AMERICAN COLLEGE OF CLINICAL PHARMACY

Updates in Therapeutics:
2013 Pharmacotherapy Preparatory Review and Recertification Course

POSTTEST ANSWERS – SESSION 6

Infectious Diseases

1. **Answer D:** *Ceftriaxone 2 g intravenously every 24 hours.*
   Ceftriaxone alone is the best option for early-onset hospital-acquired pneumonia in patients with no risk factors for multidrug-resistant organisms, according to the IDSA guidelines. Levofloxacin or ampicillin/sulbactam or ertapenem is an alternative. Two drugs like meropenem and gentamicin are unnecessary for early-onset hospital-acquired pneumonia in patients with no risk factors for multidrug-resistant organisms. In addition, activity against *Pseudomonas aeruginosa* or methicillin-resistant *Staphylococcus aureus* is unnecessary. Therefore, cefepime, tobramycin, linezolid, or vancomycin is not indicated for early hospital-acquired pneumonia.
   References:
   American Thoracic Society; Infectious Diseases Society of America. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. Am J Respir Crit Care Med 2005;171:388-416.

2. **Answer B**: *P.V. should receive the inactivated vaccine, and her daughter should receive two doses of either the inactivated or the live attenuated vaccine.*
   The best recommendation for vaccine administration in both P.V. and her daughter is that P.V. should receive the inactivated vaccine and her daughter, two doses of either vaccine. Everyone older than 6 months should receive the influenza vaccine. Children younger than 9 years require two doses of the vaccine (at least 1 month apart) in the first season they receive the vaccine. The live attenuated vaccine should only be given to people between 2 and 49 years of age and should not be given to pregnant women. The live attenuated vaccine can be given to household members of pregnant women (contraindicated only if there is a severely immunocompromised person in the household).
   References:
   Centers for Disease Control and Prevention (CDC). Prevention and control of influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices (ACIP) – United States, 2012-13 influenza season. MMWR 2012;61:613-8.

3. **Answer C**: *Trimethoprim/sulfamethoxazole double strength orally twice daily for 14 days.*
   Trimethoprim/sulfamethoxazole for 14 days is the best option for this patient with uncomplicated pyelonephritis, according to the IDSA guidelines. R.M. probably has pyelonephritis, given her high temperature and back pain. In pyelonephritis, 3 days of treatment is too short, and nitrofurantoin is ineffective. Because this is an uncomplicated pyelonephritis, R.M. does not need intravenous therapy, but instead, she can be treated as an outpatient with oral trimethoprim/sulfamethoxazole.
   References:
   Gupta K, Hooton TM, Naber KG, et al.; Infectious Diseases Society of America; European Society for Microbiology and Infectious Diseases. International clinical practice guidelines

for the treatment of acute uncomplicated cystitis and pyelonephritis in women: a 2010 update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases. Clin Infect Dis 2011;52:e103-20.

4. **Answer D**: *Nafcillin 1 g intravenously every 6 hours.*
   Because C.D.'s foot infection has been diagnosed early and is relatively mild, it can be treated like cellulitis, with either a penicillinase-resistant penicillin or first-generation cephalosporin. Therefore, nafcillin alone is the best initial therapy. Antibiotics with a broad spectrum of activity against gram-positive, gram-negative, and anaerobic organisms are not needed at this time. C.D. can be switched to oral antibiotics soon and treated as an outpatient.
   References:
   Lipsky BA, Berendt AR, Cornia PB, et al.; Infectious Diseases Society of America. 2012 Infectious Diseases Society of America clinical practice guideline for the diagnosis and treatment of diabetic foot infections. Clin Infect Dis 2012;54:e132-73.

5. **Answer C**: *Cefepime 1 g intravenously every 12 hours plus metronidazole 500 mg intravenously every 8 hours for 5 days.*
   Cefepime plus metronidazole for 5 days is the best choice, according to the IDSA guidelines for intra-abdominal infections. Although moxifloxacin has good activity against gram-negative and anaerobic organisms, it is recommended alone only for mild to moderate community-acquired intra-abdominal infections. In addition, the duration of 3 days is too short. Tigecycline as well is only recommended for mild to moderate community-acquired intra-abdominal infections. Moreover, the therapy duration is usually 4–7 days or until the patient is afebrile and the WBC has normalized. Doripenem is an appropriate antibiotic in this situation, but the length of therapy is too long.
   References:
   Solomkin JS, Mazuski JE, Bradley JS, et al.; Infectious Diseases Society of America. Diagnosis and management of complicated intra-abdominal infection in adults and children: guidelines by the Surgical Infection Society and the Infectious Diseases Society of America. Clin Infect Dis 2010;50:133-64.

HIV/Infectious Diseases

6. **Answer C**: *Zidovudine 300 mg orally twice daily and emtricitabine 200 mg daily for 4 weeks.*
   A two-drug preventive therapy with two nucleoside reverse transcriptase inhibitors is appropriate when the patient with HIV is asymptomatic or has a low viral load, according to the CDC guidelines. In this situation, the subject has an undetectable viral load, so two drugs are appropriate. Only if the exposure were severe and percutaneous (i.e., a significant needlestick) would three drugs be necessary. It is generally recommended that postexposure prophylaxis last 4 weeks.
   References:
   Centers for Disease Control and Prevention. Updated U.S. Public Health Service guidelines for the management of occupational exposures to HIV and recommendations for postexposure prophylaxis. MMWR 2005;54(RR-9):1-17.

7. **Answer B**: *Efavirenz can cause central nervous system effects, such as insomnia and impaired concentration.*
   Efavirenz is associated with a significant incidence of central nervous system effects, including insomnia and impaired concentration. Tenofovir does not cause myelosuppression—zidovudine is the only retroviral with this adverse effect. Endocrine abnormalities are primarily seen with protease inhibitors (i.e., not nonnucleoside reverse transcriptase inhibitors like efavirenz). Emtricitabine causes neither pancreatitis nor peripheral neuropathy.
   References:
   Panel on Antiretroviral Guidelines for Adults and Adolescents. Guidelines for the Use of Antiretroviral Agents in HIV-1-Infected Adults and Adolescents. Department of Health and Human Services. March 27, 2012:1-239. Available at www.aidsinfo.nih.gov/ContentFiles/AdultandAdolescentGL.pdf. Accessed October 10, 2012.

8. **Answer D**: *TMP/SMX for PCP*.
   At this time, W.C. requires only primary prophylaxis for PCP according to the CDC guidelines. Primary prophylaxis for PCP is necessary when CD4 counts drop below 200/mm^3, and TMP/SMX is an appropriate antibiotic. Primary prophylaxis for toxoplasmosis is necessary when CD4 counts drop below 100/mm^3 if the patient is seropositive (which W.C. is not). TMP/SMX can be used. Primary prophylaxis is not recommended for cryptococcosis because of the potential for fungal resistance. Primary prophylaxis for MAC is not necessary until CD4 counts drop below 50/mm^3. Primary prophylaxis for CMV retinitis is regular eye examinations, begun when CD4 counts drop below 50/mm^3.
   References:
   Centers for Disease Control and Prevention. Guidelines for prevention and treatment of opportunistic infections in HIV-infected adults and adolescents. MMWR 2009;58(RR-4):1-207.

9. **Answer D**: *Rifampin, isoniazid, pyrazinamide, and ethambutol for 2 months, followed by rifampin and isoniazid for 4 months.*
   Using four drugs (rifampin, isoniazid, pyrazinamide, and ethambutol) for 2 months, followed by two drugs (rifampin and isoniazid) for 4 months, is an appropriate option for therapy according to the American Thoracic Society/Infectious Diseases Society of America (ATS/IDSA) guidelines. Isoniazid alone for 6 months is appropriate for latent TB infections. Because this patient's sputum is positive for acid-fast bacilli, he has an active infection. Using all four drugs as initial therapy is an appropriate option, but after 2 months, therapy should decrease to only two drugs (rifampin and isoniazid).
   References:
   American Thoracic Society/Centers for Disease Control and Prevention/Infectious Diseases Society of America: treatment of tuberculosis. Am J Respir Crit Care Med 2003;167:603-62.

10. **Answer A**: *Micafungin.*
    Micafungin is the best option for T.M. It is active against *C. krusei*, does not interact with the drug therapy T.M. is receiving, and does not need to be adjusted in patients with renal dysfunction or on hemodialysis. Amphotericin has activity against *C. krusei* and could be used for this infection; however, because of its renal toxicity, amphotericin is not the best choice in this patient. Fluconazole has no activity against *C. krusei*, and it may potentially interact with warfarin. Voriconazole has activity against *C. krusei*, but it significantly

interacts with some of the drugs T.M. is receiving (atorvastatin, amiodarone, warfarin, and midazolam), making it a less-than-ideal choice in this patient.

References:

Pappas PG, Kauffman CA, Andes D, et al. Infectious Diseases Society of America. Clinical practice guidelines for the management of candidiasis: 2009 update by the Infectious Diseases Society of America. Clin Infect Dis 2009;48:503-35.

Nephrology

11. **Answer B**: *Acute tubular necrosis (ATN).*
    This patient has had a 3-fold increase in SCr, which rules out CKD. Although his urine output has been oliguric (50–500 mL/24 hours), it is unlikely caused by lower urinary obstruction because of the presence of a Foley catheter. His declining renal function despite aggressive fluid administration, his normal BUN/SCr ratio (10–15:1), and his high fractional excretion of sodium (FENa) point against prerenal azotemia and toward ATN. The occurrence of hypotension postoperatively is also consistent with the development of ATN.

    Reference:

    Dager W, Halilovic J. Acute renal failure. In: DiPiro JT, Talbert RL, Yee GC, et al., eds. Pharmacotherapy: A Pathophysiologic Approach, 8th ed. New York: McGraw-Hill, 2011:741-66.

12. **Answer C**: *Add intravenous iron.*
    Although the guidelines do not suggest the minimum hemoglobin for a patient with CKD, this patient requires additional therapy because she is still symptomatic. She has responded somewhat to epoetin therapy, but the lack of a full response is likely related to iron deficiency. This patient has inadequate iron stores with a transferrin saturation (TSAT) less than 20% (serum iron/TIBC x 100 = 25 mcg/dL/300 mcg/dL x 100 = 8.3%) and serum ferritin of less than 200 ng/mL, so iron supplementation is needed to improve responsiveness to epoetin alfa. Oral iron can be considered, even though it is unlikely inadequate, in patients with stage 3 or stage 4 CKD; however, patients in stage 5 (hemodialysis) should receive intravenous iron therapy.

    References:

    National Kidney Foundation. KDOQI clinical practice guidelines and recommendations for anemia of chronic kidney disease. Am J Kidney Dis 2006;47(suppl 3):S1-S146.

13. **Answer D**: *Stage 2 CKD with microalbuminuria.*
    This patient has stage 2 CKD because her eGFR is between 60 and 89 mL/minute, and she has microalbuminuria because her urine albumin/Cr ratio is between 30 and 300 mcg/mg.

    Reference:

    National Kidney Foundation. K/DOQI clinical practice guidelines for chronic kidney disease: evaluation: classification, and stratification. Am J Kidney Dis 2002;39(suppl 1): S1-S266.

14. **Answer B**: *Add sevelamer hydrochloride.*
    Any way you estimate it; this patient has an eGFR of less than 15 mL/minute based on his SCr of 7 mg/dL, which places him in stage 5 CKD. Therefore, his serum phosphate is greater than goal 5.5 mg/dL. Although his measured serum calcium is relatively low, his corrected serum calcium [measured Ca + (0.8)(4 – serum albumin) = 8.4 mg/dL + (0.8)(4 – 2.5) = 8.4 + 1.2 = 9.6 mg/dL] is above the goal range of 8.4–9.5 mg/dL. His iPTH is within the goal range of 150–300 pg/mL. Adjustments in therapy should then be targeted at further lowering his phosphate to less than 5.5 mg/dL. Although his calcium acetate regimen provides 1000 mg/day of elemental calcium, which is less than the maximal dose of 1500 mg/day, his dose should not be increased because of his relatively high corrected calcium concentration. A non–calcium-containing phosphate binder such as sevelamer

can safely be added to further lower his serum phosphate. Ergocalciferol is not needed because his 25-OH vitamin D level is adequate. In addition, vitamin D products may be helpful for lowering parathyroid hormone (PTH) levels but should not be used in patients with elevated corrected calcium concentrations.

Reference:

National Kidney Foundation. KDOQI clinical practice guidelines for bone metabolism and disease in chronic kidney disease. 2003;42(suppl 3):S1-S202.

15. **Answer A**: *Discontinue ibuprofen.*

An acute rise in SCr is sometimes seen with the addition of an ACE inhibitor and is caused by hemodynamic changes in glomerular pressure. An increase of less than 30% is usually considered acceptable. Coadministration of an NSAID with an ACE inhibitor can further worsen glomerular hemodynamics and worsen GFR, so without a strong indication, discontinuing ibuprofen would be the best approach. Although decreasing the dose of lisinopril might be appropriate in some circumstances, with the blood pressure inadequately controlled and the potential role of ibuprofen, lisinopril should be continued for now. Adding hydrochlorothiazide may be useful and ultimately needed to improve blood pressure control and perhaps hyperkalemia; however, the need should be reevaluated after discontinuing ibuprofen. The current 2-week period was adequate to assess the acute effects of the new therapy, so continuing therapy and reevaluating is not appropriate.

Reference:

Derebail VK, Kshirsagar AV, Joy MS. Chronic kidney disease: progression-modifying therapies. In: DiPiro JT, Talbert RL, Yee GC, et al., eds. Pharmacotherapy: A Pathophysiologic Approach, 8th ed. New York: McGraw-Hill, 2011:767-86.

16. **Answer B**: *Initiate normal saline intravenously before the procedure.*

Adequate hydration is important to prevent the development of acute kidney injury caused by radiocontrast dye. Intravenous administration of normal saline is best for optimizing fluid balance. Furosemide would likely worsen volume status. Lisinopril can slow the progression of CKD, but it is not useful in decreasing the occurrence of contrast-associated nephropathy. Although metformin should be discontinued in the setting of contrast administration because of the risk of lactic acidosis should acute kidney injury develop, metformin does not affect a patient's risk of developing contrast-associated nephropathy.

Reference:

Schweiger MJ, Chambers CE, Davidson CJ, et al. Prevention of contrast-induced nephropathy: recommendations for the high-risk patient undergoing cardiovascular procedures. Catheter Cardiovasc Interv 2007;69:135-40.