CARDIOLOGY 2023

# CARDIAC MEDICATIONS REVIEW

## Diuretics

2/26/23

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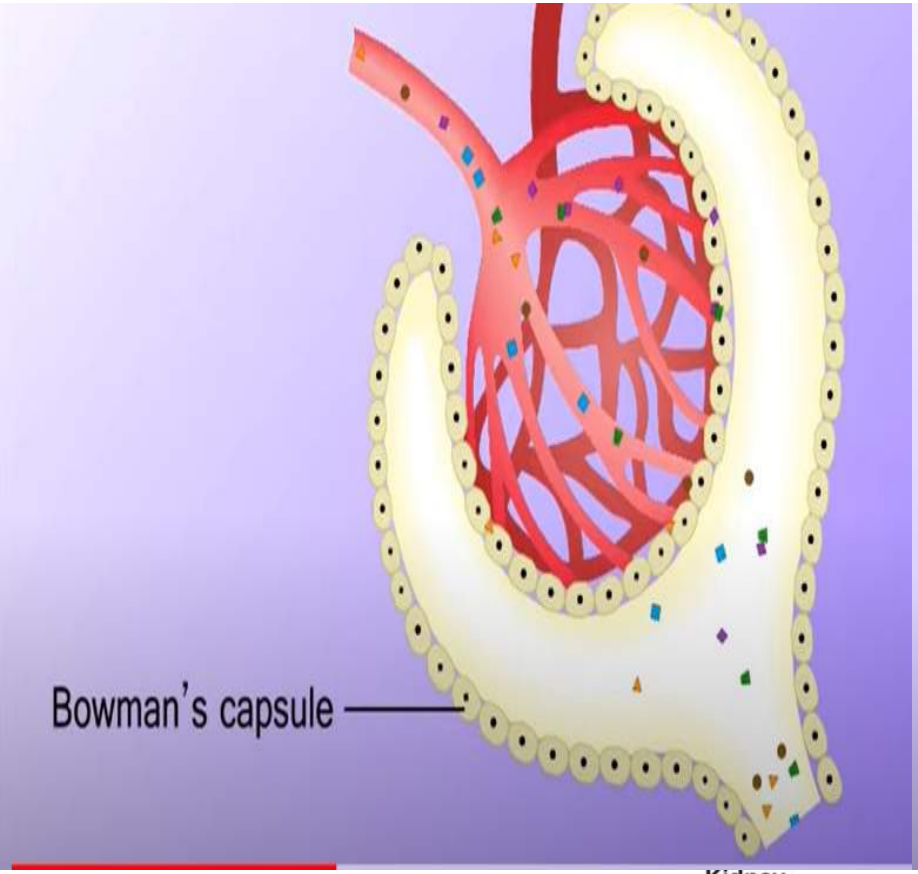
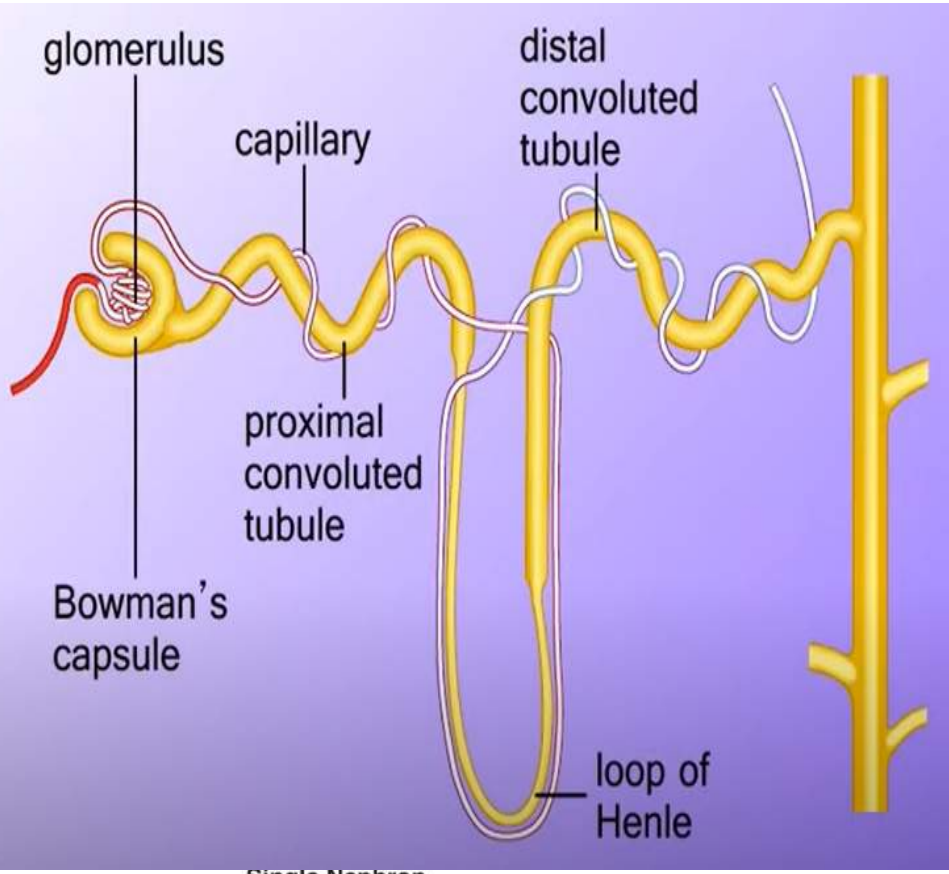
# TYPES OF DIURETICS

- Loop
- Thiazide
- Carbonic Anhydrase Inhibitor
- Potassium Sparing




Kidney




Single Nephron

# 11 MONTH OLD, SUB AS, MITRAL VALVE REGURG

- Hx of Shone's Complex & aortic arch repair (2 mo of age)
- Shone's complex- small left-sided structures (at least 3)
  - Bicuspid aortic valve and small aortic valve annulus
  - Coarctation of aorta
  - Cor triatriatum
  - Hypoplastic left heart ventricle
  - Parachute mitral valve.
  - Small aortic arch
  - Subaortic stenosis
  - Supramitral ring

# POST-OPERATIVE COURSE

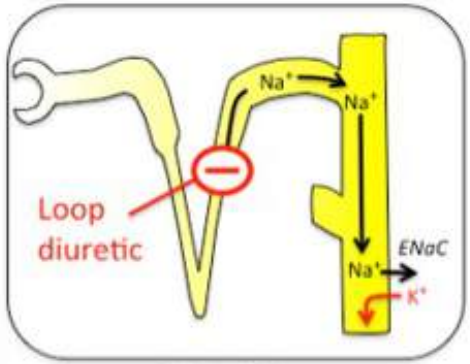
- Surgical repair: Sub-aortic resection, aortic valvuloplasty, mitral valvuloplasty
  - POD #1-fluid positive- **lasix IV**

# Loop

Furosemide
Bumetanide
Ethacrynic acid* ($$$)

-Loop of Henle
-"high ceiling"
- $Na^+$, $K^+$, $Cl^-$ loss

# LOOP




*Enhanced $Na^+$ delivery results in $K^+$ loss in the collecting duct*

25% of filtered Na is normally reabsorbed in the loop of Henle

Loop diuretics:

- Loss of Na & Water
- Hypokalemic metabolic alkalosis
- Increased $Ca^{2+}$ loss

# LASIX

- Furosemide (Lasix): Inhibits reabsorption of Na+ and Cl- in ascending loop of Henle
- Dose: 1-2 mg/kg/dose IV/po up to every 6 hours
- Continuous Infusion: 0.1-0.2 mg/kg/hr
- Onset: IV-5 min; Half-Life: 2-4 hours
- Common side effects: hypokalemia, hyponatremia, metabolic alkalosis, ototoxicity, dehydration
- Poor response to single dose- ? predictor of AKI & prolonged ventilation

# BUMETANIDE (BUMEX)

- Inhibits reabsorption of Na+ and Cl- in the ascending loop of Henle and proximal renal tubule
- Dose: 0.1 mg/kg/dose IV up to q6hr
- Cont. Infusion: 0.01mg/kg/hr or 0.4mg/kg/day
- Onset: IV-5 min; Half-Life: 2-4 hours
- 10-40 times more potent than Furosemide
- Common side effects: hypokalemia, hypochloremia, hyponatremia,

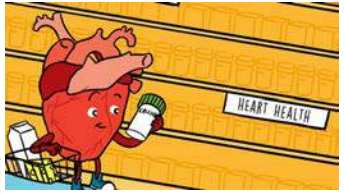
# POST-OPERATIVE COURSE

- POD #2- fluid positive- **lasix IV q6,** added **diuril IV q12**
- Labs:
  - Na, K, Cl low
  - Ca low

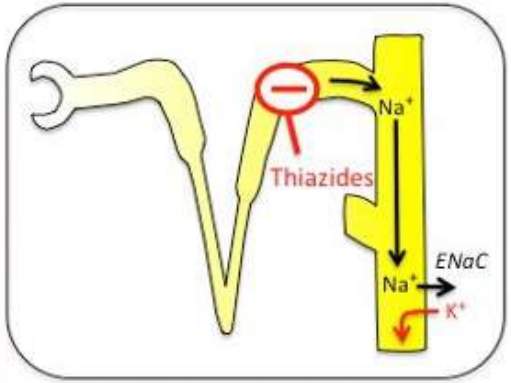
# Thiazide

Chlorothiazide
Hydrochlorothiazide
Metolazone*

-Distal convoluted tubule
-Weak relative to loops
- Calcium sparing
-Na+, K+, Cl- loss



# Thiazide




*Enhanced $Na^+$ delivery results in $K^+$ loss in the collecting duct*

10% of filtered Na
is normally reabsorbed
in the distal convoluted tubule

Thiazide diuretics:

- Loss of Na & Water
- Hypokalemic metabolic alkalosis
- Increased $Ca^{2+}$ reabsorption

# CHLOROTHIAZIDE (DIURIL)

- Inhibits NA+ reabsorption in the distal tubules.
- Dose: 5-10 mg/kg/dose IV q12hr
  - 10-20 mg/kg/dose PO q12hr- only thiazide available in IV
- Onset: IV-15 min; Half-Life: 1-2 hours
- Common side effects: hyponatremia, hypokalemia, hypochloremia, hyperglycemia
- Used in combination with loops- augments diuresis

# HYDROCHLOROTHIAZIDE

- Inhibits NA+ reabsorption in the distal tubules
- Dose: 1-2 mg/kg/day PO q12-24hr
- Onset: PO 2-4 hours; Half-Life: 6-12 hours
- Common side effects:
  hypokalemia, hypomagnesemia, hypercalcemia, and hyponatremia
- Commonly combined with ACE's or ARB's

# METOLAZONE

- Dose: 0.2 to 0.4 mg/kg/day PO divided every 12 to 24 hours (in combination with furosemide)
- Onset: PO 1 hour; Half-Life: 8-14 hours
- Common side effects: hypercalcemia, hyperglycemia, hyperuricemia, hypochloremia, hypochloremic alkalosis, hypokalemia, hypomagnesemia, hyponatremia, hypophosphatemia **electrolyte derangements**

# POST-OPERATIVE COURSE

- Severe MV regurgitation (defect in anterior leaflet)
- Moderately depressed LV systolic function
  - POD #6- **bumex gtt** 0.01 mg/kg/hr. Add **diamox**
    - Labs:
      - Low K, low Cl, metabolic alkolosis, elevated LFTs, BUN, & nt-BNP

# Carbonic Anhydrase Inhibitor

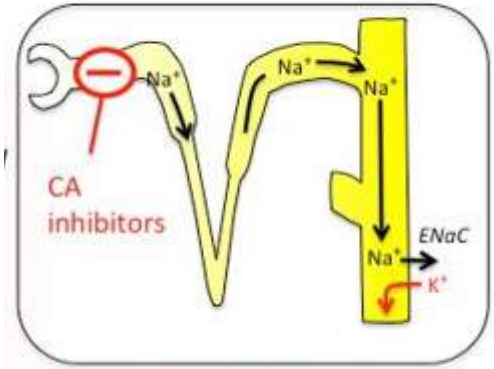
Acetazolamide (Diamox)

-Proximal convoluted tubule

-weak diuretic

- Used for its effect on bicarbonate ($HCO_3$)

# Carbonic Anhydrase Inhibitor




*Enhanced $Na^+$ delivery results in $K^+$ loss in the collecting duct*

~66% of filtered Na & 85% of $NaHCO_3$ is normally reabsorbed in the proximal tubule

Carbonic Anhydrase Inhibitors:

- Loss of $NaHCO_3$
- Hypokalemic metabolic acidosis
- Tolerance develops after 2-3 days

# ACETAZOLAMIDE (DIAMOX)

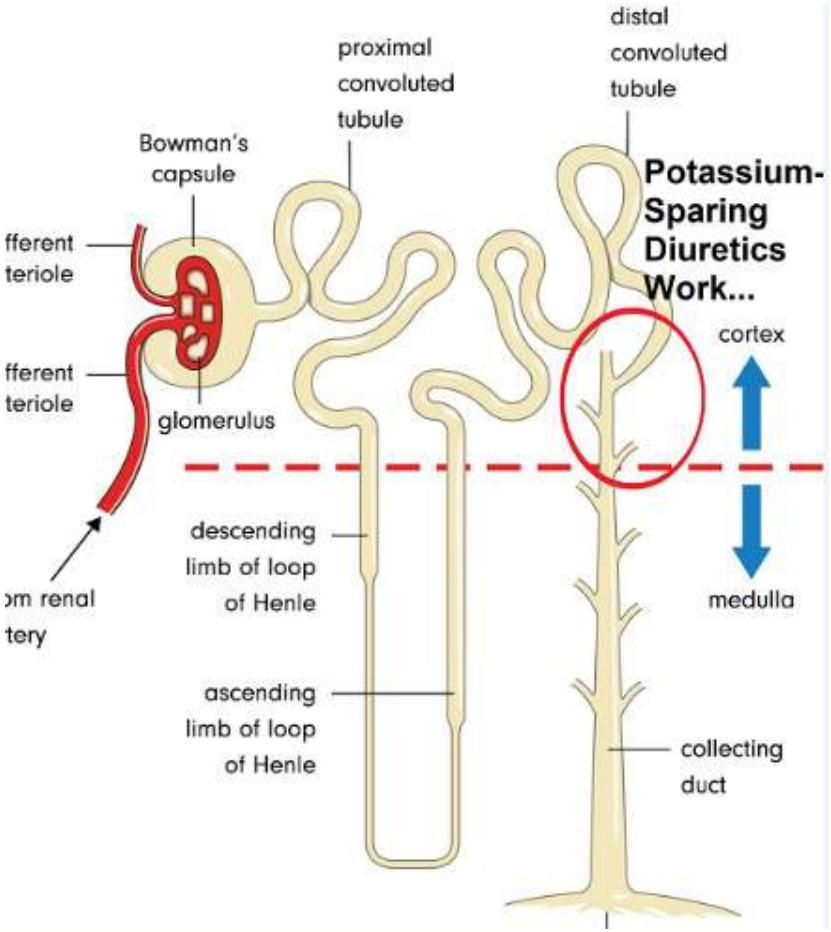
- Causes an accumulation of carbonic acid by preventing its breakdown & blocking reabsorption of bicarbonate
- Increases urinary sodium and bicarbonate excretion and improvement of hypochloremic metabolic alkalosis
- Dose: 5 mg/kg/dose IV/po q6-8 hr
  - Limited # doses (usually x 24 hours)
- Common side effects: metabolic acidosis, hypokalemia, hyponatremia

# Potassium Sparing

Spironolactone (Aldactone)

-Collecting duct
-Conserves K & H+
-Na & water excretion
-Weak diuretic
-Aldosterone receptor blocker

# Potassium Sparing




2-5% of filtered Na is normally reabsorbed in the collecting duct

Aldosterone antagonists

- Loss of Na & Water
- Hyperkalemia
- Some risk for acidosis

Children's Mercy KANSAS CITY

# SPIRONOLACTONE (ALDACTONE)

- Used frequently in Heart Failure
- Competes with aldosterone for receptor sites in the collecting duct, increasing sodium chloride and water excretion while conserving potassium and hydrogen ions
- Not a strong diuretic
- Dose: 1-3 mg/kg/day IV/po q6-12 hr
- Short half life (1-2 hrs)
- Common side effects:
  - Hyperkalemia- may be severe when combined with ACE inhibitor, beta blocker or Bactrim
  - Reduces renal tubular secretion of digoxin & can attenuate its positive inotropic effect

# SPECIAL THANKS

- Amanda Gansen- PharmD
- Angel Pope- PharmD

# REFERENCES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