

3: DIURETICS

17.1 An elderly patient with a history of heart disease has difficulty breathing and is diagnosed with acute pulmonary edema. Which treatment is indicated?

- A. Acetazolamide
- B. Chlorthalidone
- C. Furosemide
- D. Spironolactone

Correct answer = C. This is a potentially fatal situation. It is important to administer a diuretic that reduces fluid accumulation in the lungs and improves oxygenation and heart function. The loop diuretics are most effective in removing large fluid volumes from the body and are the treatment of choice in this situation. In this situation, furosemide should be administered intravenously. The other choices are inappropriate.

17.2 A group of college students is planning a mountain climbing trip to the Andes. Which is most appropriate for them to take to prevent altitude sickness?

- A. A thiazide diuretic such as hydrochlorothiazide
- B. An anticholinergic such as atropine
- C. A carbonic anhydrase inhibitor such as acetazolamide
- D. A loop diuretic such as furosemide

Correct answer = C. Acetazolamide is used prophylactically for several days before an ascent above 10,000 feet. This treatment prevents the cerebral and pulmonary problems associated with altitude sickness as well as other difficulties, such as nausea.

17.3 An alcoholic male has developed hepatic cirrhosis. To control the ascites and edema, which should be prescribed?

- A. Acetazolamide
- B. Chlorthalidone
- C. Furosemide
- D. Spironolactone

Correct answer = D. Spironolactone is very effective in the treatment of hepatic edema. These patients are frequently resistant to the diuretic action of loop diuretics, although a combination with spironolactone may be beneficial. The other agents are not indicated.

17.4 A 55-year-old male with kidney stones needs a medication to decrease urinary calcium excretion. Which diuretic is best for this indication?

- A. Torsemide
- B. Hydrochlorothiazide
- C. Spironolactone
- D. Triamterene

Correct answer = B. Hydrochlorothiazide is effective in increasing calcium reabsorption, thus decreasing the amount of calcium excreted, and decreasing the formation of kidney stones that contain calcium phosphate or calcium oxalate. Furosemide increases the excretion of calcium, whereas the K⁺-sparing diuretics, spironolactone, and triamterene do not have an effect.

17.5 A 75-year-old woman with hypertension and glaucoma is being treated with chlorthalidone, amlodipine, lisinopril, and acetazolamide. In clinic today, she complains of acute joint pain and redness in her great toe, which is diagnosed as gout. Which medication is most likely to have caused the gout attack?

- A. Amlodipine
- B. Acetazolamide
- C. Chlorthalidone
- D. Lisinopril

Correct answer = C. Thiazides such as chlorthalidone compete with uric acid for secretion into the lumen of the nephron at the proximal convoluted tubule. This competition decreases uric acid secretion, raising the serum concentration and increasing the risk of a gout attack. Loop diuretics have the same risk.

17.6 Which is contraindicated in a patient with hyperkalemia?

- A. Acetazolamide
- B. Chlorothiazide
- C. Ethacrynic acid
- D. Eplerenone

Correct answer = D. Eplerenone acts in the collecting tubule via aldosterone antagonism to inhibit Na⁺ reabsorption and K⁺ excretion. It is extremely important that patients who are treated with any potassium-sparing diuretic be closely monitored for potassium levels. Exogenous potassium supplementation is usually discontinued when potassium-sparing diuretic therapy is initiated. The other drugs promote the excretion of potassium.

17.7 A 59-year-old male patient in the intensive care unit has a metabolic alkalosis. Which therapy will treat this condition?

- A. Amiloride
- B. Hydrochlorothiazide
- C. Mannitol
- D. Acetazolamide

Correct answer = D. Acetazolamide causes an increase in the urinary excretion of bicarbonate, lowering the pH of the blood.

17.8 A male patient is placed on a new medication and notes that his breasts have become enlarged and tender to the touch. Which medication is the most likely taking?

- A. Furosemide
- B. Hydrochlorothiazide
- C. Spironolactone
- D. Triamterene

Correct answer = C. An adverse drug reaction to spironolactone is gynecomastia due to its effects on androgens and progesterone in the body. Eplerenone may be a suitable alternative if the patient is in need of an aldosterone antagonist but has a history of gynecomastia.

17.9 A patient with heart failure with reduced ejection fraction researched his medications on the Internet and found he was taking two "diuretics," bumetanide and spironolactone. He asks if this is a mistake with his therapy. What is the best response?

- A. Spironolactone is used to prevent hyponatremia.
- B. Spironolactone is used to reduce heart structure changes and decrease the risk of death.
- C. Bumetanide is used to decrease the potassium lost from spironolactone therapy.
- D. This is a duplication error and one diuretic should be stopped.

Correct answer = B. Aldosterone antagonists are used at non-diuretic doses in heart failure to prevent myocardial remodeling and decrease mortality. Bumetanide is used as a diuretic to treat edema from heart failure. Both are appropriate to use together because of the unique indications. Spironolactone reduces the potassium lost from diuresis with bumetanide.

17.10 Which diuretic has been shown to improve blood pressure in resistant hypertension or those already treated with three blood pressure medications including a thiazide or thiazide-like medication?

- A. Indapamide
- B. Furosemide
- C. Mannitol
- D. Spironolactone

Correct answer = D. Resistant hypertension, defined by the use of three or more medications without reaching the blood pressure goal, often responds well to aldosterone antagonists. This effect can be seen in those with or without elevated aldosterone levels.

4: Quinolones

31.7 A 21-year-old marathon runner reports to the clinic with acute Achilles tendon rupture. The nurse noted that the patient recently took an antibiotic for community-acquired pneumonia. Which antibiotic may have contributed to tendon rupture?

- A. Amoxicillin/clavulanate
- B. Cefdinir
- C. Levofloxacin
- D. Minocycline

Correct answer = C. Levofloxacin is associated with tendon ruptures and tendinopathy. The other agents are not associated with this adverse effect.

31.8 A 70-year-old woman with acute cystitis presents to the Family Medicine clinic for assessment. She has a past medical history of hypertension and chronic kidney disease. The team recommends initiation of nitrofurantoin for cystitis. After reviewing her antimicrobial therapy, which actions should be taken prior to clinic discharge?

- A. Continue current therapy and counsel on gastrointestinal effects of nitrofurantoin.
- B. Change nitrofurantoin to alternative agent due to chronic kidney disease.
- C. Reduce nitrofurantoin dose due to impaired renal function.
- D. Counsel patient regarding neuropathy associated with short-term therapy.

Correct answer = B. The key issue with the antibiotic recommendation is that nitrofurantoin should not be administered in patients with poor kidney function. Adjusting the dose and continuing the current regimen are not acceptable modifications. Neuropathy is more common with therapy greater than 1 month.

31.9 Which recommendation should be provided to avoid phototoxicity associated with fluoroquinolone therapy?

- A. Use sunscreen and avoid excessive exposure to UV light.
- B. Take the medication at night to avoid high drug concentrations during the day.
- C. Take with food.
- D. Drink with 1 L of water per day to minimize drug buildup in skin tissue.

Correct answer = A. Patients taking a fluoroquinolone should apply sunscreen and take precautions to minimize risk of phototoxicity. Adjusting the timing of the dose or taking with food or additional water does not change the risk of an event.

7&8: Estrogens and Androgens

Choose the ONE best answer.

- 25.1 A 53-year-old woman has severe vasomotor symptoms (hot flushes) associated with menopause. She has no pertinent past medical or surgical history. Which would be most appropriate for her symptoms?
- A. Conjugated estrogens vaginal cream
 - B. Estradiol transdermal patch
 - C. Oral estradiol and medroxyprogesterone acetate
 - D. Injectable medroxyprogesterone acetate
- 25.2 A 70-year-old woman is being treated with raloxifene for osteoporosis. Which is a concern with this therapy?
- A. Breast cancer
 - B. Endometrial cancer
 - C. Venous thrombosis
 - D. Hypercholesterolemia
- 25.3 Which is the most appropriate oral contraceptive for a patient with moderate acne?
- A. Ethinyl estradiol/levonorgestrel
 - B. Ethinyl estradiol/norethindrone acetate
 - C. Ethinyl estradiol/norgestimate
 - D. Ulipristal/
- 25.4 A 25-year-old woman is using injectable medroxyprogesterone acetate as a method of contraception. Which adverse effect is a concern if she wishes to use this therapy long-term?
- A. Hyperkalemia
 - B. Male pattern baldness
 - C. Osteoporosis
 - D. Weight loss
- 25.5 Which contraceptive method provides long-acting reversible contraception (LARC)?
- A. Contraceptive vaginal ring
 - B. Intrauterine device
 - C. Extended-cycle oral contraceptives
 - D. Transdermal contraceptive patch
- 25.6 Which is the most effective form of contraception with typical use?
- A. Combined oral contraceptives
 - B. Progestin-only "mini-pill"
 - C. Depot medroxyprogesterone acetate injection
 - D. Subdermal progestin implant

Correct answer = C. Estrogen vaginal cream only treats vaginal symptoms of menopause such as vaginal atrophy and does not treat hot flushes. Since this patient has an intact uterus, a progestin such as medroxyprogesterone needs to be used along with the estrogen to prevent the development of endometrial hyperplasia. Unopposed estrogen (for example, the estradiol transdermal patch) should not be used. Injectable medroxyprogesterone acetate is used for contraception.

Correct answer = C. Raloxifene can increase the risk of venous thromboembolism. Unlike estrogen and tamoxifen, raloxifene does not result in an increased incidence of endometrial cancer. Raloxifene lowers the risk of breast cancer in high-risk women, and it also lowers LDL cholesterol.

Correct answer = C. The progestins levonorgestrel and norethindrone acetate may have androgenic activity and contribute to acne. Norgestimate has less androgenic activity and is preferred for this patient. Ulipristal is an emergency contraceptive and should not be used as a regular method of contraception.

Correct answer = C. Medroxyprogesterone acetate may contribute to bone loss and predispose patients to osteoporosis and/or fractures. Therefore, the drug should not be continued for more than 2 years if possible. The drug often causes weight gain, not weight loss. The other adverse effects are not associated with medroxyprogesterone.

Correct answer = B. The progestin-only intrauterine devices provide contraception for 3 to 5 years, depending on the device. The etonogestrel subdermal implant is another LARC that provides contraception for 3 years. The contraceptive vaginal ring is worn for 3 weeks at a time, and the transdermal patch for 1 week at a time. Extended cycle oral contraceptives must be administered daily.

Correct answer = D. See Figure 25.9. The subdermal implant has a very low failure rate, since it does not require adherence of the patient after implantation. Progestin-only pills are less effective than combined oral contraceptives and the depot medroxyprogesterone acetate injection.

25.7 A 36-year-old woman requests birth control. She has no medical conditions, and she smokes one pack of cigarettes per day. Which would be the most appropriate to recommend?

- A. Vaginal contraceptive ring
- B. Transdermal contraceptive patch
- C. Progestin-only "mini-pill"
- D. Combination oral contraceptive pill

Correct answer = C. Progestin-only products are preferred in older women who are smokers, due to a lower risk of severe adverse effects, such as myocardial infarction and stroke. Estrogen-containing contraceptives are not recommended in women over the age of 35 who are smokers. The vaginal contraceptive ring, transdermal contraceptive patch, and combination oral contraceptive pills all contain estrogen.

25.8 A 22-year-old woman requests emergency contraception after unprotected intercourse that occurred 1 day ago. She has no medical conditions. Which agent is most appropriate?

- A. Ethinyl estradiol/norgestimate
- B. Etonogestrel
- C. Levonorgestrel
- D. Mifepristone

Correct answer = C. A single dose of levonorgestrel is preferred for emergency contraception and should be administered within 72 hours of unprotected intercourse for best efficacy. Estrogen/progestin regimens are less used for emergency contraception due to a higher incidence of adverse effects such as nausea/vomiting. Etonogestrel is a progestin used in the contraceptive ring and implant. Mifepristone is a progesterone antagonist used to terminate pregnancy once it has occurred.

25.9 A 35-year-old woman is experiencing infertility due to anovulation. Which agent is most appropriate for this patient?

- A. Clomiphene
- B. Ospemifene
- C. Raloxifene
- D. Ulipristal

Correct answer = A. Clomiphene is a SERM that interferes with negative feedback of estrogens on the hypothalamus, thereby increasing the secretion of gonadotropin-releasing hormone and gonadotropins, and leading to stimulation of ovulation. Ospemifene is a SERM indicated for the treatment of dyspareunia. Raloxifene is a SERM used in the prevention of breast cancer and osteoporosis. Ulipristal is a progesterone agonist/antagonist used as an emergency contraceptive.

25.10 Use of testosterone is most appropriate in which patient?

- A. A 25-year-old competitive athlete
- B. A 30-year-old man with hypogonadism due to testicular injury
- C. A 50-year-old man with low testosterone related to aging
- D. A 65-year-old man with low testosterone and a history of myocardial infarction

Correct answer = B. Testosterone should only be used only for hypogonadism associated with documented medical conditions and not low testosterone associated with aging. Testosterone replacement may increase the risk of cardiovascular events and should be used with caution in patients with a history of myocardial infarction and heart disease.

1&2: ANTIFUNGAL

33.1 Which antifungal agent is MOST likely to cause renal insufficiency?

- A. Fluconazole
- B. Amphotericin B
- C. Itraconazole
- D. Posaconazole

Correct answer = B. Amphotericin B is the best choice since nephrotoxicity is commonly associated with this medication. Although the dose of fluconazole must be adjusted for renal insufficiency, it is not associated with causing nephrotoxicity. Itraconazole and posaconazole are metabolized by the liver and are not associated with nephrotoxicity.

33.2 A 55-year-old woman presents to the hospital with shortness of breath, fever, and malaise. She has a history of breast cancer and is receiving chemotherapy. Her chest x-ray shows pneumonia, and respiratory cultures are positive for *Aspergillus fumigatus*. Which is the MOST appropriate choice for treatment?

- A. Voriconazole
- B. Fluconazole
- C. Flucytosine
- D. Ketoconazole

Correct answer = A. Voriconazole is the drug of choice for aspergillosis. Studies have found it to be superior to other regimens including amphotericin B. Fluconazole, flucytosine, and ketoconazole do not have reliable in vitro activity and are therefore not recommended.

33.3 Which antifungal agent should be avoided in patients with evidence of ventricular dysfunction?

- A. Micafungin
- B. Itraconazole
- C. Terbinafine
- D. Posaconazole

Correct answer = B. There is a black box warning that warns against the use of itraconazole in patients with evidence of ventricular dysfunction, including patients with heart failure.

33.4 A 56-year-old woman with diabetes complains of thickening of the nail of the right big toe and a change in color (yellow). The podiatrist diagnoses the patient with onychomycosis of the toenails. Which is the most appropriate choice for treating this infection?

- A. Terbinafine
- B. Micafungin
- C. Itraconazole
- D. Griseofulvin

Correct answer = A. Terbinafine is better tolerated, requires a shorter duration of therapy, and is more effective than either itraconazole or griseofulvin. Micafungin is not active for this type of infection.

33.5 A 44-year-old man presents to clinic with fevers and chills, headaches, and shortness of breath. He reports that he was exploring caves about 5 weeks ago. He is diagnosed with mild/moderate acute pulmonary histoplasmosis. Which is the most appropriate choice for treating this infection?

- A. Micafungin
- B. Itraconazole
- C. Terbinafine
- D. Griseofulvin

Correct answer = B. Itraconazole is the treatment of choice in patients with mild/moderate acute pulmonary histoplasmosis who have had symptoms for more than 1 month. Micafungin, terbinafine, and griseofulvin are not active for this type of infection.

33.6 A 32-year-old HIV-positive woman is admitted to the hospital with severe confusion and dizziness. She has been nonadherent with her HIV medications for several months. She is diagnosed with meningitis caused by Cryptococcus neoformans. Which is the most appropriate choice for treating the infection in this patient?

- A. Anidulafungin alone
- B. Amphotericin B plus flucytosine
- C. Flucytosine alone
- D. Isavuconazole plus anidulafungin

Correct answer = B. The treatment of choice for initial therapy for cryptococcal meningitis is the combination of amphotericin B and flucytosine. Flucytosine should not be given alone because of the rapid development of resistance. Anidulafungin is not active against this type of infection. Isavuconazole has not been studied for the treatment of cryptococcal meningitis.

33.7 A 22-year-old woman reports a cottage cheese-like vaginal discharge and slight dysuria for 1 week. The patient is diagnosed with vulvovaginal candidiasis. She requests as short a course of treatment as possible due to her busy schedule. Which antifungal is the best choice?

- A. Oral fluconazole
- B. Topical miconazole
- C. Oral terbinafine
- D. Topical efinaconazole

Correct answer = A. Oral fluconazole can be given as a one-time dose for vulvovaginal candidiasis. Topical miconazole requires multiple days of therapy. Terbinafine and efinaconazole are not used clinically for vulvovaginal candidiasis.

33.8 Which drug is relatively free of drug–drug interactions?

- A. Voriconazole
- B. Itraconazole
- C. Micafungin
- D. Terbinafine

Correct answer = C. The echinocandins (including micafungin) are not metabolized by the CYP450 enzyme system, so they have very few drug–drug interactions. Voriconazole, itraconazole, and terbinafine are all metabolized by the CYP450 enzyme system, so they have significant drug–drug interactions.

33.9 Which drug works by creating pores/channels in the fungal cell membrane?

- A. Fluconazole
- B. Anidulafungin
- C. Amphotericin B
- D. Flucytosine

Correct answer = C. Amphotericin B creates pores/channels in the fungal cell membrane. Fluconazole works by inhibiting the conversion of lanosterol to ergosterol. Anidulafungin inhibits the synthesis of β -D-glucan. Flucytosine disrupts nucleic acid and protein synthesis.

33.10 Which drug requires a loading dose?

- A. Caspofungin
- B. Micafungin
- C. Liposomal amphotericin B
- D. Tavaborole

Correct answer = A. Caspofungin is the only drug listed that requires a loading dose before starting the maintenance dosing.

