Introduction to Clinical Pharmacology

Chapter 32
Diuretics

Common Causes for Edema

- Heart failure
- Endocrine disturbances
- Kidney and liver diseases
- Fluid overload from other causes

Edema

- Edema: accumulation of excess water in the body
- Edema (fluid retention) associated with HF, corticosteroid/estrogen therapy, and cirrhosis of the liver

Diuretics

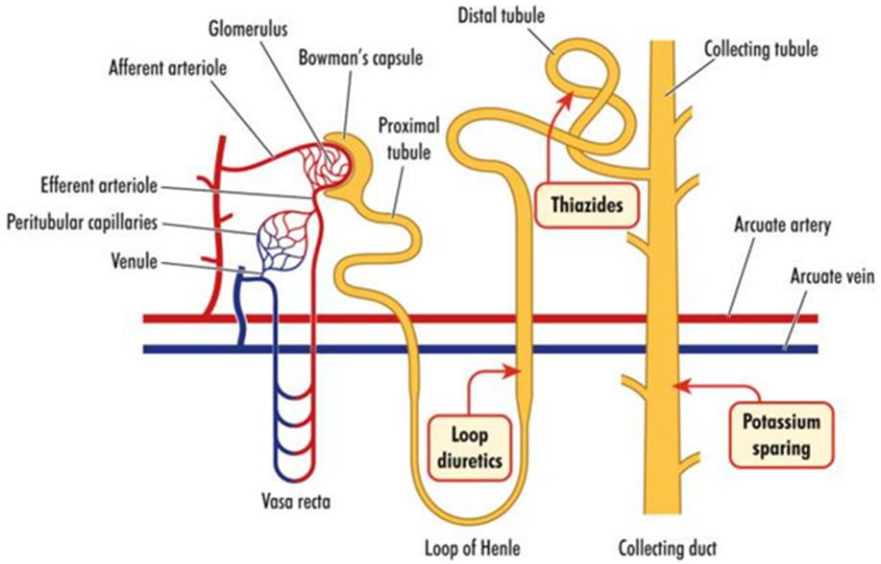
- Carbonic anhydrase inhibitors
- Loop diuretics
- Osmotic diuretics
- Potassium-sparing diuretics
- Thiazides and related diuretics

Diuretics: Actions #1

- Carbonic anhydrase inhibitors: such as acetazolamide (Diamox) and methazolamide
  - Inhibit the enzyme carbonic anhydrase
  - Result in excretion of sodium, potassium, bicarbonate, and water
  - Used to treat glaucoma
  - Decrease the production of aqueous humor in the eye, which in turn decreases intraocular pressure

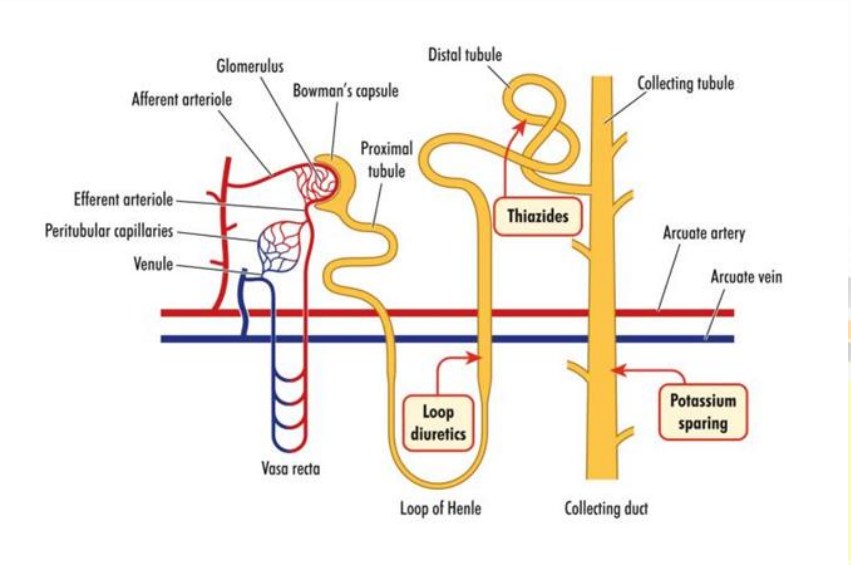
Diuretics: Actions #2

- Loop diuretics: such as furosemide (Lasix)
  - Increase the excretion of sodium and chloride
  - Torsemide(Demadex): acts primarily in the ascending portion of the loop of Henle
  - Bumetanide: acts primarily in the proximal tubule of the nephron



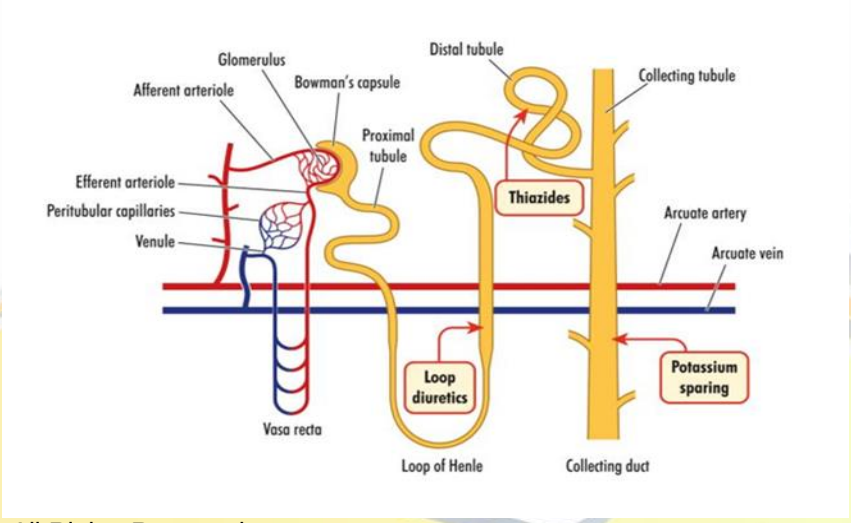
Diuretics: Actions #3

- Potassium-sparing diuretics:
  - Triamterene, amiloride: depress the reabsorption of sodium in the kidney tubules
  - Spironolactone: antagonizes the action of aldosterone
  - Aldosterone: enhances the reabsorption of sodium in the distal convoluted tubules of the kidney



Diuretics: Actions #4

- Thiazides and related diuretics: such as chlorothiazide, hydrochlorothiazide, metolazone
  - Inhibit reabsorption of sodium and chloride ions in the ascending portion of the loop of Henle and early distal tubule of nephron
- Osmotic diuretics: Such as isosorbide, mannitol, urea
  - Increase the density of the filtrate in the glomerulus
  - Mannitol given only IV (intravenously)



Diuretics: Uses

- Used in the treatment of:
  - Edema associated with congestive heart failure
  - Hypertension
  - Renal disease
  - Cerebral edema
  - Acute glaucoma and increased IOP
  - Seizures and altitude sickness

Diuretics: Adverse Reactions

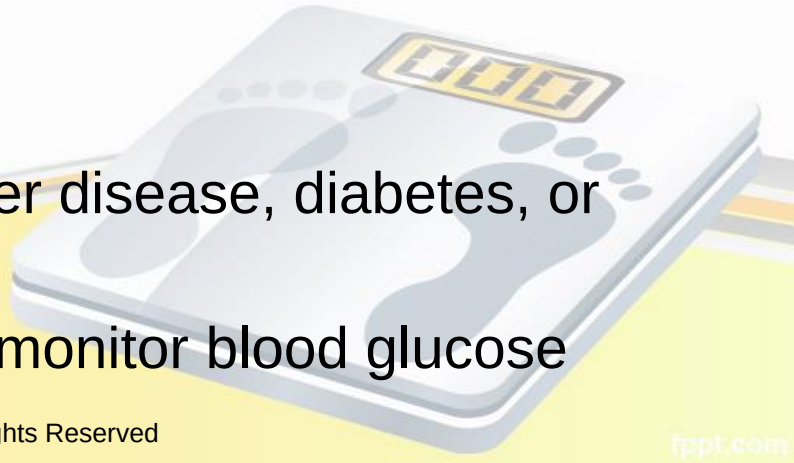
- Neuromuscular reactions: dizziness, lightheadedness, headache, weakness, fatigue
- Cardiovascular reactions: orthostatic hypotension, electrolyte imbalances, glycosuria
- Gastrointestinal (GI) reactions: anorexia, nausea, vomiting
- Other reactions: hypokalemia, hyperkalemia, gynecomastia

Diuretics: Contraindications

- Contraindicated in patients:
  - With known hypersensitivity to the drugs, electrolyte imbalances, severe kidney or liver dysfunction, and anuria
- Mannitol: contraindicated in patients with active intracranial bleeding
- Potassium-sparing diuretics: contraindicated in patients with hyperkalemia; not recommended for children

Diuretics: Precautions

- Used cautiously in patients with renal dysfunction; during pregnancy, lactation
- Thiazide and loop diuretics:
  - Used cautiously in patients with liver disease, diabetes, systemic lupus erythematosus, or diarrhea
  - Hold next dose in patients with renal compromise if BUN is elevated
  - Question if giving with a sulfonamide due to possible cross sensitivity
  - Monitor pulse rate and rhythm when taking digoxin due to possible cardiac arrhythmias
- Potassium-sparing diuretics:
  - Used cautiously in patients with liver disease, diabetes, or gout
  - When diabetic taking loop diuretic monitor blood glucose



Diuretics: Interactions #1

- Carbonic anhydrase inhibitors

Interactant drug	Effect of interaction
Primidone	Decreased effectiveness of primidone

Diuretics: Interactions #2

- Loop diuretics

Interactant drug	**Effect of interaction**
Digitalis	Increased risk of arrhythmias
Cisplatin, aminoglycosides	Increased risk of ototoxicity
Anticoagulants or thrombolytics	Increased risk of bleeding
Lithium	Increased risk for lithium toxicity
Hydantoins (phenytoin)	Decreased diuretic effectiveness
NSAIDs and salicylates	Decreased diuretic effectiveness

Diuretics: Interactions #3

- Potassium-sparing diuretics

Interactant drug	Effect of interaction
Angiotensin-converting enzyme (ACE) inhibitors or potassium supplements such as lisinopril	Increased risk for hyperkalemia
Nonsteroidal anti-inflammatory drugs (NSAIDs), salicylates, and anticoagulants	Decreased diuretic effectiveness

Diuretics: Interactions #4

- Thiazides and related diuretics

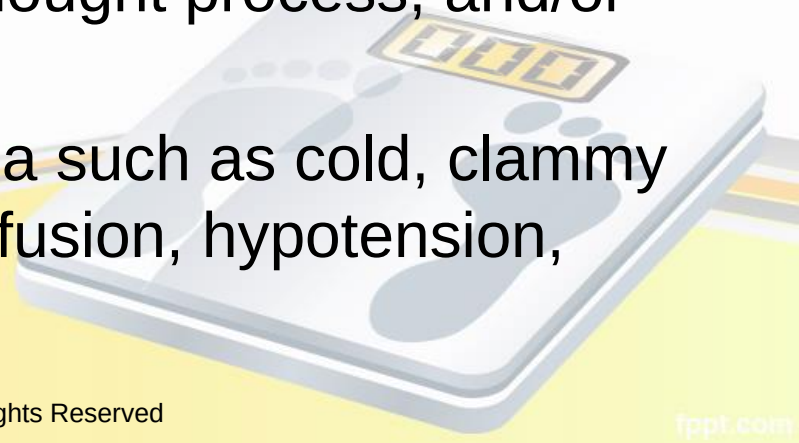
Interactant drug	**Effect of interaction**
Allopurinol	Increased risk for hypersensitivity to allopurinol
Anesthetics	Increased anesthetic effectiveness
Antineoplastic drugs	Extended leukopenia
Antidiabetic drugs	Hyperglycemia

Nursing Process: Assessment #1

- Preadministration assessment:
  - Take vital signs and weigh the patient
  - Review laboratory results; especially electrolytes such as potassium
  - If patient has peripheral edema: inspect the involved areas and record in the patient's chart the degree and extent of edema
  - Review the patient's chart for a description of the seizures and their frequency

Nursing Process: Assessment #2

- Ongoing assessment:
  - Measure and record fluid intake and output
  - Ensure diuretic given early in day (AM and lunch)
  - Report to the primary health care provider any marked decrease in the fluid output
  - Weigh the patient daily
  - Assess for possible signs of hypokalemia which include anorexia, vomiting, nausea, depression, confusion, cardiac arrhythmias, impaired thought process, and/or drowsiness
  - Assess for signs of hyponatremia such as cold, clammy skin, decreased skin turgor, confusion, hypotension, irritability, tachycardia



Nursing Process: Diagnosis

- **Impaired Urinary Elimination** related to action of the diuretics causing increased frequency
- **Risk for Deficient Fluid Volume** related to excessive diuresis secondary to administration of a diuretic
- **Risk for Injury** related to lightheadedness, dizziness, or cardiac arrhythmias

Nursing Process: Planning

- Expected outcomes:
  - Optimal response to drug therapy
  - Management of patient needs related to adverse drug reactions
  - Correction of a fluid volume deficit
  - Absence of injury
  - Understanding of and compliance with the postdischarge drug regimen

Nursing Process: Implementation #1

- Promoting an optimal response to therapy
  - Patient with edema:
    - Weigh the patient; measure and record the fluid intake and output
    - Assess the blood pressure, pulse, respiratory rate
    - Examine areas of edema daily and record findings in the patient's chart

Nursing Process: Implementation #2

- Promoting an optimal response to therapy (cont.)
  - Patient with hypertension:
    - Monitor blood pressure, pulse, respiratory rate before administration of the drug

Nursing Process: Implementation #3

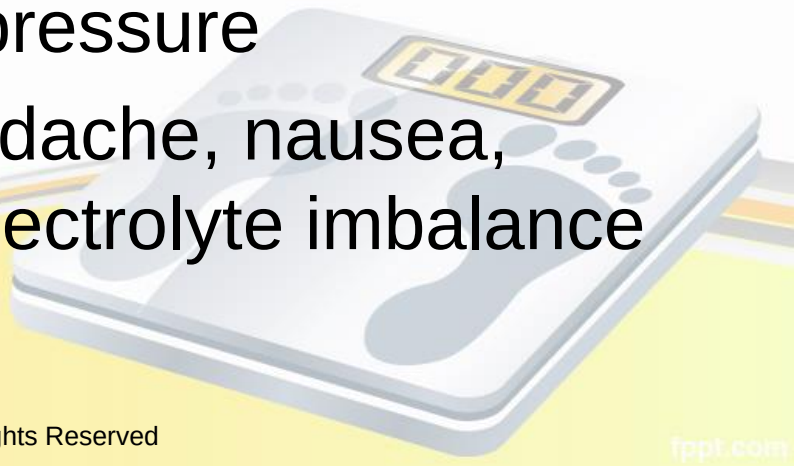
- Promoting an optimal response to therapy (cont.)
  - Patient with acute glaucoma:
    - Evaluate the patient's response to drug therapy every 2 hours
    - Assist the patient with ambulatory and self-care activities

Nursing Process: Implementation #4

- Promoting an optimal response to therapy (cont.)
  - Patient with seizure activity:
    - Assess the patient at frequent intervals for the occurrence of seizures
    - Record a description of the seizure in the patient's chart, including time of onset and duration

Nursing Process: Implementation #5

- Promoting an optimal response to therapy (cont.)
  - Patient with increased intracranial pressure
    - Monitor the urine output, blood pressure, pulse, and respiratory rate
    - Perform neurologic assessments at specific time intervals
    - Monitor for signs and symptoms indicating decrease in intracranial pressure
    - Monitor for syncope; headache, nausea, vomiting, and fluid and electrolyte imbalance



Nursing Process: Implementation #6

- Promoting an optimal response to therapy (cont.)
  - Patient with renal compromise:
    - Monitor renal function periodically
    - Monitor serum uric acid concentrations and serum glucose concentration periodically
    - Monitor for any joint pain or discomfort

Nursing Process: Implementation #7

- Promoting an optimal response to therapy (cont.)
  - Patient at risk for hypokalemia:
    - Monitor serum potassium levels frequently
    - Treatment for hyperkalemia: administer IV bicarbonate or oral or parenteral glucose with rapid-acting insulin

Nursing Process: Implementation #8

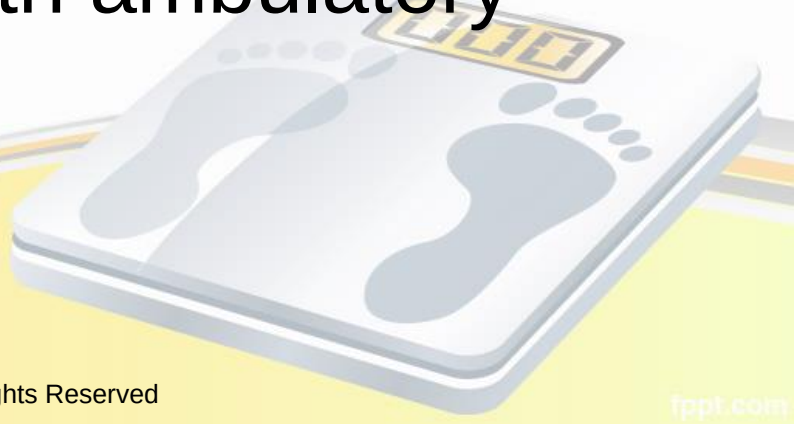
- Monitoring and managing patient needs
  - Impaired urinary elimination:
    - Explain the purpose and effects of the drug to reduce anxiety
    - Administer the drug early in the day
    - Make sure that patient on bed rest has a call light and a bedpan or urinal within easy reach

Nursing Process: Implementation #9

- Monitoring and managing patient needs (cont.)
  - Risk for deficient fluid volume:
    - Encourage patients to eat and drink all food and fluids served at mealtime
    - Monitor fluid intake and output
    - Assess for signs and symptoms of electrolyte imbalance

Nursing Process: Implementation #10

- Monitoring and managing patient needs (cont.)
  - Risk for injury:
    - Frequently monitor pulse rate and rhythm
    - Assist patients who are dizzy but allowed out of bed with ambulatory activities



Nursing Process: Implementation #11

- Educating the patient and family
  - Explain the importance of taking the drug at prescribed time intervals and as directed
  - Advise about the importance of completing the entire course of treatment
  - Emphasize the importance of taking the drug with food or milk

Nursing Process: Implementation #12

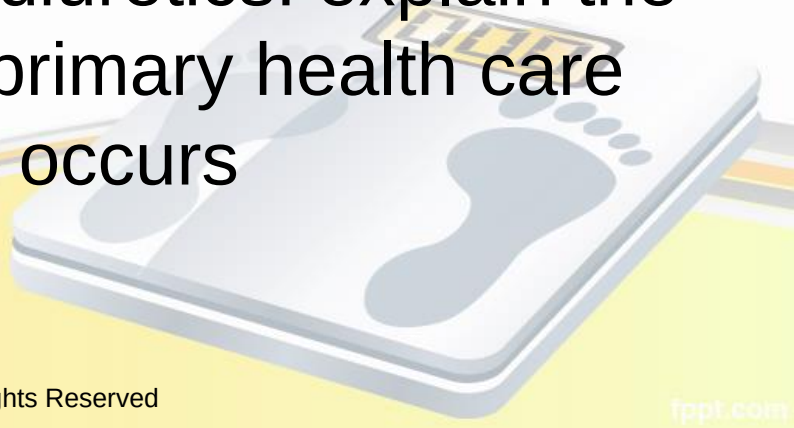
- Educating the patient and family (cont.)
  - Do not reduce fluid intake to reduce the need to urinate
  - Instruct patient to avoid alcohol and nonprescription drugs
  - Emphasize observing caution while driving or performing hazardous tasks
  - Explain necessary interventions if dizziness or weakness occurs

Nursing Process: Implementation #13

- Educating the patient and family (cont.)
  - Explain the importance of avoiding exposure to sunlight or ultraviolet light
  - Explain to patients with diabetes mellitus and who take loop or thiazide diuretics to contact health care provider if increase in blood glucose level; avoid OTC drugs for appetite suppression and cold symptoms due to increase in blood pressure

Nursing Process: Implementation #14

- Educating the patient and family (cont.)
  - For patients taking potassium-sparing diuretics: emphasize the importance of avoiding foods high in potassium and use of salt substitutes containing potassium
  - Monitor potassium levels; sodium and other electrolyte levels
  - For patients taking thiazide diuretics: explain the necessity of contacting the primary health care provider if sudden joint pain occurs



Nursing Process: Implementation #15

- Educating the patient and family (cont.)
  - For patients taking carbonic anhydrase inhibitors: *e*xplain the necessity of contacting the primary health care provider immediately if eye pain is not relieved or increased

Nursing Process: Evaluation #1

- Therapeutic effect is achieved
- Adverse reactions are identified, reported, and managed successfully
- Fluid volume problems are corrected
- No injury is evident

Nursing Process: Evaluation #2

- Patient verbalizes the importance of complying with the prescribed treatment regimen
- Patient and family demonstrate an understanding of the drug regimen
- Need to also ensure that patient is aware of the nutrition needs and awareness that can influence electrolytes when on diuretics
- Also need to be aware of the signs and symptoms of hypokalemia, hyperkalemia, hyponatremia, hypernatremia to name a few
- Need to be aware of signs and symptoms of fluid and electrolyte imbalances