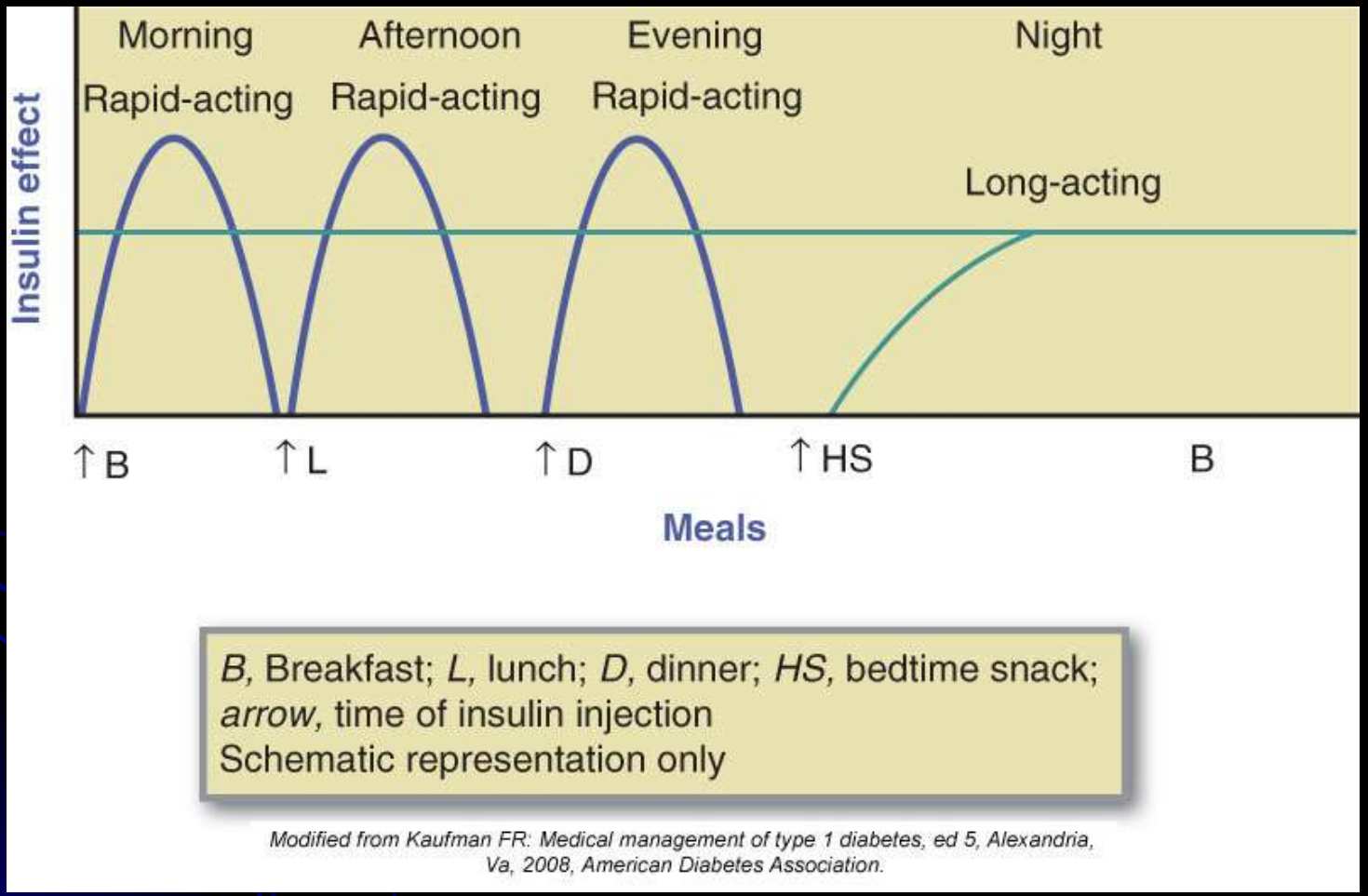
- Exenatide (Byetta): incretin mimetic or incretin-like agent
  - Hormones released during nutrient absorption that increase glucose-dependent insulin secretion, slow gastric emptying, decrease glucagon production, and decrease appetite
- Pramlintide (Symlin): synthetic form of amylin
  - Hormone normally co-secreted with insulin in response to food intake

Insulin

- Essential to survive in type 1 diabetes
- May be needed to restore glycemia in type 2 diabetes
- Onset, peak, and duration
- Inhaled insulin
- Individualize type and timing of insulin regimen based on eating and exercise habits and blood glucose levels
- Insulin pump

Action Times of Human Insulin Preparations

Type of Insulin	Onset of Action	Peak Action	Usual Effective Duration	Monitor Effect In
Rapid Acting	<15 min	1–2 hr	3–4 hr	2 hr
Insulin lispro (Humalog)				
Insulin aspart (NovoLog)				
Insulin glulisine (Apidra)				
Short Acting	0.5–1 hr	2–3 hr	3–6 hr	≈4 hr
Regular				
Intermediate-Acting				
NPH	2–4 hr	4–10 hr	10–16 hr	8–12 hr
Long Acting				
Insulin glargine (Lantus)	2–4 hr	Peakless	20–24 hr	10–12 hr
Insulin determir (Levemir)	2–4 hr	Peakless	18–24 hr	10–12 hr
Mixtures	0.5–1 hr	Dual	10–16 hr	
70/30 (70% neutral protamine Hagedorn [NPH], 30% regular)				
75/25 (75% neutral protamine lispro [NPL], 25% lispro)				
70/30 (70% neutral protamine aspart [NPA], 30% aspart)				



B, Breakfast; *L,* lunch; *D,* dinner; *HS,* bedtime snack; *arrow,* time of insulin injection
Schematic representation only

Modified from Kaufman FR: Medical management of type 1 diabetes, ed 5, Alexandria, Va, 2008, American Diabetes Association.

Monitoring

- Self-monitoring of blood glucose (SMBG) up to eight times per day
- Training and record keeping
- Used to adjust insulin doses and food
- Continuous ambulatory blood glucose monitoring
- Urine and blood ketones

Medical Nutrition Therapy for Type 1 Diabetes

- Integrate insulin regimen into usual eating habits and physical activity schedule
- Multiple injections (≥3/day) of insulin pump
- Half insulin as basal or background; other half before meals
- Total energy intake and CHO intake to avoid weight gain

Medical Nutrition Therapy for Type 2 Diabetes

- Lifestyle interventions to improve metabolic abnormalities (glycemia, dyslipidemia, hypertension)
- Progressive: usually need to add medication to MNT
- Blood glucose control, improve food choices, increase physical activity, moderate energy restriction to promote weight loss
- Teaching: carbohydrate sources, serving sizes, number of servings, meal planning, limiting fats
- SMBG

	Meal/Snack/Time										
Food Group	Breakfast	Snack	Lunch	Snack	Dinner	Snack	Total servings/ day	CHO (g)	Protein (g)	Fat (g)	Calories
Starches								15	3	1	80
Fruit								15			60
Milk								12	8	1	100
Vegetables								5	2		25
Meats/ Substitutes									7	5(3)	75(55)
Fats										5	45
CHO Choices							Total grams				
							Calories/ gram	X4=	X4=	X9=	Total calories
							Percent calories				

Calculations are based on medium-fat meats and skim/very low-fat milk. If diet consists predominantly of low-fat meats, use the factor 3 g instead of 5 g fat; if predominantly high-fat meats, use 8 g fat. If low-fat (2%) milk is used, use 5 g fat; if whole milk is used, use 8 g fat.

	Meal/Snack/Time										
Food Group	Breakfast 7:30 AM	Snack 10:00	Lunch 12:00	Snack 3:00	Dinner 6:30	Snack 10:00	Total servings/ day	CHO (g)	Protein (g)	Fat (g)	Calories
Starches	2	1	2–3	1	2–3	1–2	10	15 150	3 30	1 10	80
Fruit	1		1		1	0–1	3	15 45			60
Milk	1				1		2	12 24	8 16	1 2	100
Vegetables			✓		✓			5 10	2 4		25
Meats/ Substitutes			2–3		3–4		6		7 42	5(3) 30	75(55)
Fats	1	0–1	1–2	0–1	1–2	0–1	5			5 25	45
CHO Choices	3–4 CHO	1 CHO	3–4 CHO	1 CHO	4–5 CHO	1–2 CHO	Total grams	229	92	67	
							Calories/ gram	X4= 916	X4= 368	X9= 603	Total calories
							Percent calories	50	19	30	1900–2000

1900–2000 calories
230 g CHO-50%
90 g protein-20%
65 g fat-30%

Calculations are based on medium-fat meats and skim/very low-fat milk. If diet consists predominantly of low-fat meats, use the factor 3 g, instead of 5 g fat; if predominantly high-fat meats, use 8 g fat. If low-fat (2%) milk is used, use 5 g fat; if whole milk is used, use 8 g fat.

Medical Nutrition Therapy for Type 1 Diabetes in Youth

- Maintain normal growth and development
- Nutrition prescription based on nutrition assessment
- Use typical food and nutrition history
- Adjust with age, physical activity, and growth rate
- Individualize food plans and insulin regimens
- Realistic blood glucose goals
- Reduce risk of CVD
- Meal planning approaches: CHO counting

Medical Nutrition Therapy for Type 2 Diabetes in Youth

- Accompanies childhood obesity
- Cessation of excessive weight gain, promote normal growth and development
- Address CVD risk
- Teaching must include carbohydrate foods and portion size
- Physical activity
- Bariatric surgery

Physical Activity and Exercise

- Integral part of treatment plan for diabetes
- Improve insulin sensitivity
- Reduce cardiovascular risk factors
- Weight control
- Improve well-being
- May prevent type 2 diabetes in high-risk individuals
- Glycemic responses to exercise in type 1 and type 2 diabetes

Potential Problems with Exercise

- Hypoglycemia if using insulin or insulin secretagogues
  - Caused by increased insulin sensitivity
- Hyperglycemia
  - Caused by a greater than normal increase in counterregulatory hormones
- Exercise guidelines
  - Frequent blood glucose monitoring before, during, and after exercise
  - Reduce insulin or ingest carbohydrate

Carbohydrate for Insulin or Insulin Secretagogue Users

- Add 15 g of carbohydrate for every 30 to 60 minutes of activity (depending on intensity)
- No adjustment for exercise <30 min
- Add carbohydrate if pre-exercise glucose level <100 mg/dL
- No supplementary carbohydrate if not receiving insulin or secretagogues
- CHO ingestion during prolonged exercise improves performance

Insulin Guidelines for Exercise

- Moderate to strenuous activity >45 to 60 minutes: decrease rapid- or short-acting insulin (1–2 U)
- Prolonged vigorous exercise: may need a 15% to 20% decrease in total daily insulin dose

Exercise Prescription

- At least 150 min/wk of moderate-intensity aerobic physical activity or at least 90 min/wk of vigorous aerobic exercise
- Distribute over at least 3 days/wk with no more than 2 consecutive days without activity
- Resistance exercise 3×/wk

Common Causes of Hypoglycemia

- Inadvertent or deliberate errors in insulin doses
- Excessive insulin or oral secretagogue medications
- Improper timing of insulin in relation to food intake
- Intensive insulin therapy
- Inadequate food intake
- Omitted or inadequate meals or snacks
- Delayed meals or snacks
- Unplanned or increased physical activities or exercise
- Prolonged duration or increased intensity of exercise
- Alcohol intake without food

Medical Nutrition Therapy for Cardiovascular Disease

Cardiovascular Disease

- Coronary heart disease
- Atherosclerosis
- Hypertension
- Peripheral vascular disease
- Heart failure

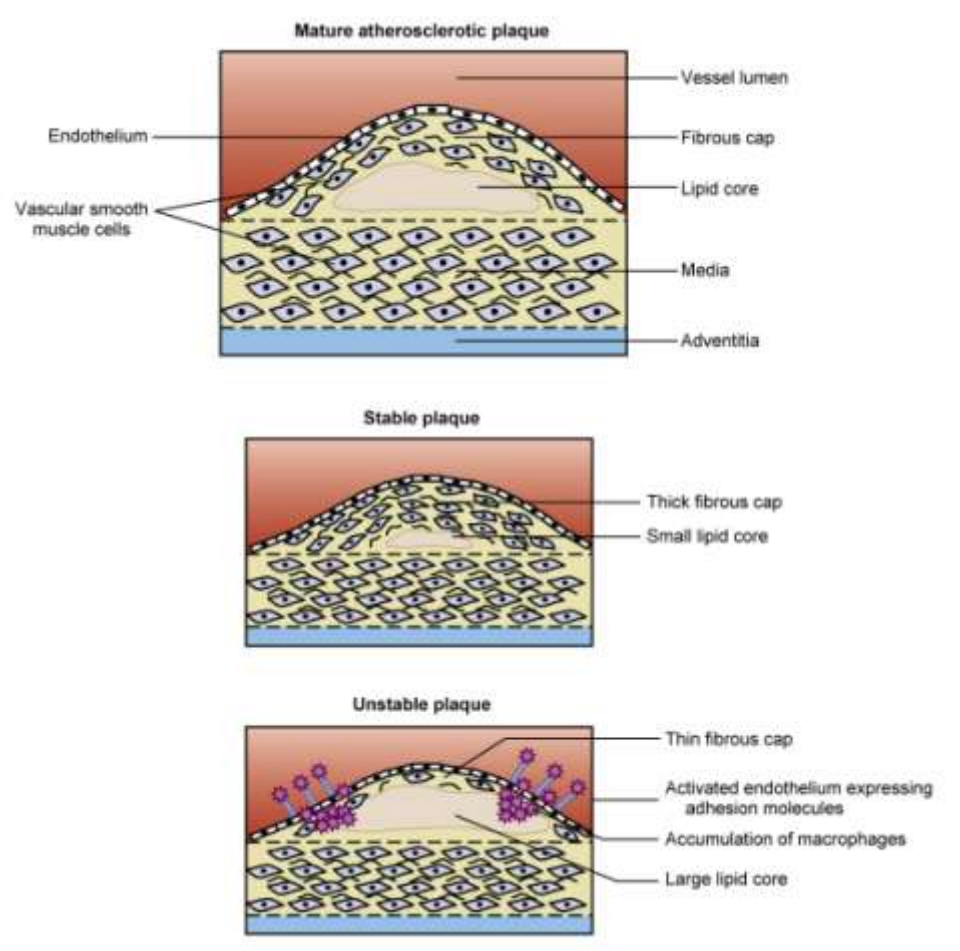
Cardiovascular Disease (cont'd)

- Remains #1 killer of both men in women in the United States
- Causes one of every 2.9 deaths
- Every minute someone in the United States dies from a coronary event
- Heart disease and stroke cause the most deaths in both sexes of all ethnic groups and increase with age

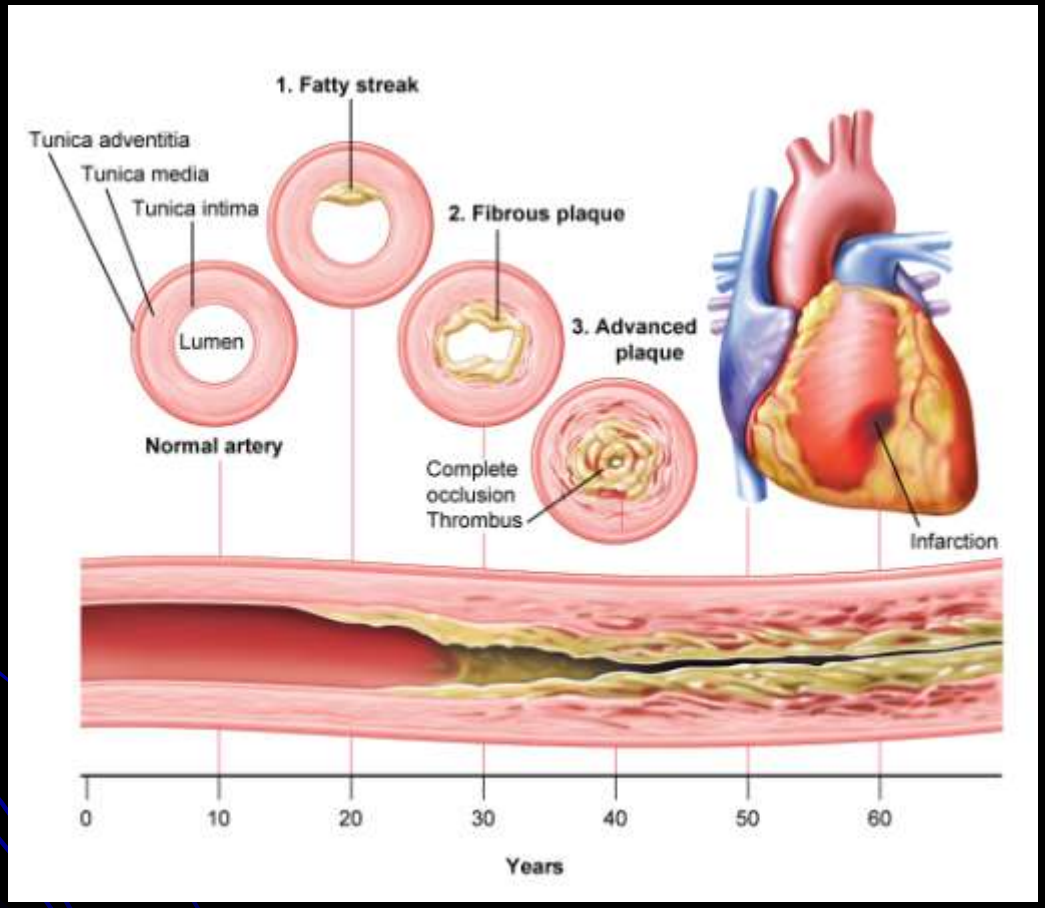
Atherosclerosis and Coronary Heart Disease

- Atherogenesis is the process leading to the development of atherosclerosis
- Chronic, local, inflammatory response
- Narrowed blood vessels that are more rigid

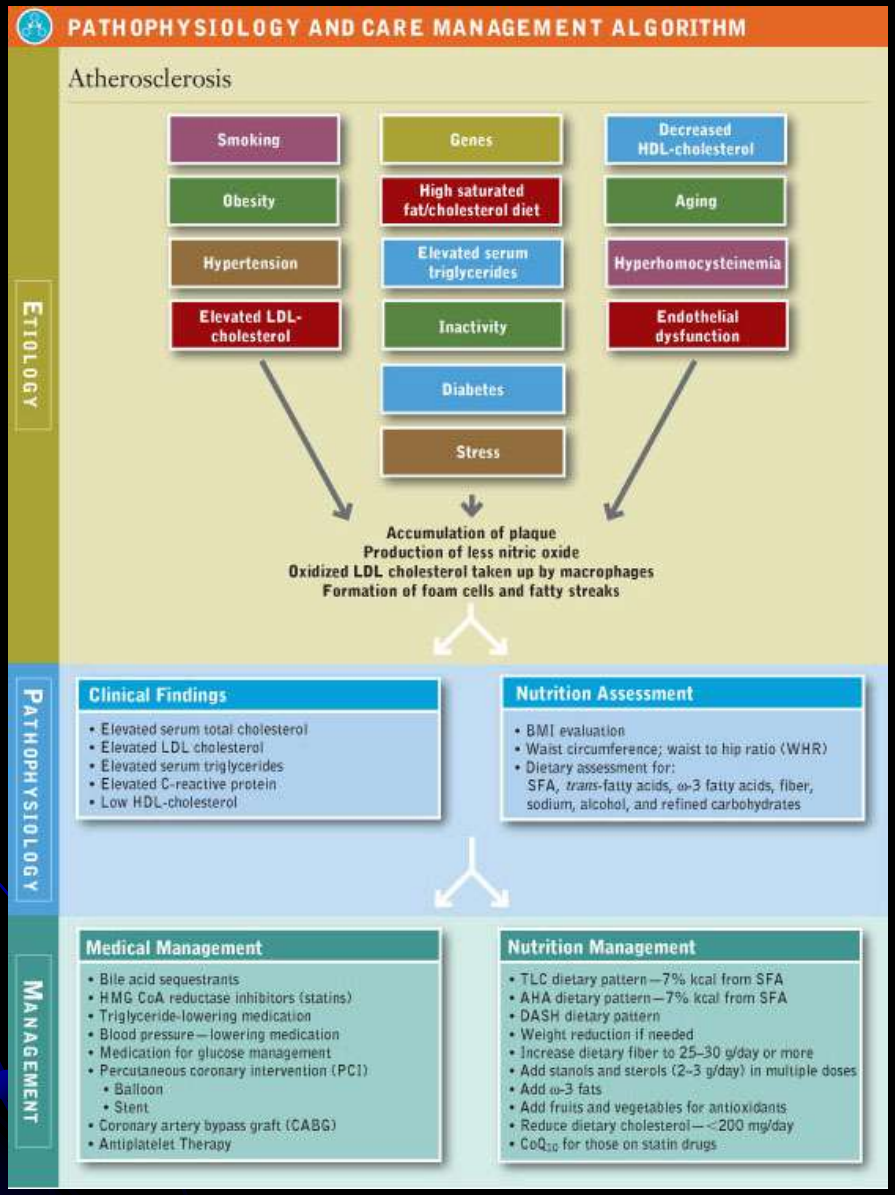
Structure of Plaque



Natural Progression of Atherosclerosis



Algorithm for Atherosclerosis



Lipoproteins

- Total cholesterol: amount in all lipoprotein fractions
- Chylomicrons: transport dietary fat and cholesterol to the liver; major component of triglycerides
- Apolipoproteins: carry lipids in the blood and control the metabolism of the lipoprotein molecule
- VLDLs: formed from triglyceride hydrolysis and considered nonatherogenic

Lipoproteins (cont'd)

- LDLs: the primary cholesterol carrier in blood; formed by the breakdown of VLDL
- HDLs: contain more protein than other lipoproteins; serve as a reservoir of the apolipoproteins that direct lipid metabolism

Genetic Hyperlipidemias

- Familial hypercholesterolemia
- Polygenic familial hypercholesterolemia
- Familial combined hyperlipidemia
- Familial dysbetalipoproteinemia

Cardiovascular Disease Risk Factors

- Inflammatory markers
- Blood lipids
- Lifestyle factors
- Age
- Gender
- Genetics
- Presence of other diseases

Blood Lipoprotein Goals

- Total cholesterol <200 mg/dL
- LDL <130 mg/dL or <100 mg/dL in high-risk patients or <70 mg/dL in very high-risk patients
- HDL >40 mg/dL

Inflammatory Markers in Clinical Use

- C-reactive protein
- Interleukin-6
- Fibrinogen
- Erythrocyte sedimentation rate

Modifiable Risk Factors

- Tobacco use
- Physical inactivity
- Poor diet
- Stress

Diseases and Syndromes Related to Cardiovascular Disease

- Hypertension
- Diabetes
- Obesity (especially abdominal obesity)
- Metabolic syndrome

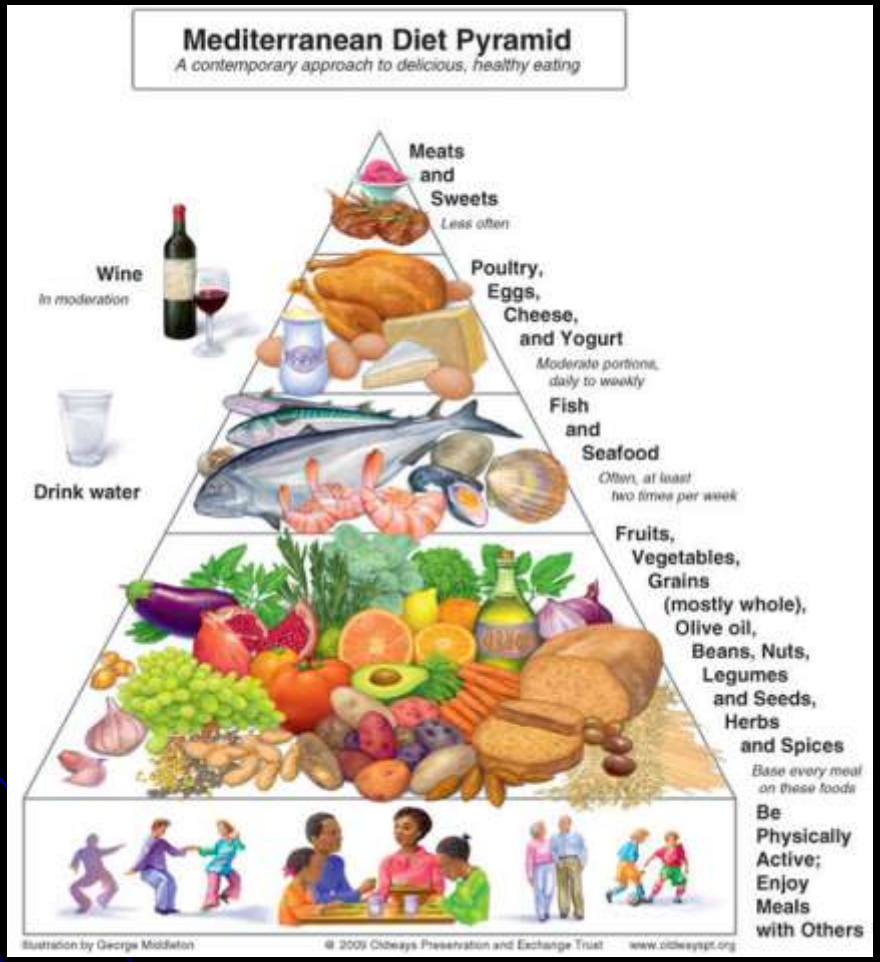
Nonmodifiable Risk Factors

- Menopausal status
- Age
- Family history

AHA 2006 Diet Recommendations for CVD Risk Reduction

- Balance calorie intake and physical activity to achieve or maintain a healthy body weight.
- Consume a diet rich in vegetables and fruits.
- Choose whole-grain, high-fiber foods.
- Consume fish, especially oily fish, at least twice a week.
- Limit intake of saturated fat to <7% of energy, *trans* fat to <1% of energy, and cholesterol to <300 mg/day by:
  - Choosing lean meats and vegetable alternatives.
  - Selecting fat-free (skim), 1%-fat, and low-fat dairy products.
  - Minimizing intake of partially hydrogenated fats.
- Minimize your intake of beverages and foods with added sugars.
- Choose and prepare foods with little or no salt.
- When consuming alcohol, do so in moderation.
- When eating food that is prepared outside of the home, follow the American Heart Association Diet and Lifestyle Recommendations.

The Mediterranean Diet Pyramid



Hypertension

- Persistently high arterial blood pressure
- Systolic blood pressure above 140 mm Hg and/or diastolic blood pressure above 90 mm Hg
- Normotensive = 120/80 mm Hg
- Prehypertensive = 120–139/80-89 mm Hg
- Stage 1 hypertension = 140–159/90-99 mm Hg
- Stage 2 hypertension = >160/>100 mm Hg

Risk Factors for and Adverse Prognosis in Hypertension

Risk Factors
Black race
Youth
Male gender
Persistent diastolic pressure >115 mm Hg
Smoking
Diabetes mellitus
Hypercholesterolemia
Obesity
Excessive alcohol intake
Evidence of end organ damage

Cardiac
Cardiac enlargement
Electrocardiographic signs of ischemia or left ventricular strain
Myocardial infarction
Congestive heart failure

Risk Factors for and Adverse Prognosis in Hypertension – cont.

Eyes Retinal exudates and hem-or-rhages Papilledema
Renal Impaired renal function
Nervous system Cerebrovascular accident

Fisher ND, Williams GH: Hypertensive vascular disease. In Kasper DL et al., editors: *Harrison's principles of internal medicine,* ed 16, New York, 2005, McGraw-Hill.

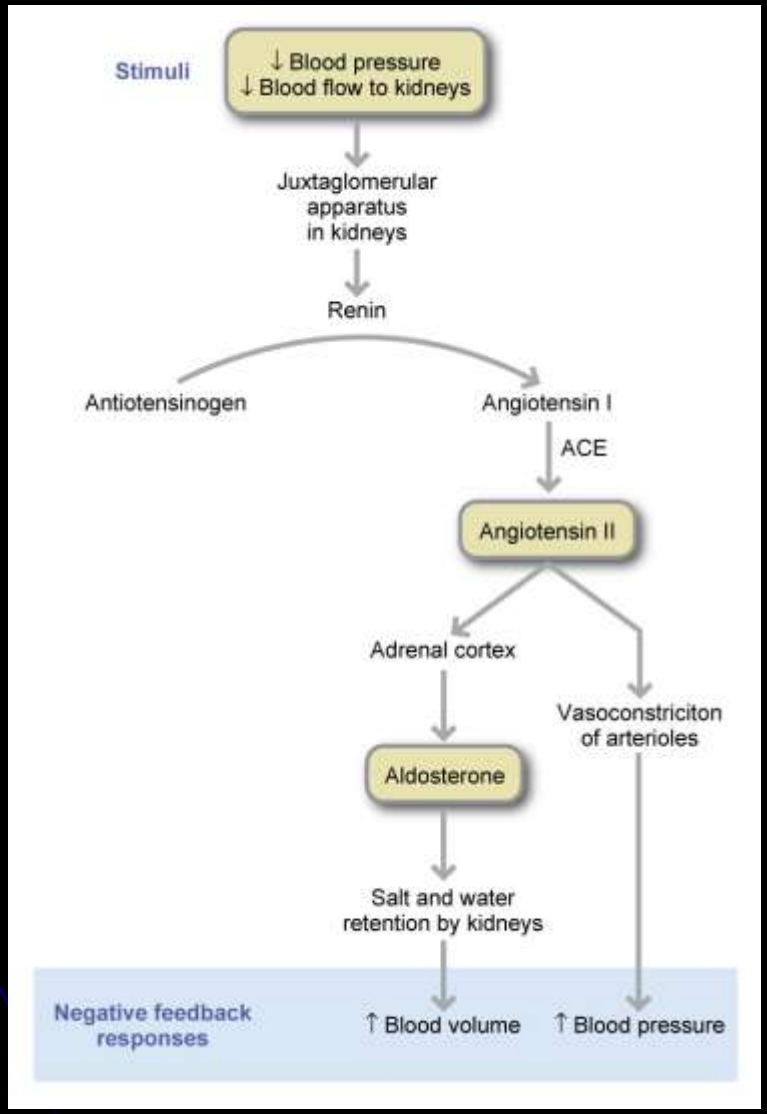
Pathophysiology

- Blood pressure is a function of cardiac output multiplied by peripheral resistance
- Affected by diameter of blood vessel
- Atherosclerosis decreases diameter, increases blood pressure
- Drug therapy increases diameter, lowers blood pressure

Homeostatic Control of Blood Pressure

- Sympathetic nervous system (short-term control)
- Kidney (long-term control)
- Causes of hypertension
  - Hyperactive sympathetic nervous system, overstimulated renin-angiotensin system, low-potassium diet, use of cyclosporine (cause vasoconstriction)
  - Chronic inflammation
  - Multi-factorial

Renin-Angiotensin Cascade



Lifestyle Modifications to Prevent and Manage Hypertension

Modification	Recommendation	Approximate SBP Reduction (Range)†
Weight reduction	Maintain normal body weight (body mass index 18.5-24.9 kg/m^2).	5-20 mm Hg/10 kg
Adopt DASH eating plan	Consume a diet rich in fruits, vegetables, and low-fat dairy products with a reduced content of saturated and total fat.	8-14 mm Hg
Dietary sodium reduction	Reduce dietary sodium intake to no more than 100 mmol per day (2.4 g of sodium or 6 g of sodium chloride).	2-8 mm Hg
Physical activity	Engage in regular aerobic physical activity such as brisk walking (at least 30 min/day most days of the week).	4-9 mm Hg
Moderation of alcohol consumption	Limit consumption to no more than 2 drinks (e.g., 24 oz of beer, 10 oz of wine, or 3 oz of 80-proof whiskey) per day in most men and to no more than 1 drink per day in women and lighter weight persons.	2-4 mm Hg

From National Institutes of Health, National Heart, Lung, and Blood Institute National High Blood Pressure Education Program: The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, NIH Publication No. 04-5230, August 2004.

DASH, Dietary Approaches to Stop Hypertension; *SBP,* systolic blood pressure.

*For overall cardiovascular risk reduction, stop smoking.

†The effects of implementing these modifications are dose and time dependent and could be greater for some individuals.

Other Dietary Factors

- Potassium: inverse relationship
- Calcium: inverse relationship
- Magnesium: vasodilator
- Lipids: amount and type

Medical Management

- Assessment and history
- Lifestyle changes
- Pharmacologic therapy
  - Diuretics
  - β-blockers
  - Other drugs

Nutrition Management

- Lifestyle modifications
- Weight reduction
- Changing dietary patterns
  - DASH diet
- Salt restriction
- Other dietary modifications
  - Minerals, lipids, alcohol, exercise

DASH Diet

- Grains: 6 to 8 servings/day
- Vegetables: 4 to 5 servings/day
- Fruits: 4 to 5 servings/day
- Fat-free or low-fat milk and milk products: 2 to 3 servings/day
- Lean meats, poultry, and fish: 6 oz or less/day
- Nuts, seeds, and legumes: 4 to 5 servings/week
- Fats and oils: 2 to 3 tsp/day
- Sweets and added sugars: 5 or less servings/week

Sodium

- Processed and restaurant foods provide 80% of sodium intake
- Read labels; sodium content of different brands varies
- Americans consume ~4,000 mg/day; 2005 Dietary Guidelines for Americans recommend <2,300 mg/day; those with hypertension, African Americans and middle-aged and elderly should consume <1,500 mg/day

Heart Failure (HF)

- Heart cannot provide adequate blood flow to the rest of the body causing fatigue, shortness of breath (dyspnea) and fluid retention
- May be caused by diseases of the heart (valves, muscle, blood vessels) and vasculature (hypertension)
- Major public health problem; 80% of cases aged >65 years; most common in black women and black men

Risk Factors for Heart Failure

- Hypertension
- Diabetes
- Coronary heart disease
- Left ventricular hypertrophy
- Enlargement of left ventricle

Prevention of Heart Failure

- Primary prevention: aggressive treatment of underlying risk factors and diseases: dyslipidemia, hypertension, and diabetes
  - Pharmacologic therapy
  - Lifestyle changes (heart-health diet, lose or maintain body weight, increase physical activity, avoid tobacco and alcohol)
- Secondary prevention
  - ACE inhibitors, angiotensin receptor blockers, aldosterone blockers, β-blockers, and digoxin

Progression of HF

- Asymptomatic phase when damage is occurring silently (stages A and B)
- Further ventricle damage, remodeling, and appearance and worsening of symptoms (stage C)
- Final stage (stage D): subjective scale to classify symptoms based on degree of limitation of daily activities
- Hallmarks: fatigue, shortness of breath, and fluid retention

Classifications of Heart Failure

Class I	No undue symptoms associated with ordinary activity and no limitation of physical activity
Class II	Slight limitation of physical activity; patient comfortable at rest
Class III	Marked limitation of physical activity; patient comfortable at rest
Class IV	Inability to carry on physical activity without discomfort; symptoms of cardiac insufficiency or chest pain at rest

(Reprinted with permission from Bender JR: Heart valve disease. In Zaret BL, Moser M, and Cohen LS (eds.): Yale University School of Medicine Heart Book, New York, Heart Books, 1992.)

Cardiac Cachexia

- Involuntary weight loss of >6% of nonedematous body weight over a 6-month period
- Significant loss of lean body mass: exacerbates HF
- Cachectic heart: soft and flabby
- Structural, circulatory, metabolic, inflammatory, and neuroendocrine changes in skeletal muscle
- Serious complication of HF

Medical Management of Congestive Heart Failure

- Therapy corresponds to stage of HF
- Stage A: treat underlying conditions (hypertension, dyslipidemia, thyroid disorders, arrhythmias), avoid high-risk behaviors (tobacco, alcohol, illicit drug use), and lifestyle changes (weight loss, exercise, low-sodium diet, heart-healthy diet)
- Later stages: implantable defibrillator, pharmacologic treatment, surgically implanted ventricular assist devices, heart transplantation, and continual IV therapy

Medical Management of Congestive Heart Failure–cont'd

- Short-term goals
  - Relieve symptoms
  - Improve quality of life and depression
- Long-term goal
  - Prolong life by lessening, stopping, or reversing left ventricular dysfunction

Medical Nutrition Therapy for Heart Failure

- Nutrition screening
- Body weight
  - Consider fluid balance
  - Edema may mask cachexia
- Anthropometrics to assess lean body mass
- Dietary assessment

Sodium in Patients with Heart Failure

- Recommendations vary between 1200 to 2400 mg/day
- Severe restrictions are unpalatable and nutritionally inadequate
- Adherence problems
- Ethnic differences
- Eliminate table salt and high-sodium foods