Cardiac Arrhythmias and Advanced Cardiac Life Support
Core Therapeutic Module Series

Self-Assessment Practice Test

The following practice questions are structured to illustrate key knowledge or skills that practitioners might be asked on a Board of Pharmacy Specialties (BPS) Certification Examination. Questions address one or more of the knowledge or skills listed for each case study. Correct answers with explanations are provided.

Planned by the ASHP Section of Clinical Specialists and Scientists.

PRACTICE QUESTIONS

1. Which of the following statements most accurately describes the potential outcome resulting from a drug interaction associated with the combination of amiodarone and warfarin in a patient with atrial fibrillation?
    a. Increased risk of ischemic stroke
    b. Increased risk of torsades de pointes
    c. Increased risk of gastrointestinal bleeding
    d. Increased risk of atrial fibrillation with rapid ventricular response

2. Which of the following represents the potential adverse effects that may be seen in a patient receiving lidocaine for non-sustained ventricular tachycardia?
    a. Central nervous system adverse effects, including dizziness, drowsiness, and slurred speech.
    b. Anticholinergic adverse effects, including dry mouth, blurred vision, and constipation.
    c. Hepatotoxicity, including pale colored stool, jaundice, or dark or amber colored urine.
    d. Cardiovascular adverse effects, including bradycardia, hypotension, and exacerbation of heart failure.

3. Which of the following patients with atrial fibrillation would be considered to be at high risk for stroke based upon your assessment and standardized tools for risk stratification?
    a. A 74 year-old male with hypertension and a 15 year-history of atrial fibrillation
    b. A 25 year-old female who develops atrial fibrillation after a weekend-long cocaine binge
    c. A 48 year-old male with hypertension who develops atrial fibrillation after a surgical procedure to repair a shoulder injury
    d. A 56 year-old female with a history of transient ischemic attack with atrial fibrillation that was discovered incidentally on routine ECG testing

4. HR is a 74 year-old male patient hospitalized with new onset atrial fibrillation. The patient's past medical history is significant for coronary artery disease with myocardial infarction last year, heart failure, and hypertension. The patient is currently prescribed aspirin, clopidogrel, furosemide, and lisinopril. Which of the following agents would be most appropriate for rate control in this patient with atrial fibrillation?
    a. Metoprolol
    b. Diltiazem
    c. Digoxin
    d. Amiodarone

5. JR is a 68-year old female patient who presents to the clinic for follow-up after a hospitalization related to atrial fibrillation. The patient's past medical history is significant for hypertension, diabetes mellitus, chronic renal insufficiency on hemodialysis, and a myocardial infarction three years ago. Her current medication regimen includes lisinopril 10 mg daily, furosemide 20 mg daily, atorvastatin 10 mg daily, and aspirin 81 mg daily. Which of the following treatment recommendations would be the most appropriate for the prevention of stroke in JR?
    a. Begin warfarin 5 mg daily
    b. Begin dabigatran 150 mg twice daily
    c. Begin rivaroxaban 20 mg once daily
    d. Continue aspirin 81 mg daily

6. SG is a 54 year-old male patient who presents to the emergency department with a chief complaint of intermittent palpitations and shortness of breath for the past three weeks. The initial assessment reveals a blood pressure of 154/88 mmHg, heart rate 86 bpm, and an electrocardiogram (ECG) reveals atrial fibrillation. The team is considering synchronized cardioversion for this patient. Which of the following treatment recommendations is most appropriate for this patient at this time?
    a. Anticoagulation is not needed prior to cardioversion, but should be followed by four weeks of anticoagulation with dose-adjusted warfarin
    b. Start treatment-dose heparin immediately, but delay cardioversion by 48 hours, followed by four weeks of anticoagulation with dose-adjusted warfarin after cardioversion
    c. Start treatment-dose heparin immediately and proceed with cardioversion now, followed by four weeks of anticoagulation with dose-adjusted warfarin after cardioversion
    d. Delay cardioversion, and begin anticoagulation with dose-adjusted warfarin for three weeks prior to and four weeks after cardioversion

7. Which of the following antiarrhythmic drugs is most appropriate for secondary prevention of ventricular arrhythmia in a 69 year-old male patient with hypertension, coronary artery disease, heart failure, and a creatinine clearance of 30 mL/min?
    a. Dofetilide
    b. Dronedarone
    c. Sotalol
    d. Amiodarone

8. Which of the following variables is associated with an increased risk for proarrhythmia during initiation of dofetilide therapy?
    a. Male gender
    b. Hypermagnesemia
    c. Hypertension
    d. Hypokalemia

9. A 68 year-old patient is found unresponsive in his hospital room. The cardiac monitor reveals ventricular fibrillation. The patient has received no intervention, and the resuscitation team has just arrived. At this time, the most appropriate treatment recommendation is to:
    a. Charge defibrillator and defibrillate
    b. Establish an advanced airway (e.g., endotracheal intubation)
    c. Administer epinephrine 1 mg IV push
    d. Administer amiodarone 300 mg slow IV push

10. The resuscitation team is called to an unresponsive patient with pulseless electrical activity. The rhythm displayed on the monitor is sinus rhythm with a heart rate of 76 beats per minute but no pulse. Which of the following treatment recommendations is warranted at this time?
    a. Administer epinephrine 1 mg IV
    b. Administer atropine 1 mg IV
    c. Administer amiodarone 300 mg slow IV push
    d. Charge defibrillator and defibrillate

ANSWERS TO PRACTICE QUESTIONS

1. Which of the following statements most accurately describes the potential outcome resulting from a drug interaction associated with the combination of amiodarone and warfarin in a patient with atrial fibrillation?

   Answer: C

Answer Choice	Rationale/Explanation
A	This answer is incorrect. This response makes the assumption that the drug interaction between amiodarone and warfarin would result in a decrease in the warfarin concentration, which would reduce the effectiveness of warfarin. As described in answer choice C below, the opposite is true – the concentration of warfarin would be increased, not decreased, when used in combination with amiodarone. As a side note, this drug interaction could potentially result in an increased risk of hemorrhagic stroke associated with an elevated warfarin concentration and INR, but not an ischemic stroke.
B	This response makes the assumption that this potential drug interaction would result in an increase in the amiodarone concentration, thereby increasing the risk for proarrhythmia. Warfarin is a substrate for shared CYP P450 isoenzymes with amiodarone, but it is not an inhibitor and does not adversely affect amiodarone exposure.
C – CORRECT	**Amiodarone is a substrate for and potent inhibitor of several cytochrome (CYP) P450 isoenzymes, including CYP 2C9, 2D6, and 3A4. Warfarin is metabolized by CYP 1A2 (R-warfarin) and CYP 2C9 (S-warfarin). When these two medications are used in combination, amiodarone inhibits the metabolism of warfarin, resulting in an increased warfarin concentration, which would increase the prothrombin time/INR and thereby increase the risk for bleeding.**
D	This response makes the assumption that this potential drug interaction would result in a decrease in the amiodarone concentration, thereby decreasing the efficacy of amiodarone and resulting in a break through or worsening of atrial fibrillation (i.e., rapid ventricular response). Warfarin is a substrate for shared CYP P450 isoenyzmes with amiodarone, but warfarin is not an inducer of these isoenzymes and does not adversely affect amiodarone exposure.
Reference(s): 1. *Micromedex® 2.0 Healthcare Series [intranet database].* Greenwood Village, Colorado: Truven Health Analytics. March 12, 2016. 2. Anderson JR, Nawarskas JJ. Cardiovascular drug-drug interactions. *Cardiol Clin.* 2001; 19:215-34. 3. Cheng JW, Frishman WH, Aronow WS. Updates on cytochrome P450-mediated cardiovascular drug interactions. *Am J Ther.* 2009; 16:155-63.	
Domain 1; Task 3d; Knowledge 2	

2. Which of the following represents the potential adverse effects that may be seen in a patient receiving lidocaine for non-sustained ventricular tachycardia?

   Answer: A

Answer Choice	Rationale/Explanation
A — Correct	**The adverse effect profile of lidocaine is unique in that it is limited to the central nervous system. The central nervous system toxicity of lidocaine is based upon the serum concentration: at a serum concentration of 3—6 mcg/mL, adverse effects include dizziness, drowsiness, slurred speech, and parasthesias; at 6—8 mcg/mL, adverse effects include visual disturbances, hallucinations, and tinnitus; and at a serum concentration greater than 8 mcg/mL, patients may experience seizures and/or coma.**
B	This response is incorrect because the toxicity (adverse effects) of lidocaine is limited to the central nervous system. Other antiarrhythmic drugs, such as disopyramide, are associated with anticholinergic adverse effects.
C	This response is incorrect because the toxicity (adverse effects) of lidocaine is limited to the central nervous system. Other antiarrhythmic drugs, such as procainamide, disopyramide, and amiodarone, are associated with hepatotoxicity.
D	This response is incorrect because the toxicity (adverse effects) of lidocaine is limited to the central nervous system. Many of the antiarrhythmic drugs are associated with cardiovascular toxicity, including proarrhythmias. It is postulated that lidocaine is free of cardiovascular toxicity due to its lack of therapeutic effect on “normal” cardiac myocytes.
Reference(s): 1. Sanoski CA, Bauman JL. The arrhythmias. In: DiPiro JT, Talbert RL, Yee GC, Martzke GR, Wells BG, Posey M. Pharmacotherapy: A Pathophysiologic Approach. 8th ed. New York, NY. The McGraw-Hill Companies, Inc; 2011: 273—309. 2. Micromedex® 2.0 Healthcare Series [intranet database]. Greenwood Village, Colorado: Truven Health Analytics. Accessed March 12, 2016.	
Doman 1; Task 1a; Knowledge 2	

3. Which of the following patients with atrial fibrillation would be considered to be at high risk for stroke based upon your assessment and standardized tools for risk stratification?

   Answer: D

Answer Choice	Rationale/Explanation
A	Treatment guidelines recommend stroke risk stratification for each patient with atrial fibrillation. The recommended risk stratification tools is the $CHADS_2$-VASc score, which assigns a risk score for a concomitant diagnosis of *C*ongestive heart failure (1 point), *H*ypertension (1 point), *A*ge greater than 75 years (2 points), *D*iabetes mellitus (1 point), *S*troke, transient ischemic attack, or thromboembolism (2 points), *V*ascular disease (1 point), *A*ge 65—74 years (1 point), and *S*ex *c*ategory (i.e., female gender, 1 point). As the $CHADS_2$-VASc score increases, the risk for stroke increases. Using this risk stratification tool, this patient's $CHADS_2$ score is 2 (1 point for age 64—74 years and 1 point for hypertension), which is lower than that of the patient in answer choice D.
B	This patient's **CHA_2DS_2-VASc** score is 1 (1 point for female gender), which is lower than that of the patient in answer choice D.
C	This patient's **CHA_2DS_2-VASc** score is 1 (1 point for hypertension), which is lower than that of the patient in answer choice D.
D – CORRECT	**As described in answer choice A above, this patient's CHA_2DS_2-VASc score is 3 (1 point for female gender and 2 points for prior transient ischemic attack), which is the highest score of all of the patients described in this question, thus placing this patient at the greatest risk for future stroke associated with atrial fibrillation.**
Reference(s): 1. January CT, Wann S, Alpert JS. 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: a report of the American College of Cardiology\American Heart Association Task Force Practice Guidelines and the Heart Rhythm Society. *Circulation* 2014; 130: e199-267.	
Domain 1; Task 1a; Knowledge 4	

4. HR is a 74 year-old male patient hospitalized with new onset atrial fibrillation. The patient's past medical history is significant for coronary artery disease with myocardial infarction last year, heart failure, and hypertension. The patient is currently prescribed aspirin, clopidogrel, furosemide, and lisinopril. Which of the following agents would be most appropriate for rate control in this patient with atrial fibrillation?

   Answer: A

Answer Choice	Rationale/Explanation
A – CORRECT	**The beta-adrenergic receptor antagonists (beta-blockers), including metoprolol, are the most effective for rate control in patients with atrial fibrillation. Furthermore, this patient has a past medical history of coronary artery disease with recent myocardial infarction and heart failure, which are compelling indications for long-term use of a beta-blocker.**
B	Non-dihydropyridine calcium channel antagonists (calcium channel blockers), such as diltiazem, may considered as a second-line treatment alternative to beta-blockers for rate control in atrial fibrillation for those patients who have not achieved adequate rate control with a beta-blocker or in those patients with compelling indications. In addition, the use of a non-dihydropyridine calcium channel blocker in a patient with a history of heart failure (as in this case) is generally not recommended due to potential worsening of the heart failure.
C	Digoxin can be used for rate control in atrial fibrillation, but due to the narrow therapeutic index of the drug, the significant toxicity profile, and other viable treatment options, digoxin is generally resigned to a last-line treatment alternative in atrial fibrillation.
D	Amiodarone is generally used for rhythm control in patients with atrial fibrillation, although it does possess beta-adrenergic receptor blockade and provides additional benefit for rate control. However, due to the significant toxicity and need for extensive monitoring associated with amiodarone, it is generally considered only as a last-line treatment option for rate control in those patients with atrial fibrillation in which other treatment options have failed.
Reference(s): 1. January CT, Wann S, Alpert JS. 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: a report of the American College of Cardiology\American Heart Association Task Force Practice Guidelines and the Heart Rhythm Society. *Circulation* 2014; 130: e199-267. 2. Wyse DG, Waldo AL, DiMarco JP, et al. A comparison of rate control and rhythm control in patients with atrial fibrillation. *New Engl J Med*. 2002; 347:1825-33.	
Domain 1; Task 3c; Knowledge 2, 4	

5. JR is a 68-year old female patient who presents to the clinic for follow-up after a hospitalization related to atrial fibrillation. The patient's past medical history is significant for hypertension, diabetes mellitus, chronic renal insufficiency on hemodialysis, and a myocardial infarction three years ago. Her current medication regimen includes lisinopril 10 mg daily, furosemide 20 mg daily, atorvastatin 10 mg daily, and aspirin 81 mg daily. Which of the following treatment recommendations would be the most appropriate for the prevention of stroke in JR?

   Answer: A

Answer Choice	Rationale/Explanation
A – CORRECT	**A determination of a patient's risk for stroke due to atrial fibrillation must first be completed to determine the appropriate stroke prevention treatment strategy. The recommended risk stratification tools is the CHA_2DS_2-VASc score, which assigns a risk score for a concomitant diagnosis of *C*ongestive heart failure (1 point), *H*ypertension (1 point), *A*ge greater than 75 years (2 points), *D*iabetes mellitus (1 point), *S*troke, transient ischemic attack, or thromboembolism (2 points), *V*ascular disease (1 point), *A*ge 65—74 years (1 point), and *S*ex *c*ategory (i.e., female gender, 1 point). As the CHA_2DS_2-VASc score increases, the risk for stroke increases. Using this risk stratification tool, this patient's CHA_2DS_2-VASc score is 5 (1 for hypertension, 1 point for diabetes mellitus, 1 point for vascular disease, 1 point for age 65—74, and 1 point for female gender). The recommendation for stroke prevention is based upon the CHA_2DS_2-VASc risk score. Patients with a CHA_2DS_2-VASc risk score of 0 may receive no therapy; patients with a CHA_2DS_2-VASc risk score of 1 may receive either oral anticoagulation, aspirin, or no therapy; and patients with a CHA_2DS_2-VASc risk score of two or more should receive anticoagulation. This patient's CHA_2DS_2-VASc risk score is 5, placing her at increased risk for stroke, warranting the need for anticoagulation. Treatment guidelines recommend oral anticoagulation with warfarin, dabigatran, rivaroxaban, or apixaban for patients at high risk for stroke. Dabigatran and rivaroxaban should not be used in patients with a creatinine clearance less than 15 mL/min and/or receiving hemodialysis, which is applicable to this patient with a history of chronic renal insufficiency requiring hemodialysis. Therefore, warfarin would be the recommended anticoagulant in this patient, with a goal INR 2—3 and a target INR of 2.5.**
B	As described above, this patient is at high risk for stroke associated with atrial fibrillation and should receive anticoagulation. Dabigatran is contraindicated in patients with a creatinine clearance less than 15 mL/min or those that require hemodialysis, which is applicable to this patient with a history of chronic renal insufficiency requiring hemodialysis. Therefore, dabigatran should not be used.
C	As described above, this patient is at high risk for stroke associated with atrial fibrillation and should receive anticoagulation. Rivaroxaban should not be used in patients with a creatinine clearance < 15 mL/min, which is applicable to this patient with a history of chronic renal insufficiency requiring dialysis.
D	Aspirin therapy alone for the prevention of stroke in patients with atrial fibrillation is limited only to those patients who are assessed to be at low risk for stroke (CHA_2DS2-VASc score 0 or 1). As described above, this patient is at high risk for stroke and anticoagulation is recommended.

Reference(s):
1. January CT, Wann S, Alpert JS. 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: a report of the American College of Cardiology\American Heart Association Task Force Practice Guidelines and the Heart Rhythm Society. *Circulation* 2014; 130: e199-267.
2. You JJ, Singer DE, Howard PA, et al. Antithrombotic therapy for atrial fibrillation: antithrombotic therapy and prevention of thrombosis, 9th edition: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest.* 2012; 141:e531S-e575S.
3. Pradaxa® [package insert]. Ridgefield, CT. Boehringer Ingelheim Pharmaceuticals. January 2015.
4. Xarelto® [package insert]. Titusville, NJ. Janssen Pharmaceuticals, Inc. September 2015.

Domain 1; Task 3c;, Knowledge 2, 4

6. SG is a 54 year-old male patient who presents to the emergency department with a chief complaint of intermittent palpitations and shortness of breath for the past three weeks. The initial assessment reveals a blood pressure of 154/88 mmHg, heart rate 86 bpm, and an electrocardiogram (ECG) reveals atrial fibrillation. The team is considering synchronized cardioversion for this patient. Which of the following treatment recommendations is most appropriate for this patient at this time?

   Answer: D

Answer Choice	Rationale/Explanation
A	Cardioversion is associated with an increased risk for stroke in patients with atrial fibrillation. This risk greatly increases as the duration of atrial fibrillation increases. Therefore, prior to cardioversion, all patients with atrial fibrillation should be evaluated for the need for anticoagulation. The exact duration of atrial fibrillation in this patient is not known; the patient reports that he has experienced intermittent symptoms (palpitations, shortness of breath) for the past three weeks. It would be prudent to assume that the duration of atrial fibrillation in this patient is at least 3 weeks, which necessitates the use of anticoagulation prior to cardioversion, followed by at least 4 weeks of anticoagulation thereafter, provided the patient is stable. Based on the provided subjective complaints and vital signs, this patient is stable and cardioversion could be delayed.
B	As described above, the exact duration of atrial fibrillation in this patient is not known. The patient reports intermittent symptoms (palpitations, shortness of breath) for the past three weeks; it would be prudent to assume that the duration of atrial fibrillation in this patient is at least 3 weeks, which necessitates the use of anticoagulation prior to cardioversion. The duration of anticoagulation prior to cardioversion is dictated based on the patient's status. At this point, this patient is hemodynamically stable: the patient is not hypotensive (is hypertensive in fact), has a normal heart rate, and from the details of the case, does not appear to have an altered mental status or ischemic changes on the electrocardiogram (ECG). Because the patient is hemodynamically stable, emergent cardioversion is not needed. Because of this assessment combined with the risk of stroke associated with cardioversion, it would be prudent to delay cardioversion until the patient receives cardioversion for at least three weeks prior to cardioversion. If this delay is not desired, a transesophageal echocardiogram could be performed to evaluate for thrombus and to serve as a guide for the risk of stroke and to determine an optimal duration of anticoagulation.
C	As described above, the patient is hemodynamically stable and emergent cardioversion is not needed. Because of this assessment combined with the risk of stroke associated with cardioversion, it would be prudent to delay cardioversion until the patient receives cardioversion for at least three weeks prior to cardioversion. If this delay is not desired, a transesophageal echocardiogram could be performed to evaluate for thrombus and to serve as a guide for the risk of stroke and to determine an optimal duration of anticoagulation.

D — CORRECT	**In a patient with a duration of atrial fibrillation greater than 48 hours or unknown, the preferred recommendation is to administer anticoagulation for at least 3 weeks prior to and for at least 4 weeks following cardioversion. This treatment strategy would reduce the risk of stroke associated with cardioversion, although the success of cardioversion does decrease as the duration of atrial fibrillation increases. Treatment options for anticoagulation prior to cardioversion include warfarin (INR 2—3), low molecular-weight heparin or unfractionated heparin at treatment doses, dabigatran, rivaroxaban, or apixaban. It is important to note that this recommendation only applies to patients in which a delay in cardioversion would be acceptable. In those patients in need of emergent cardioversion (e.g., hemodynamically unstable), anticoagulation should not delay cardioversion. Finally, as noted above, a transesophageal echocardiogram may be performed prior to cardioversion to evaluate for thrombus and to guide the duration of anticoagulation therapy.**

Reference(s):

1. January CT, Wann S, Alpert JS. 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: a report of the American College of Cardiology\American Heart Association Task Force Practice Guidelines and the Heart Rhythm Society. *Circulation* 2014; 130: e199-267.
2. You JJ, Singer DE, Howard PA, et al. Antithrombotic therapy for atrial fibrillation: antithrombotic therapy and prevention of thrombosis, 9th edition: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest* 2012; 141:e531S-e575S.

Domain 1; Task 3c; Knowledge 2, 4

7. Which of the following antiarrhythmic drugs is most appropriate for secondary prevention of ventricular arrhythmia in a 69 year-old male patient with hypertension, coronary artery disease, heart failure, and a creatinine clearance of 30 mL/min?

   Answer: D

Answer Choice	Rationale/Explanation
A	Amiodarone and sotalol are the preferred antiarrhythmic drugs for secondary prevention of ventricular arrhythmias. Currently, dofetilide is only indicated for the treatment of atrial arrhythmias, specifically atrial fibrillation and atrial flutter. Dofetilide is primarily excreted renally as the unchanged drug, which requires dose adjustment in patients with reduced creatinine clearance due to the risk for accumulation and subsequent toxicity, including proarrhythmias. Dofetilide is contraindicated in patients with a creatinine clearance less than 20 mL/min. Due to the potential for increased toxicity associated with decreased renal function in this patient and other suitable treatment alternatives that are preferred for prevention of ventricular arrhythmias, dofetilide is not the preferred treatment option for this patient.
B	Amiodarone and sotalol are the preferred antiarrhythmic drugs for secondary prevention of ventricular arrhythmias. Currently, dronedarone is only indicated in select patients for the treatment of atrial fibrillation. Due to a risk for increased mortality, dronedarone is contraindicated in patients with New York Heart Association (NYHA) functional Class IV heart failure or in patients with NYHA Class II-III heart failure with recent decompensation. Due to the potential for increased mortality associated with a concomitant diagnosis of heart failure in this patient and other suitable treatment alternatives, dronedarone is not the preferred treatment option in this patient.
C	Sotalol is one of the preferred antiarrhythmic drugs for secondary prevention of ventricular arrhythmias. Sotalol is primarily excreted renally as the unchanged drug, which requires dose adjustment in patients with reduced creatinine clearance due to the risk for drug accumulation and subsequent toxicity. Sotalol is a Class III antiarrhythmic drug, but also exhibits significant beta-adrenergic receptor blockade, which may be of particular concern related to the potential for heart failure exacerbation in this patient, particularly in the setting of drug accumulation. Due to this potential for increased toxicity associated with decreased renal function in this patient, and the presence of a suitable treatment alternative, sotalol would not be the preferred treatment option in this patient.
D – CORRECT	**Amiodarone is one of the preferred antiarrhythmic drugs for secondary prevention of ventricular arrhythmias. Amiodarone is considered a safe treatment option for patients with heart failure, prior myocardial infarction, and in renal insufficiency. Amiodarone is metabolized by and is an inhibitor of several cytochrome (CYP) P450 isoenzymes, which dictates the need for monitoring for potential drug-drug interactions, particularly when used in combination with other cardiovascular medications. Amiodarone does have a significant adverse reaction profile, which requires appropriate monitoring with long-term therapy.**

Reference(s):

1. Zipes DP, Camm AJ, Borggrefe M, et al. ACC/AHA/ESC 2006 Guidelines for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death: a report of the American College of Cardiology/American Heart Association Task Force and the European Society of Cardiology Committee for Practice Guidelines (writing committee to develop Guidelines for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death): developed in collaboration with the European Heart Rhythm Association and the Heart Rhythm Society. *Circulation.* 2006; 114:e385-454.
2. Micromedex® 2.0 Healthcare Series [intranet database]. Greenwood Village, Colorado: Truven Health Analytics. Accessed March 12, 2016.
3. Multaq® [package insert]. Ambares, France. Sanofi-Aventis U.S. LLC. March 2014.

Domain 1; Task 3c; Knowledge 2, 4

8. Which of the following variables is associated with an increased risk for proarrhythmia during initiation of dofetilide therapy?

   Answer: D

Answer Choice	Rationale/Explanation
A	Female gender, not male gender, is associated with an increased risk for proarrhythmia.
B	Hypomagnesemia, not hypermagnesemia, is associated with an increased risk for proarrhythmia, including Torsade de Pointes.
C	Hypertension has not been identified as a risk factor for proarrhythmia associated with the antiarrhythmic drugs.
D – CORRECT	**The risk for proarrhythmia associated with dofetilide is greatest upon initiation. For this reason, dofetilide must be initiated under close observation in a setting that can provide monitoring of the serum creatinine and continuous electrocardiography and that can provide resuscitation in the event of cardiac arrest. This is typically done in the in-patient setting, where monitoring is required for a minimum of 3 days. Several patient-specific and medication-specific risk factors for proarrhythmia, including Torsade de Pointes, have been identified. Hypokalemia is a significant risk factor for proarrhythmia. Additional patient-specific risk factors include hyperkalemia, bradycardia, and heart failure; medication-related risk factors include rapid dose titration and drug-drug interactions.**
Reference(s): 1. Drew BJ, Ackerman MJ, Funk M, et al. Prevention of Torsade de Pointes in hospital settings: a scientific statement from the American Heart Association and the American College of Cardiology Foundation. *Circulation* 2010; 121:1047—60. 2. Roden DM. Drug-induced prolongation of the QT interval. *N Engl J Med.* 2004; 350:1013—22. 3. Tikosyn® [package insert]. New York, NY. Pfizer, Inc. January 2014.	
Domain 1; Task 3d; Knowledge 2	

9. A 68 year-old patient is found unresponsive in his hospital room. The cardiac monitor reveals ventricular fibrillation. The patient has received no intervention, and the resuscitation team has just arrived. At this time, the most appropriate treatment recommendation is to:

   Answer: A

Answer Choice	Rationale/Explanation
A – CORRECT	**Ventricular fibrillation, as well as pulseless ventricular tachycardia, is responsive to defibrillation. The success of defibrillation significantly decreases over time; therefore, early defibrillation is key for successful resuscitation. Cardiopulmonary resuscitation (CPR) should be administered until the defibrillator arrives and is prepared for use.**
B	Cardiopulmonary resuscitation and defibrillation should not be delayed by attempts to establish an advanced airway. Rescue breathing using bag mask ventilations are appropriate in cardiac arrest, provided that ventilation by this method is successful.
C	Epinephrine is indicated in the resuscitation of ventricular fibrillation, but should administered after cardiopulmonary resuscitation has begun and defibrillation has been administered.
D	Amiodarone is indicated in the resuscitation of ventricular fibrillation, but should be administered only after cardiopulmonary resuscitation, defibrillation, and epinephrine have been administered and the patient remains in ventricular fibrillation.
Reference(s): 1. Link MS, Berkow LC, Kudenchuk PJ, et al. Part 7: adult Advanced Cardiac Life Support: 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation* 2015: 132: S444-64.	
Domain 1; Task 3c; Knowledge 2, 4	

10. The resuscitation team is called to an unresponsive patient with pulseless electrical activity. The rhythm displayed on the monitor is sinus rhythm with a heart rate of 76 beats per minute but no pulse. Which of the following treatment recommendations is warranted at this time?

    Answer: A

Answer Choice	Rationale/Explanation
A – CORRECT	**Epinephrine may be administered when feasible to a patient in cardiac arrest when the rhythm is pulseless electrical activity. Epinephrine may be given every 3—5 minutes as needed. The key to successful resuscitation of pulseless activity is to identify and reverse the cause of arrest, and efforts should be focused on identify the possible causes of arrest.**
B	The routine use of atropine for resuscitation of pulseless electrical activity is no longer recommended.
C	Amiodarone is not indicated for the resuscitation of pulseless electrical activity.
D	Pulseless electrical activity is not responsive to defibrillation and is not recommended. However, a defibrillator should readily be available and the patient should have defibrillator pads in place in the event that the pulseless electrical activity transforms to a shockable rhythm, such as ventricular fibrillation or pulseless ventricular tachycardia.
Reference(s): 1. Link MS, Berkow LC, Kudenchuk PJ, et al. Part 7: adult Advanced Cardiac Life Support: 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation* 2015: 132: S444-64.	
Domain 1; Task 3c; Knowledge 2, 4	