



GENITOURINARY SYSTEM

SUBJECT : Pharmacology

LEC NO. : 1+2

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Questions: IV-1 Diuretics

Directions for questions 1–5

Match each diuretic with the appropriate description (each lettered option can be selected once, more than once, or not at all).

- A. Acetazolamide
- B. Amiloride
- C. Conivaptan
- D. Ethacrynic acid
- E. Indapamide
- F. Mannitol
- G. Spironolactone
- H. Triamterene

Difficulty level: Easy

1. This drug inhibits Na^+ reabsorption in the proximal tubule.

Difficulty level: Easy

2. This drug inhibits the synthesis of new Na^+ channels in the collecting duct.

Difficulty level: Easy

3. This drug causes an initial extracellular volume expansion in normal subjects.

Difficulty level: Easy

4. This drug increases the renal reabsorption of Ca^{2+} .

Difficulty level: Easy

6. A 56-year-old woman recently diagnosed with congestive heart failure started a therapy that included furosemide. Acetazolamide was added to counteract the potential metabolic alkalosis induced by furosemide. Which of the following molecular actions most likely mediated the therapeutic effect of acetazolamide in this patient?
 - A. Inhibition of carbonic acid dehydration in the tubular lumen
 - B. Stimulation of bicarbonate reabsorption in the proximal tubule
 - C. Inhibition of Na^+ reabsorption in the early distal tubule
 - D. Stimulation of H^+ reabsorption in the proximal tubule
 - E. Stimulation of carbonic acid formation inside the tubular cells

Difficulty level: Medium

7. A 27-year-old woman with a history of high altitude sickness was placed on prophylactic treatment with a diuretic drug prior to going on a hiking trip in the Rocky Mountains. Which of the following urine electrolyte profiles is most consistent with this drug treatment?

	HCO_3^-	Na^+	Ca^{2+}	K^+
P	++	+	0	+
Q	+	++	+	+
R	+	++	–	++
S	+	+++	+	++
T	0	+	–	–

Note: +, increased; –, decreased; 0, negligible changes.

- A. Profile P
- B. Profile Q
- C. Profile R
- D. Profile S
- E. Profile T

Difficulty level: Medium

8. A 69-year-old depressed man with a 10-year history of glaucoma was admitted to the emergency department after he took several tablets of one of his medications in a suicide attempt. The patient was drowsy and complained of nausea, paresthesias, and tiredness. Physical examination revealed erythematous skin eruptions. Lab tests indicated hyperchloremic metabolic acidosis. Which of the following medications might have caused the patient's symptoms?
 - A. Mannitol
 - B. Latanoprost
 - C. Timolol
 - D. Acetazolamide
 - E. Pilocarpine

Difficulty level: Hard

9. A 55-year-old alcoholic man was admitted to the emergency department because of disorientation, amnesia, confusion, and bizarre behavior for the past 24 hours. His wife reported that the man was being treated for hypertension and for recently diagnosed glaucoma. Physical examination revealed a cachectic male in a confused mental state. His abdomen appeared tense with prominent veins and ascites, and a musty, pungent odor was noted in his breath. Neurologic signs included nystagmus, ataxia, and asterixis. Which of the following drugs most likely triggered the patient's syndrome?
- A. Acetazolamide
 - B. Nifedipine
 - C. Losartan
 - D. Timolol
 - E. Lovastatin

Difficulty level: Hard

11. A 15-year-old boy awoke with weakness and 1 hour later realized that he could not move his legs. The attack lasted about 2 hours but then disappeared without residual symptoms. The boy was referred to a neurologic clinic, where the diagnosis of familial hypokalemic periodic paralysis was made. He was prescribed potassium chloride and a diuretic that is able to prevent the attacks in many cases. Which of the following drugs was most likely prescribed?
- A. Mannitol
 - B. Hydrochlorothiazide
 - C. Ethacrynic acid
 - D. Triamterene
 - E. Acetazolamide

Difficulty level: Medium

12. A 67-year-old man was found to have a plasma calcium level of 12.2 mg/dL during a follow-up visit. The man had a 3-year history of Hodgkin lymphoma. He was recently diagnosed with nephrolithiasis for which he had been treated with hydrochlorothiazide for the past 3 weeks. Which of the following best explains the most likely mechanism of thiazide-induced hypercalcemia?
- A. Activation of the $\text{Na}^+/\text{Ca}^{2+}$ exchanger in the distal tubule
 - B. Increased Ca^{2+} reabsorption in the proximal tubule
 - C. Decreased secretion of parathyroid hormone
 - D. Decreased renal excretion of vitamin D
 - E. Activation of $\text{Na}^+/\text{K}^+/\text{2Cl}^-$ symporter in the thick ascending loop of Henle
 - F. Increased glomerular filtration of Ca^{2+}

Difficulty level: Medium

13. A 67-year-old woman was found to have a plasma level of potassium 2.8 mEq/L (normal 3.5–5.0 mEq/L) during a follow-up visit. The woman had been receiving hydrochlorothiazide for 1 month to treat her recently diagnosed essential hypertension. Which of the following actions most likely contributed to the thiazide-induced increase in renal excretion of potassium?
- A. Increased Na^+ load in the lumen of the collecting tubule
 - B. Blockade of $\text{Na}^+/\text{K}^+/\text{2Cl}^-$ cotransporter
 - C. Thiazide-induced decrease in renal secretion of uric acid
 - D. Stimulation of Na^+/K^+ pump
 - E. Decreased delivery of bicarbonate to the collecting duct



Difficulty level: Medium

17. A 63-year-old man with a long history of heart failure was admitted to the emergency department because of severe dyspnea and edema in his legs, thighs, and lower abdominal wall. Pertinent lab results on admission included a glomerular filtration rate of 20 mL/min. A diuretic with which of the following mechanism of action would be appropriate to relieve the edema in this patient?
- A. Blockade of Na⁺ reabsorption in the proximal tubule
 - B. Blockade of Na⁺ channels in the collecting tubule
 - C. Blockade of Na⁺/K⁺/2Cl⁻ symport in the loop of Henle
 - D. Inhibition of aldosterone actions in the collecting tubule
 - E. Blockade of Na⁺/Cl⁻ symport in the early distal tubule

Difficulty level: Medium

18. A 42-year-old obese woman was hospitalized because of hypokalemia despite daily administration of a potassium supplement. Laboratory tests on admission revealed metabolic alkalosis. The patient admitted taking furosemide tablets in an effort to lose weight. Which of the following actions most likely contributed to furosemide-induced metabolic alkalosis in this patient?
- A. Increased reabsorption of uric acid
 - B. Increased delivery of Na⁺ to the distal tubule
 - C. Mild inhibition of carbonic anhydrase
 - D. Decreased reabsorption of Ca²⁺ in the loop of Henle
 - E. Inhibition of renin secretion

Difficulty level: Hard

16. A 47-year-old woman suffering from metastatic breast cancer was admitted to the emergency department because of persistent thirst and polyuria. Pertinent serum values on admission were serum K⁺ 2.8 mEq/L (normal 3.5–5.0 mEq/L); Ca 16.2 mg/dL (normal 8.5–10.5 mg/dL); Na⁺ 155 mEq/L (normal 136–145 mEq/L). Urinalysis: specific gravity 1.001; osmolality 80 mOsm/L (range 50–1440 mOsm/L); chemistry and sediment negative. The patient was given a water deprivation test: all fluids were withheld until serum osmolality increased into the hyperosmolar range (> 310), then 5 units of vasopressin were given subcutaneously. Results are shown in the following table.

	Urine Osmolality (mOsm/L)	Serum Osmolality (mOsm/L)
Onset of test	80	292
Water deprivation	82	312
After vasopressin	84	310

Which of these drugs would be most appropriate to treat the patient's condition?

- A. Desmopressin
- B. Hydrochlorothiazide
- C. Demeclocycline
- D. Amiloride
- E. Furosemide

Difficulty level: Hard

19. A 78-year-old man from a nursing home was admitted to the emergency department because of a change in his mental state over the past few hours. He had a medical history of angina and hypertension presently treated with isosorbide mononitrate, losartan, and hydrochlorothiazide. Physical examination showed a person with decreased skin turgor and disorientation to time and place without focal neurologic deficits. Blood pressure was 110/65 mm Hg on standing and 140/88 mm Hg on lying. Pertinent blood tests on admission were Na⁺ 116 mEq/L (normal 136–145 mEq/L); K⁺ 3.1 mEq/L (normal 3.5–5.0 mEq/L); uric acid 10.2 mg/dL (normal 3.0–8.2 mg/dL); creatinine 3.1 mg/dL (normal 0.6–1.2 mg/dL). The physician thought that the syndrome was due to diuretic therapy. Which of the following drug-induced adverse effects most likely caused the patient's signs and symptoms?
- A. Kidney insufficiency
 - B. Hypokalemia
 - C. Hypovolemic hyponatremia
 - D. Hyperuricemia
 - E. Hypervolemic hyponatremia

Difficulty level: Medium

20. A 66-year-old woman suffering from systolic cardiac failure was brought to the emergency department because of a sudden onset of extreme dyspnea. She presented with cyanosis, tachypnea, hyperpnea, restlessness, anxiety, and a sense of suffocation. Cough was prominent and produced pink-tinged, frothy sputum. Pulse was thready and fast (120 bpm), blood pressure 80/45 mm Hg, and rales were audible at the lung bases. Which of the following drugs was most likely included in the immediate medical treatment of this patient?
- A. Hydrochlorothiazide
 - B. Amiloride
 - C. Mannitol
 - D. Epinephrine
 - E. Furosemide
 - F. Metoprolol

Difficulty level: Hard

21. A 63-year-old woman was brought to the emergency department because she had become more lethargic and unresponsive over the past several days. Her past medical history was significant for bone metastases from breast cancer. Physical examination revealed a dehydrated, cachectic female responsive only to painful stimuli. Pertinent serum values were Na^+ 148 mEq/L (136–145 mEq/L); Ca 19.2 mg/dL (8.5–10.5 mg/dL). An intravenous saline infusion was started, and a diuretic was given concurrently. Which of the following diuretics was most likely administered?
- A. Acetazolamide
 - B. Hydrochlorothiazide
 - C. Furosemide
 - D. Amiloride
 - E. Spironolactone

Difficulty level: Medium

22. A 64-year-old woman suffering from stage C heart failure had her diuretic medication changed because of a serious allergic reaction to furosemide. Which of the following diuretics was most likely prescribed?
- A. Spironolactone
 - B. Acetazolamide
 - C. Mannitol
 - D. Ethacrynic acid
 - E. Triamterene
 - F. Indapamide

Difficulty level: Easy

23. A 49-year-old woman was admitted to the hospital because of generalized weakness, continuous nausea, and diarrhea.

Bowel movements were frequent and watery. The patient's own report was vague, but notes in the chart from other hospitals revealed that she had a very long history of laxative abuse. Blood test results on admission showed pronounced hypokalemia (K^+ 2.8 mEq/L). An appropriate therapy was started that included the administration of triamterene. Which of the following actions best explains the potassium-sparing effect of this drug?

- A. Enhancement of K^+ reabsorption in the proximal tubule
- B. Blockade of Na^+ channels in the collecting duct
- C. Enhancement of K^+ reabsorption in the loop of Henle
- D. Blockade of aldosterone receptors in the collecting duct
- E. Blockade of Na^+ reabsorption in the proximal tubule

Difficulty level: Medium

24. A 60-year-old man was admitted to the hospital because of symptoms of episodic weakness, polydipsia, and polyuria over the past 2 weeks. Vital signs on admission were blood pressure 136/95 mm Hg; heart rate 80 bpm; respirations 13/min. Significant serum results on admission were K^+ 3.1 mEq/L (normal 3.5–5.0 mEq/L); aldosterone 45 ng/dL (normal 7–30 ng/dL). A computed tomography scan showed bilateral adrenal hyperplasia. Which of the following drugs was most likely included in the therapeutic regimen of this patient?
- A. Hydrochlorothiazide
 - B. Mannitol
 - C. Furosemide
 - D. Fenoldopam
 - E. Nitroprusside
 - F. Spironolactone

Difficulty level: Medium

25. A 54-year-old alcoholic man was admitted to the emergency department with a 2-week history of nausea, vomiting, and lower abdominal cramps. Physical examination revealed an afebrile, jaundiced, and cachectic male in moderate distress. The abdomen appeared very tense with prominent veins, and 2+ ascites was noted by shifting dullness and a fluid wave. Pertinent serum values on admission were Na^+ 144 mEq/L (normal 136–145 mEq/L); K^+ 2.9 mEq/L (normal 3.5–5.0 mEq/L); bicarbonate 34 mEq/L (normal 22–28 mEq/L); albumin 2.3 g/dL (normal 3.3–4.8 mEq/L). Which of the following diuretics would be the drug of choice for this patient?
- A. Indapamide
 - B. Mannitol
 - C. Spironolactone
 - D. Furosemide
 - E. Triamterene

Difficulty level: Easy

26. A 65-year-old patient was scheduled for surgery to remove a glioma located on his left parietal lobe. Which of the following drugs would be most appropriately given before and after surgery to prevent increased intracranial pressure?
- A. Mannitol
 - B. Hydrochlorothiazide
 - C. Triamterene
 - D. Verapamil
 - E. Propranolol

Difficulty level: Easy

27. A 57-year-old Black woman, recently diagnosed with closed-angle glaucoma, was scheduled for iridotomy. Which of the following agents was most likely given intravenously before and after surgery to reduce intraocular pressure?
- A. Furosemide
 - B. Triamterene
 - C. Mannitol
 - D. Hydrochlorothiazide
 - E. Homatropine
 - F. Phenylephrine

Difficulty level: Medium

29. A 69-year-old man was recently diagnosed with severe cardiac failure, and the physician started treatment with propranolol, captopril, and digoxin. Diuretic therapy was also included. Which of the following pairs of diuretics would have been most appropriate for this patient?
- A. Hydrochlorothiazide and acetazolamide
 - B. Furosemide and spironolactone
 - C. Triamterene and acetazolamide
 - D. Hydrochlorothiazide and mannitol
 - E. Furosemide and mannitol

Difficulty level: Medium

30. A 63-year-old man was admitted to the emergency department because of a 12-hour history of dyspnea and bradycardia. He was taking propranolol, captopril, furosemide, and amiloride because of a previous myocardial infarction, as well as ibuprofen for osteoarthritis. Physical examination showed the patient was in respiratory distress with the following vital signs: blood pressure 150/86 mm Hg; heart rate 40 bpm; respirations 20/min. A lab analysis was ordered. Which of the following substances was most likely increased in the patient's serum?
- A. Sodium
 - B. Calcium
 - C. Glucose
 - D. Potassium
 - E. Urea nitrogen
 - F. Triglycerides

Difficulty level: Easy

31. A 32-year-old woman suffering from idiopathic hypercalciuria was diagnosed with a large urinary stone in the right renal pelvis. She was scheduled for surgical removal of the calculus. Which of the following drugs would be appropriate for this patient to prevent new stone production after the operation?
- A. Acetazolamide
 - B. Hydrochlorothiazide
 - C. Furosemide
 - D. Triamterene
 - E. Spironolactone

DIURETICS
Answer key

1. A 2. G 3. F 4. E 5. C	6. A 7. A 8. D 9. A 10. D	11. E 12. A 13. A 14. C 15. F
16. B 17. C 18. B 19. C 20. E	21. C 22. D 23. B 24. F 25. C	26. A 27. C 28. C 29. B 30. D 31. B 32. A