Sample Cardiovascular/Thoracic Surgery Questions & Critiques

The sample NCCPA items and item critiques are provided to help PAs better understand how exam questions are developed and should be answered for NCCPA's Cardiovascular/Thoracic Surgery CAQ exam.

Question #1

A 70-year-old woman comes to the office because she has had claudication in her left hip and buttock during the past eight months. She says the symptoms occur after she walks approximately one block. Medical history includes type 2 diabetes mellitus, hypertension, and hyperlipidemia. Daily medications include amlodipine, atenolol, metformin, glyburide, and rosuvastatin. The patient has a 40–pack-year history of cigarette smoking. Physical examination shows diminished left femoral pulse and absent left popliteal pulse. Right femoral and popliteal pulses are intact. Which of the following is the most likely site of arterial stenosis in this patient?

(A) Abdominal aorta

(B) Left common iliac artery

(C) Left deep femoral artery

(D) Left popliteal artery

(E) Left superficial femoral artery

Content Area: Vascular (5%)

Critique

This question tests the examinee's understanding of vascular anatomy as well as the ability to identify the source of claudication based on the patient's history. The correct answer is Option (B),left common iliac artery. The patient has claudication in an anatomic location in which blood is supplied from the left common iliac artery.

Option (A), abdominal aorta, is incorrect because the patient's symptoms are only occurring on theleft side, not bilaterally, and the patient's pulses on the right side are not diminished. Option (C), left deep femoral artery, Option (D), left popliteal artery, and Option (E), left superficial femoral artery, are all incorrect because stenosis in these sites would cause claudication in the left thigh or calf.

Question #2

A 63-year-old woman is brought to the emergency department by her husband because she has had crushing chest pain for the past 20 minutes. Pulse rate is 97/min, respirations are 22/min, and blood pressure is 145/80 mmHg. On physical examination, no pulmonary abnormalities are noted. On auscultation of the chest, an S_4 gallop is heard. Electrocardiography shows ST-segment elevations in leads V_2 through V_5. Morphine, nitroglycerin, aspirin, and oxygen are administered. Which of the following is the most appropriate next step?

(A) Transesophageal echocardiography

(B) Transfer to the cardiac catheterization laboratory

(C) Transfer to the intensive care unit

(D) Transfer to the operating room

(E) Transthoracic echocardiography

Content Area: Cardiac (40%)

Critique

This question tests the examinee's ability to identify the most appropriate next step in management of acute anterior myocardial infarction. The correct answer is Option (B), transfer tothe cardiac catheterization laboratory. The patient is having an acute anterior myocardial infarction, as indicated by the electrocardiography findings of ST-segment elevations in leads V_2 through V_5. It is important that cardiac catheterization is performed emergently for removal of blockages and placement of stents. Therefore, the most appropriate next step in management of the patient's condition is transfer to the cardiac catheterization laboratory, which will provide rapidrevascularization to the affected coronary artery.

Option (A), transesophageal echocardiography, and Option (E), transthoracic echocardiography, are incorrect because these studies are not indicated for acute anterior myocardial infarction. Option (C), transfer to the intensive care unit, is incorrect because this step would be performed after cardiac catheterization. Option (D), transfer to the operating room, is incorrect because this would not be appropriate unless traumatic rupture of the coronary artery were to occur during the cardiac catheterization procedure.

Question #3

An 82-year-old man is referred to the office by his cardiologist for aortic valve replacement. The patient has had increasing dyspnea on exertion for the past two months, and during this time, he had one episode of substernal chest pain while walking. Based on the results of multiple diagnostic tests, the patient's cardiologist diagnosed aortic stenosis. Which of the following values is most important in determining whether aortic valve replacement is needed in this patient?

(A) Ejection fraction

(B) Left ventricular end-diastolic pressure

(C) Mean gradient

(D) Pulmonary artery pressures

(E) Valve area

Content Area: Cardiac (40%)

Critique

This question tests the examinee's understanding and interpretation of invasive and noninvasive parameters measured and used to diagnose valvular heart disease. The correct answer is Option(C), mean gradient. The mean gradient measures the pressure differences above and below the aortic valve. It is the most important value measured during echocardiography to determine whether aortic valve replacement is necessary.

Option (A), ejection fraction, is incorrect because this value may be within normal limits or diminished in a patient with aortic stenosis. Option (B), left ventricular end-diastolic pressure, is incorrect because this value is a measurement of left ventricular function and is not specific for valvular heart disease. Option (D), pulmonary artery pressures, is incorrect because these values may be within normal limits in patients with severe aortic stenosis. Option (E), valve area, is plausible but incorrect because a patient may be of small stature and, therefore, have a small valvearea. In a case such as this, the decision to replace a valve would be determined by mean gradient and not valve area.

Question #4

A 72-year-old man is referred to the clinic after his first physical examination since 50 years of age. At that time, hypertension was diagnosed but the patient refused drug therapy. Medical history includes no known illnesses or surgical procedures. The patient has smoked two packs of cigarettes daily since 20 years of age. Review of systems shows dyspnea on exertion, tightness of the calves after walking up three or four flights of stairs, and forgetfulness. Screening for which of the following conditions is the most appropriate next step?

(A) Abdominal aortic aneurysm

(B) Chronic obstructive pulmonary disease

(C) Coronary artery disease

(D) Major neurocognitive disorder (dementia)

(E) Peripheral vascular disease

Content Area: Vascular (5%)

Critique

This question tests the examinee's understanding of the importance of screening all patients for abdominal aortic aneurysm during any physical examination. This question also tests the examinee's understanding of patient presentation as well as the order of importance in screening for acute conditions. The correct answer is Option (A), abdominal aortic aneurysm. The patient hasclaudication in both calves, which is a finding that is consistent with abdominal aortic aneurysm. Of the options listed, abdominal aortic aneurysm is the acute condition that is most likely to result in sudden death from rupture. Therefore, screening for this condition during the physical examination is the most appropriate next step.

Option (B), chronic obstructive pulmonary disease, is incorrect because despite the patient's history of cigarette smoking and dyspnea on exertion, which are related to chronic obstructive pulmonary disease, it is not an acute condition and would be screened for after abdominal aorticaneurysm. Option (C), coronary artery disease, is incorrect because even if the patient has coronary artery disease, his symptoms are consistent with stable angina, not unstable angina. Stable angina is not an acute condition and would be screened for after abdominal aortic aneurysm. Option (D), major neurocognitive disorder (dementia), is incorrect because the patient's symptom of forgetfulness does not meet diagnostic criteria for the condition and is not consideredan acute condition. Option (E), peripheral vascular disease, is plausible but incorrect because peripheral vascular disease is not considered an acute condition that may result in sudden death as compared with rupture of an abdominal aortic aneurysm.

Question #5

A 57-year-old man comes to the medical clinic because he has had fatigue and unintentional weight loss of 20 lb during the past month. He also has had inability to swallow solid foods for the past two weeks. He has a 30–pack-year history of cigarette smoking. Medical history includes Barrett esophagus, achalasia, alcohol use disorder (alcohol abuse), and ingestion of lye at 15 yearsof age. Esophagogastroduodenoscopy confirms the suspected diagnosis of adenocarcinoma of the distal esophagus. Which of the following findings in this patient's history is his greatest risk factor for this condition?

(A) Achalasia

(B) Alcohol use disorder (alcohol abuse)

(C) Barrett esophagus

(D) Cigarette smoking

(E) Ingestion of lye

Content Area: Thoracic (15%)

Critique

This question tests the examinee's ability to identify the greatest risk factor for adenocarcinoma ofthe esophagus in a patient who has multiple risk factors. The correct answer is Option (C), Barrett esophagus. Among the patient's risk factors for adenocarcinoma of the esophagus, Barrett esophagus is the greatest. Most, if not all, cases of adenocarcinoma of the esophagus arise in the Barrett epithelium.

Option (A), achalasia, and Option (B), alcohol use disorder (alcohol abuse), are incorrect becausethese conditions are risk factors for squamous cell carcinoma but not adenocarcinoma. Option (D), cigarette smoking, and Option (E), ingestion of lye, are incorrect because these behaviors arealso associated with squamous cell carcinoma and not adenocarcinoma.

Question #6

A 72-year-old woman is referred to the thoracic surgery office by her primary care provider because she has had worsening cough over the past six weeks as well as recent onset of wheezing, shortness of breath, night sweats, and unintentional weight loss. Medical history includes hypertension that is managed with hydrochlorothiazide and hyperlipidemia that is managed with atorvastatin. The patient smokes one pack of cigarettes daily. Chestx-ray studies show a mass in the lower lobe of the left lung as well as pleural effusion on the left. Which of the following is the most appropriate next step?

(A) Chemotherapy

(B) Closed pleural biopsy

(C) Surgical resection of the mass

(D) Surgical thoracoscopy

(E) Thoracentesis with cytology

Content Area: Thoracic (15%)

Critique

This question requires the examinee to first identify the suspected diagnosis of lung cancer andthen determine the most appropriate next step in diagnosis and staging of this disorder. The correct answer is Option (E), thoracentesis with cytology. Cytology of pleural fluid is most effective in confirming the suspected diagnosis of lung cancer and directing further testing andtreatment.

Option (A), chemotherapy, is incorrect because the diagnosis of lung cancer has not been confirmed and the type of cancer has not been specified. Therefore, initiation of therapy is inappropriate. Option (B), closed pleural biopsy, is plausible but incorrect because thoracentesis with cytology should be performed before biopsy if a pleural effusion is present. Option (C), surgical resection of the mass, is incorrect because the diagnosis of lung cancer has not been confirmed. Therefore, surgical removal of the mass is inappropriate. Option (D), surgical thoracoscopy, is incorrect because thoracentesis with cytology should be performed before biopsy via thoracoscopy.

Question #7

A 49-year-old man is brought to the emergency department after he sustained injuries as the unrestrained driver in a head-on motor vehicle collision. The patient says he has pain in his chest. Pulse rate is 118/min, respirations are 18/min, and blood pressure is 142/96 mmHg. Oxygen saturation is 96% on room air. Physical examination shows multiple lacerations and contusions on the face. On chest x-ray study in this patient, which of the following findings is most indicative of injury to the aorta?

(A) Apical pleural hematoma

(B) Left pneumothorax

(C) Left pulmonary contusion

(D) Multiple rib fractures on the right

(E) Pneumomediastinum

Content Area: Cardiac (40%)

Critique

This question tests the examinee's ability to formulate a diagnosis and determine indicative injuries based on the described mechanism. The correct answer is Option (A), apical pleural hematoma. In patients who have sustained abrupt deceleration injuries associated with motor vehicle collisions or falls from great heights, the finding of apical pleural hematoma on chest x-ray study is suggestive of injury to the aorta. Other findings on chest x-ray study that suggest injury to the aorta include the following: widening of the mediastinum (>8 cm), indistinct aortic knob, opacification of the aortopulmonary window, fractures of the first and/or second ribs, deviation of the esophagus or nasogastric tube to the right, depression of the left main stem bronchus, and widening of the paratracheal or paraspinous strip.

Option (B), left pneumothorax, is incorrect because this finding is indicative of an injury to the lung and not the aorta. Option (C), left pulmonary contusion, is incorrect because this finding is associated with bruising of the lung and not injury to the aorta. Option (D), multiple rib fractures on the right, is incorrect because injuries to the aorta are seen with fractures of the first and second ribs, most commonly on the left. Option (E), pneumomediastinum, is incorrect because this finding is seen with rupture of the tracheobronchial tree and not injury to the aorta.

Question #8

An 18-year-old man is brought to the trauma center by ambulance after he sustained a gunshot wound to the chest. Physical examination shows narrow pulse pressure, jugular venous distention,muffled heart sounds, and pulsus paradoxus. Which of the following is the most likely diagnosis?

(A) Cardiac tamponade

(B) Cardiogenic shock

(C) Perforation of the left ventricle

(D) Pneumothorax

(E) Rupture of the aorta

Content Area: Cardiac (40%)

Critique

This question tests the examinee's knowledge of the signs of cardiac tamponade. The correct answer is Option (A), cardiac tamponade. The physical examination findings of narrow pulse pressure, jugular venous distention, and pulsus paradoxus are characteristic of cardiac tamponade.

Option (B), cardiogenic shock, is plausible but is not the most likely diagnosis because the physical findings do not include hypotension. Option (C), perforation of the left ventricle, is also plausible but is not the most likely diagnosis because most perforating traumatic injuries to the chest affect the right ventricle because it is located in the anterior mediastinum, whereas the left ventricle is situated posteriorly to the right ventricle in the mediastinum. Option (D), pneumothorax, is plausiblebut incorrect because findings of narrow pulse pressure and pulsus paradoxus are not characteristic of this condition. Option (E), rupture of the aorta, is incorrect because patients with this condition may only have pain in the back or chest. Narrow pulse pressure, jugular venous distention, muffled heart sounds, and pulsus paradoxus are not indicative of rupture of the aorta.

Question #9

A 22-year-old man is brought to the emergency department after he sustained a gunshot wound to the left thigh. Pulse rate is 122/min, respirations are 18/min, and blood pressure is 128/88 mmHg. Oxygen saturation is 96% on room air. Physical examination shows a bleeding wound in the left upper thigh, just below the inguinal ligament. The left foot is pale, cool, and hyperesthetic, but peripheral pulses are absent. Surgical exploration of the wound shows destruction of a 5.5-cm portion of the superficial femoral artery. The most appropriate management is debridement of the wound and which of the following?

(A) End-to-end anastomosis

(B) End-to-side anastomosis

(C) Repair with an interposition artery graft

(D) Repair with an interposition prosthetic graft

(E) Repair with an interposition vein graft

Content Area: Clinical Skill Requirements (5%)

Critique

This question tests the examinee's ability to first identify the injury and then describe the most appropriate management. The correct answer is Option (E), repair with an interposition vein graft. The patient has several hard signs of vascular injury, which include the following: evidence of distal ischemia, absent or diminished pulses, expanding hematoma, palpable thrill, pulsatile bleeding, and a bruit. Because the patient's injury was caused by a gunshot, the wound is considered to be contaminated, and the arterial injury is of major concern because the length is 5.5cm. Repair with an interposition vein graft is the most appropriate management considering these factors because of the potential for contamination and the length of the arterial damage.

Appropriate surgical repair of an arterial injury depends on the extent of the vascular injury. Option(A), end-to-end anastomosis, and Option (B), end-to-side anastomosis, are incorrect because although these procedures are used for extensive injuries requiring some debridement of the artery, they are only appropriate when there is no significant loss of the original length of the artery. Injury to at least 5.5 cm of an artery is considered significant and is of major concern. Option (C), repair with an interposition artery graft, is incorrect because repairing an artery with anartery can cause stenosis and is not favorable. Option (D), repair with an interposition prosthetic graft, is incorrect because use of a prosthetic graft is contraindicated in a wound that is infected or contaminated.

Question #10

A 66-year-old man is recovering in the hospital five hours after undergoing three-vessel coronary artery bypass grafting. Initial output from the mediastinal chest tube was 300 mL of bloody drainage per hour. One hour ago, no further evidence of bleeding from the tube was noted. Despiterepeated intravenous bolus administration of fluid, mean arterial pressure has decreased from 80to 40 mmHg. Central venous pressure is increased at 20 mmHg (N=2-6 mmHg), and administration of dopamine has been required for maintenance of blood pressure. Which of the following is the most appropriate next step in the management of this patient's condition?

(A) Administration of phenylephrine via intravenous drip

(B) Infusion of streptokinase into the mediastinal chest tube

(C) Placement of an intra-aortic balloon pump

(D) Surgical exploration of the mediastinum

(E) Transfusion of two units of packed red blood cells

Content Area: Cardiac (40%)

Critique

This question tests the examinee's ability to recognize cardiac tamponade in a patient who is recovering from coronary artery bypass grafting and then identify the most appropriate next step inmanagement. The correct answer is Option (D), surgical exploration of the mediastinum. In the patient described, cardiac tamponade secondary to postoperative bleeding is evidenced by significant blood loss noted in the drainage from the chest tube as well as persistent hypotension and decrease in mean arterial pressure despite repeated intravenous hydration. Returning the patient to the operating room for surgical exploration is needed for evacuation of blood from the pericardium and mediastinum. After this has been accomplished, blood flow will return to the right side of the heart and cardiac output will improve.

Option (A), administration of phenylephrine via intravenous drip, Option (B), infusion of streptokinase into the mediastinal chest tube, and Option (E), transfusion of two units of packedred blood cells, are incorrect because these interventions will not relieve cardiac tamponade. Option (C), placement of an intra-aortic balloon pump, is incorrect because this intervention would be appropriate only if ventricular failure were present.

Question #11

A 40-year-old man is brought to the emergency department by his wife one hour after he had sudden onset of shortness of breath. Medical history includes chronic obstructive pulmonary disease and prior spontaneous right pneumothorax. The patient has an 80–pack-year history of cigarette smoking. Temperature is 37.1°C (98.7°F), pulse rate is 95/min, respirations are28/min, and blood pressure is 140/100 mmHg. Oxygen saturation is 87% on 2 L of oxygen via nasal cannula. On physical examination, breath sounds are distant bilaterally. Chest x-ray study shows alarge right pneumothorax. After placement of an appropriately sized chest tube, which of the following is the most definitive management?

(A) Discharge the patient with a Heimlich valve and schedule outpatient follow-up

(B) Initiate patient-controlled anesthesia

(C) Perform pleurodesis with doxycycline

(D) Schedule the patient for blebectomy

(E) Wait for the lung to seal on continuous suction

Content Area: Thoracic (15%)

Critique

This question tests the examinee's ability to identify the most appropriate next step in management of recurrent primary spontaneous pneumothorax. The correct answer is Option (D), schedule the patient for blebectomy. The patient has characteristic risk factors for primary spontaneous pneumothorax: male gender, 20 to 40 years of age, history of cigarette smoking, history of lung disease, and prior spontaneous pneumothorax. The cause of primary spontaneous pneumothorax is rupture of a small air blister or bleb on the anterior surface of the lung. In patients who have had a prior primary spontaneous pneumothorax, risk of recurrence within three years is greater than 50%. To prevent recurrence of spontaneous pneumothorax, the bleb must be surgically removed. Therefore, blebectomy is the most appropriate next step in management of thepatient's condition.

Option (A), discharge the patient with a Heimlich valve and schedule outpatient follow-up, is incorrect because a definitive procedure is needed to correct the patient's underlying condition of spontaneous rupture of the bleb. Option (B), initiate patient-controlled anesthesia, is incorrect because this will not correct the underlying condition of recurrent spontaneous rupture of the bleb.Option (C), perform pleurodesis with doxycycline, is incorrect because it would not prevent future recurrence of pneumothorax. Option (E), wait for the lung to seal on continuous suction, is incorrect because this intervention would reexpand the current pneumothorax but would not prevent future recurrence.

Question #12

A 58-year-old man is undergoing three-vessel coronary artery bypass grafting with replacement of the aortic valve. Multiple attempts to separate the patient from the heart-lung machine are unsuccessful. The surgeon decides that insertion of an intra-aortic balloon pump is indicated. Inthis patient,the primary goal of this procedure is increase in which of the following?

(A) Afterload

(B) Contractility

(C) Coronary blood flow

(D) Peripheral resistance

(E) Preload

Content Area: Clinical Skill Requirements (5%)

Critique

This question tests the examinee's understanding of the function of an intra-aortic balloon pump. The correct answer is Option (C), coronary blood flow. An intra-aortic balloon pump is a mechanical device that increases myocardial oxygen perfusion while simultaneously increasingcardiac output. Increasing cardiac output increases coronary blood flow and, in turn, increases myocardial oxygen delivery. Therefore, the primary goal of insertion of an intra-aortic balloon pump is to increase coronary blood flow.

Option (A), afterload, Option (B), contractility, Option (D), peripheral resistance, and Option (E), preload, are all incorrect because use of an intra-aortic balloon pump would cause a decrease in each of these factors.

Question #13

A 70-year-old man is transferred to the cardiac surgical intensive care unit after undergoing aortic valve replacement. Respirations are being assisted by mechanical ventilation. A spontaneous breathing trial is planned for the following morning. Which of the following is an appropriate criterion for extubation in this patient?

(A) Heart rate less than 100/min

(B) Hemoglobin level greater than 8 g/dL

(C) Maximum inspiratory force greater than -20 cmH_2O

(D) Minute ventilation greater than 10-15 L/min

(E) pO_2 of 50 mmHg on fraction of inspired oxygen (FIO_2) of 40%

Content Area: ICU Management (15%)

This question tests the examinee's understanding of the criteria for deciding when to safely perform extubation after cardiac surgery. The correct answer is Option (C), maximum inspiratory force greater than -20 cmH_2O. Maximum inspiratory force is a weaning parameter that is specifically measured to determine whether a patient has enough physical strength to breathe without assistance after extubation is performed. Any value less than -20 cmH_2O is considered acceptable to safely extubate a patient.

Option (A), heart rate less than 100/min, is incorrect because a patient may have a heart rate of 110/min and be safely extubated, but heart rate is generally not considered a criterion for deciding when to extubate a patient, unless rapid atrial fibrillation and hemodynamic instability are present. Option (B), hemoglobin level greater than 8 g/dL, is incorrect because hemoglobin is not a criterion for extubation, and extubation can be performed safely with hemoglobin level less than 8 g/dL. Option (D), minute ventilation greater than 10-15 L/min, is plausible but incorrect. Although minute ventilation is a weaning parameter that is measured and used in making the decision to extubate a patient, negative inspiratory force is a more sensitive test, and a patient may be safely extubated with a minute ventilation less than 10 L/min or greater than 15 L/min. Option (E), pO_2 of 50 mmHg on fraction of inspired oxygen (FIO_2) of 40%, is incorrect because a patient with a pO_2 of only 50 mmHg would not be extubated in most circumstances. An exception is preexisting severe chronic obstructive pulmonary disease.

Question #14

A 78-year-old man with hypertension and chronic obstructive pulmonary disease is transferred tothe intensive care unit after undergoing two-vessel coronary artery bypass grafting. Four hours later, atrial fibrillation develops at a rate of 140/min. Amiodarone therapy is initiated. Which of thefollowing is the most serious adverse effect of this therapy?

(A) Bradycardia

(B) Hypoglycemia

(C) Hypothyroidism

(D) Liver dysfunction

(E) Pulmonary toxicity

Content Area: Pharmacotherapy (10%)

Critique

This question tests the examinee's ability to identify a serious adverse effect of a medication inan elderly patient with diminished lung function who is recovering after undergoing coronary artery bypass grafting. The correct answer is Option (E), pulmonary toxicity. In patients with decreased lung function, pulmonary toxicity is the most serious adverse effect of amiodarone therapy. Patients who have undergone cardiac surgery are at increased risk for atrial fibrillation. Risk factors related to amiodarone therapy include high cumulative dose (more than 400 mg/day), duration greater than two months, age older than 70 years, and preexisting pulmonary disease. In some patients treated with amiodarone, pulmonary fibrosis develops after the first week of therapy. However, other patients are treated with amiodarone for years without development of adverse effects. Common practice is to avoid amiodarone therapy, if possible, inpatients with decreased lung function.

Option (A), bradycardia, Option (B), hypoglycemia, Option (C), hypothyroidism, and Option (D), liver dysfunction, are incorrect because these conditions have not been described as adverse effects of amiodarone therapy.

Question #15

A 60-year-old man who is recovering in the hospital 15 days after undergoing repeat repair of an ascending aortic aneurysm has had atrial fibrillation for the past five days. Laboratory studies show platelet count of 45,000/mm^3 and confirm the diagnosis of heparin-induced thrombocytopenia. Anticoagulation therapy is planned to prevent complications from the patient'scondition. Prior to initiation of warfarin therapy, the most appropriate anticoagulant therapy is administration of which of the following medications?

(A) Argatroban

(B) Clopidogrel

(C) Enoxaparin

(D) Eptifibatide

(E) Heparin

Content Area: Pharmacotherapy (10%)

Critique

This question tests the examinee's knowledge of various intravenous and oral anticoagulants andtheir appropriate therapeutic use. The correct answer is Option (A), argatroban. Argatroban is specifically indicated for management of heparin-induced thrombocytopenia.

Option (B), clopidogrel, is incorrect because it is a platelet inhibitor and would further increase the patient's risk of spontaneous bleeding. Option (C), enoxaparin, is incorrect because it is a low- molecular form of heparin, which would worsen thrombocytopenia in the patient and increase his risk of spontaneous bleeding or thrombosis. Option (D), eptifibatide, is incorrect because it is a potent intravenous platelet inhibitor and would increase the patient's risk of spontaneous bleeding. Option (E), heparin, is incorrect because this medication is the cause of thrombocytopenia in the patient and, therefore, would be contraindicated in further use for anticoagulation.