D.PHARM • SECOND YEAR

Pharmacology

CHAPTER 9

Drugs Acting on the Kidney



ENGLISH CHAPTER NOTES

DIPLOMA IN PHARMACY

Diuretics: Definition and Classification

Diuretics increase renal excretion of sodium and water, so urine volume rises. They are used mainly for oedema and hypertension.

4. Carbonic anhydrase inhibitor

- acetazolamide

Main site: proximal convoluted tubule.

2. Thiazide and thiazide-like diuretics

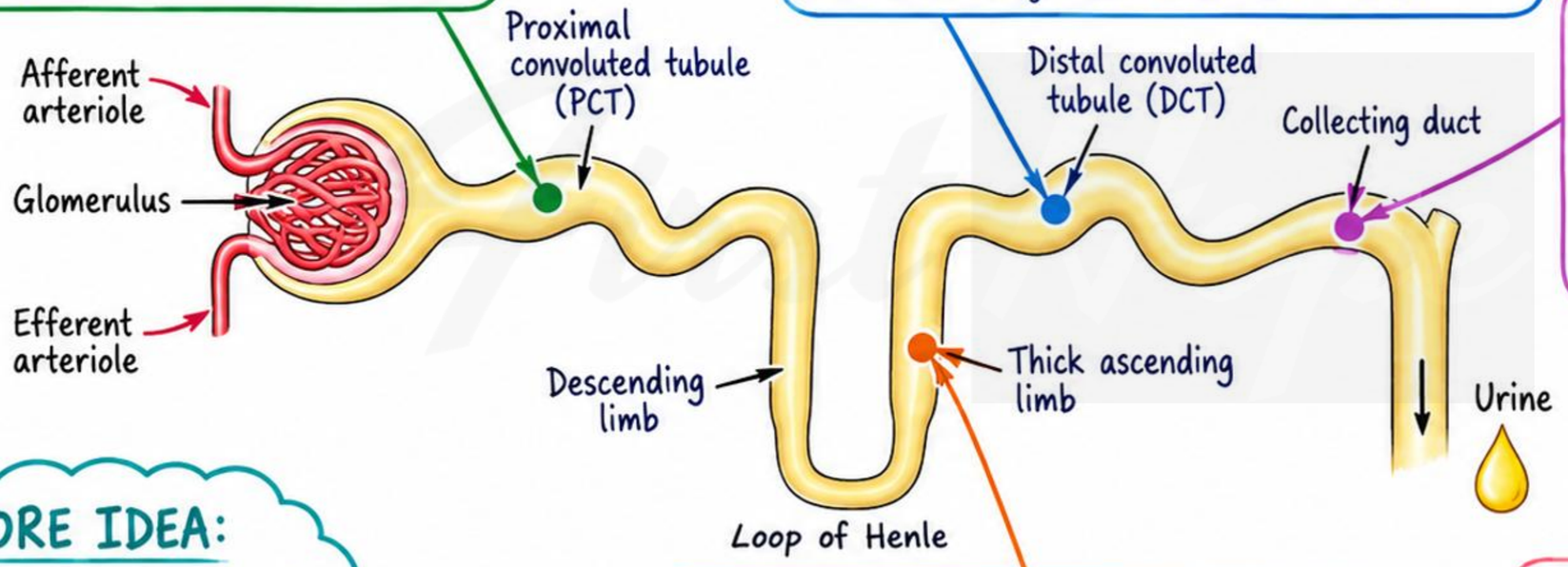
- hydrochlorothiazide, chlorthalidone, indapamide

Main site: early distal convoluted tubule.

3. Potassium-sparing diuretics

- aldosterone antagonists: spironolactone, eplerenone
- ENaC blockers: amiloride, triamterene

Main site: late distal tubule and collecting duct.



Core idea:

Different classes act at different nephron sites and vary greatly in potency and electrolyte effects.

1. Loop diuretics

- furosemide, torsemide, bumetanide
- ethacrynic acid

Main site: thick ascending limb of loop of Henle. Most powerful class.

5. Osmotic diuretic

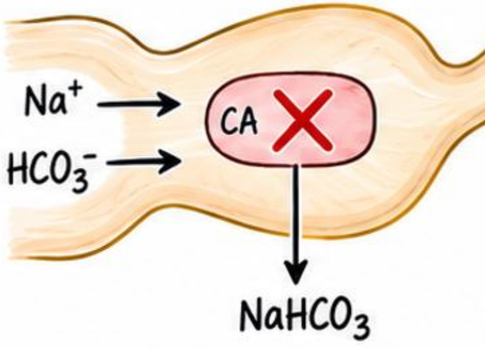
- mannitol, given IV

Acts mainly in water-permeable parts of the nephron.

DIURETICS: SITES AND MECHANISMS

PROXIMAL TUBULE

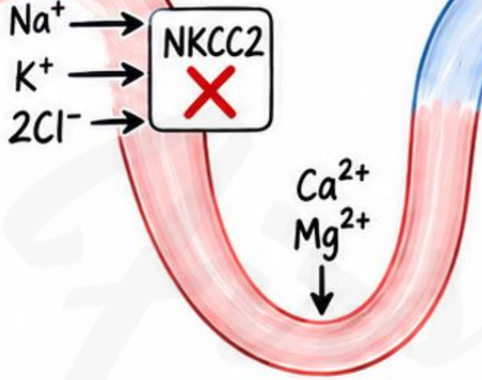
acetazolamide



Inhibits carbonic anhydrase → reduces $NaHCO_3$ reabsorption → bicarbonate-rich urine and mild diuresis.

THICK ASCENDING LIMB

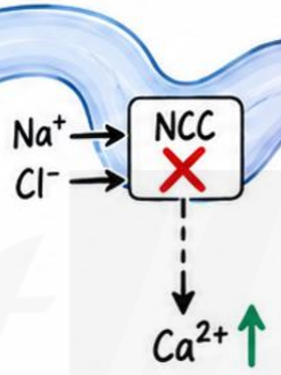
loop diuretics



Block the $Na^+/K^+/2Cl^-$ cotransporter, NKCC2 → marked natriuresis and diuresis. Urinary Ca^{2+} and Mg^{2+} loss also increases.

DISTAL CONVOLUTED TUBULE

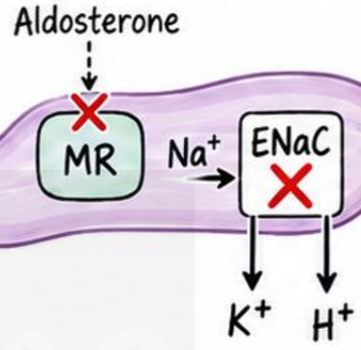
thiazides



Block the Na^+/Cl^- cotransporter, NCC → moderate natriuresis. They reduce urinary Ca^{2+} excretion.

LATE DISTAL TUBULE AND COLLECTING DUCT

potassium-sparing drugs

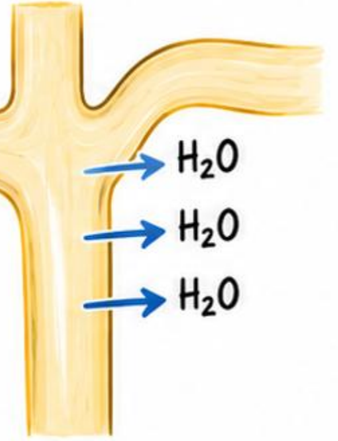


- spironolactone and eplerenone block mineralocorticoid receptors
- amiloride and triamterene block epithelial sodium channels, ENaC

Both reduce Na^+ reabsorption and reduce K^+ and H^+ loss. Their diuretic effect is weak.

OSMOTIC ACTION

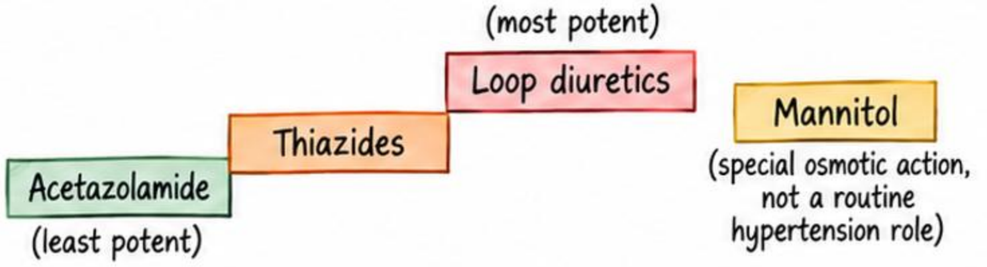
mannitol



Freely filtered but not significantly reabsorbed → raises tubular osmotic pressure → holds water in the lumen.

RELATIVE POTENCY

Loop diuretics > thiazides > potassium-sparing or carbonic anhydrase inhibitors.
Mannitol has a special osmotic action, not a routine hypertension role.



DIURETICS: DOSES AND THERAPEUTIC USES



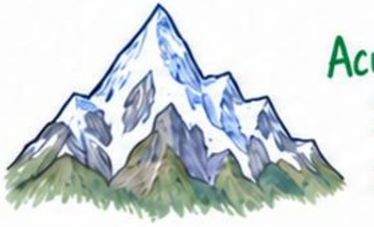
Raised intracranial pressure or cerebral oedema

Mannitol under specialist monitoring.



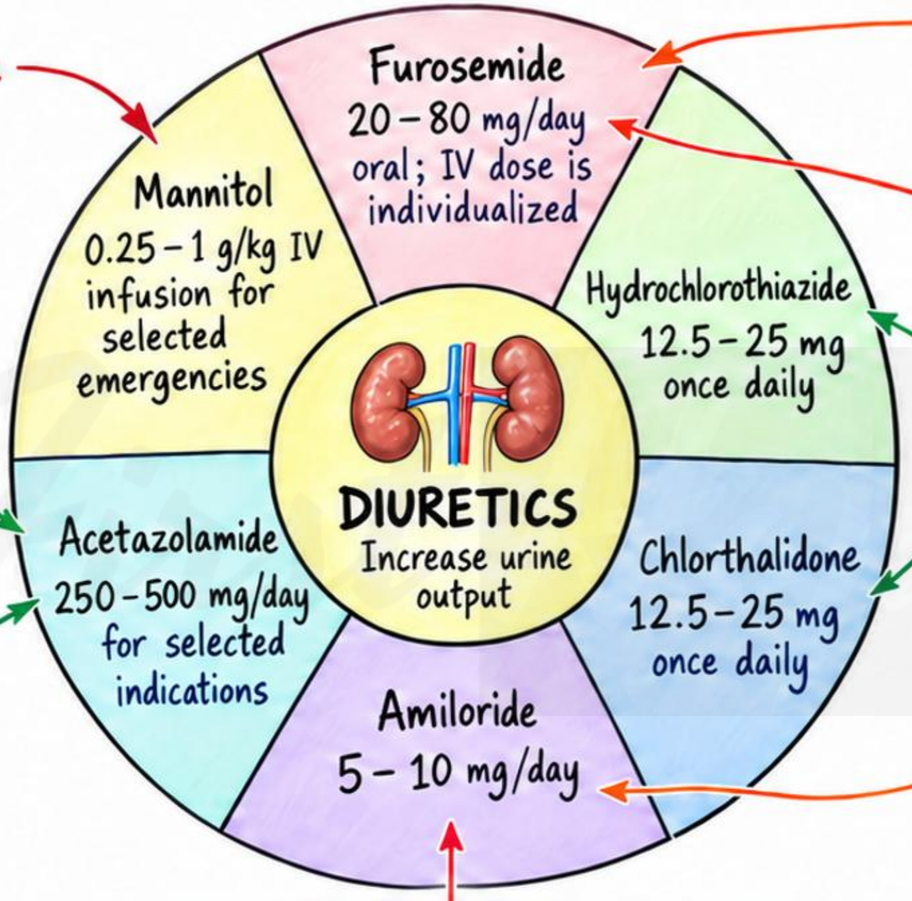
Glaucoma

Acetazolamide.



Acute mountain sickness

Acetazolamide.





Oedema due to heart failure, cirrhosis or nephrotic syndrome

Usually loop diuretic.



Acute pulmonary oedema

IV loop diuretic with urgent clinical care.



Hypertension

Thiazide or thiazide-like drug is commonly used.



Heart failure or hyperaldosteronism

Spironolactone or eplerenone in selected patients.

Spironolactone 25 – 100 mg/day

Prevent diuretic-induced hypokalaemia

Low-dose potassium-sparing drug when appropriate.

Severe hypercalcaemia

Loop diuretic only in selected adequately hydrated patients.

PRACTICAL POINT

Most diuretics are taken in the morning to reduce nocturia; a second dose is usually taken early afternoon.

Dose depends on indication, kidney function, response and product.

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