Cardiovascular Medicine:Question 1
A 42-year-old man comes to your office for a risk assessment for coronary artery disease. He is 178 cm (70 inches) tall and weighs 75 kg (165 lb); his body mass index is 25. Blood pressure is 126/84 mm Hg. He does not have diabetes, and a lipid panel shows a plasma LDL cholesterol level of 120 mg/dL and HDL cholesterol level of 45 mg/dL. The patient runs 4 days a week and does weight training. He has a family history of premature vascular disease. His father died of a myocardial infarction at age 45 years. Which of the following tests should be included in this patient's workup?
A. Measurement of serum lipoprotein (a) assay
B. Measurement of plasma homocysteine level
C. High-sensitivity measurement of C-reactive protein
D. Maximal treadmill exercise test

Cardiovascular Medicine:Question 2
A 60-year-old man is hospitalized after he is taken to the emergency department because of dyspnea and leg edema. He has a longstanding history of essential hypertension that is treated with a thiazide diuretic and amlodipine. Coronary angiography performed 1 year ago because of chest pain was normal, but left ventriculogram showed an ejection fraction of 45%. On admission, blood pressure is 180/100 mm Hg and heart rate is 110/min and regular. Jugular venous distension is 10 cm while the patient is lying on a stretcher with his head elevated at 45 degrees. He has a positive hepatojugular reflex, 2+ pitting leg edema to the knees, soft S1 and S2, an S3 gallop, and diffuse pulmonary crackles. No heart murmurs are auscultated. Echocardiogram shows left ventricular ejection fraction of 20% and left ventricular end-diastolic dimension in diastole of 7 cm. He has 1+ mitral and 1+ tricuspid regurgitation with an estimated right ventricular systolic pressure of 40 mm Hg. Electrocardiogram shows a left bundle branch block. Serum electrolytes and hepatic and renal function measurements are normal. Acute ischemic syndrome is excluded by repeated measurements of cardiac enzymes. He receives furosemide, three boluses of 60 mg intravenously, and nesiritide over a 24-hour period and improves rapidly with diuresis of 2200 mL. Which of the following drugs should be initiated before discharge to improve long-term survival in this patient?
A. Digoxin
B. Furosemide
C. Carvedilol
D. Lisinopril
E. Spironolactone

Cardiovascular Medicine:Question 3
A 75-year-old woman with no past medical history presents to the emergency department 4 hours after the onset of stuttering, severe substernal chest pain with radiation to the left arm and jaw. After two sublingual nitroglycerin tablets in the emergency department, the patient is free of chest pain. Electrocardiography reveals 2-mm ST-segment depression in leads I, aVL, V5, and V6. The initial troponin I level is elevated at 8 ng/mL. The patient has no clear-cut medical contraindications to anticoagulation. The patient is treated with aspirin, intravenous β-blocker, and intravenous nitroglycerin. In addition to the medications that have been started, which of the following would be the optimal management strategy at this time?
A. Unfractionated heparin, tirofiban.
B. Enoxaparin.
C. Clopidogrel, enoxaparin.
D. Clopidogrel, enoxaparin, tirofiban.
E. Clopidogrel, enoxaparin, tirofiban, diltiazem.
Cardiovascular Medicine: Question 4
A 20-year-old college student is evaluated for palpitations. She has noticed a rapid pounding in her chest on several occasions. She first noticed it in middle school. Most episodes last less than 1 minute, but a few have lasted one-half hour. During an episode, she feels lightheaded, but is not short of breath and does not have syncope or chest pain. She is most aware of the pounding sensation in her neck. Symptoms usually occur without warning while she is at rest. If she breathes slowly and deeply, the episodes usually stop on their own. They have never interfered with her activities, and she continues to run cross-country. Recently, the episodes have been longer and more frequent. She has never had the rhythm documented. Physical examination and electrocardiogram findings are normal. She has no family history of heart disease.
Which of the following is the most likely diagnosis?
A. Benign premature atrial contractions
B. Palpitations related to mitral valve prolapse
C. Paroxysmal supraventricular tachycardia
D. Ventricular tachycardia
E. Paroxysmal atrial flutter

Cardiovascular Medicine: Question 5
A 63-year-old man is evaluated for a rash. During evaluation, you note a grade 3/6 holosystolic murmur at the apex that radiates throughout the precordium and is loudest along the left sternal border. The left ventricular point of maximum impulse is diffuse and displaced laterally. The heart rate is 94/min and blood pressure is 136/80 mm Hg. Jugular venous pressure is increased. The rest of the findings on physical examination are unremarkable, except for an area of contact dermatitis under the patient’s wristwatch band. The patient works full-time as a dairy farmer and has not seen a physician for 10 years. He denies shortness of breath, orthopnea, or paroxysmal nocturnal dyspnea. Electrocardiogram shows sinus rhythm with left atrial enlargement. Echocardiography shows myxomatous degeneration of the mitral valve, with partial flail of the posterior leaflet and severe mitral regurgitation. The left atrium is enlarged. The left ventricle is also enlarged, measuring 71 mm in diastole (normal range, 37 to 57 mm) and 51 mm in systole (normal range for fractional shortening, 28 mm to 44 mm). The left ventricular ejection fraction is estimated at 52% (normal ≥55%).
Which of the following statements about surgical intervention for this patient is true?
A. Surgery is indicated if the left ventricle remains dilated after 8 weeks of afterload-reducing therapy with an ACE inhibitor.
B. Surgery is indicated if the findings on myocardial perfusion imaging with sestamibi are normal. C. Surgery is indicated if transesophageal echocardiographic imaging shows that the mitral valve is amenable to repair.
D. Surgery is indicated despite the absence of symptoms.
E. Surgery is contraindicated based on the presence of left ventricular systolic dysfunction.

Cardiovascular Medicine: Question 6
A 54-year-old man is discharged from the hospital 3 days after undergoing stenting of the left anterior descending coronary artery for acute coronary syndrome. He is asymptomatic, and left ventricular function, blood pressure, and plasma glucose level are normal. The serum cholesterol level was high on admission. Telemetry showed frequent premature ventricular contractions with occasional couplets. At discharge, the patient was prescribed clopidogrel, 75 mg/d; aspirin, 325 mg/d; metoprolol, 50 mg twice a day; and simvastatin, 20 mg/d.
Which of the following medications would likely prevent future cardiac events?
A. Folic acid
B. Vitamin E
C. Ramipril
D. Isosorbide mononitrate
E. Propafenone

**Cardiovascular Medicine:Question 7**
A 29-year-old woman in the 28th week of pregnancy has sudden onset of severe anterior chest pain radiating to her back. The pain began 2 hours earlier and increased in severity. It was not associated with shortness of breath, nausea or vomiting, or diaphoresis. The patient has a history of mitral valve prolapse that was diagnosed on echocardiogram 10 years earlier. Her only medication is a prenatal vitamin. Her family history is unremarkable.

On physical examination, blood pressure is 105/78 mm Hg, heart rate is 110/min, and respiration rate is 18/min while the patient is lying still. The patient is afebrile. Examination of the head, eyes, ears, nose, and throat shows a high, arched palate. Carotid pulses are normal bilaterally, with no jugular venous distension. The lungs are clear to auscultation. Cardiac examination shows a nondisplaced apical impulse, diminished S1, physiologically split, and a soft blowing murmur in early diastole along the right sternal border. A midsystolic click and a late systolic murmur are noted. Abdominal examination shows a gravid uterus that is appropriate for gestational age. Trace pedal edema and intact symmetrical pulses are noted throughout. Fetal heart sounds are normal. An electrocardiogram shows mild T-wave flattening. Laboratory findings include hematocrit of 32% and platelet count of 170,000/μL. Fetal monitoring is instituted, and morphine is administered for pain control.

Which of the following is the most appropriate diagnostic test?
A. Serum troponin measurement
B. Transthoracic echocardiogram
C. Magnetic resonance angiography
D. Transesophageal echocardiography
E. Helical computed tomography scan

**Cardiovascular Medicine:Question 8**
A 43-year-old man comes to the emergency room for evaluation of severe chest pain that awoke him from sleep. While the patient was seated, the pain gradually resolved after 5 minutes, but recurred several minutes later. The patient reports that he has had nasal congestion, nausea, fatigue, and a low-grade fever for the past few days.

Physical examination shows a temperature of 38 °C (100.4 °F), heart rate of 104/min, and recurrence of pain while lying in the left lateral decubitus position. A three-component pericardial friction rub is noted. Laboratory findings include a total leukocyte count of 11,000/μL, an erythrocyte sedimentation rate of 55 mm/h, and a slightly elevated troponin level. Electrocardiogram shows diffuse ST-T-wave changes (see below).
Which of the following is the best course of treatment for this patient?
A. Metoprolol, 25 mg twice a day orally
B. Colchicine, 0.5 mg twice a day orally for 2 weeks
C. Prednisone, 25 mg/d orally for 2 weeks, followed by a taper
D. Indomethacin, 25 mg four times a day orally for 2 weeks
E. Reteplase, 10 U by intravenous bolus, repeated in 30 minutes

**Cardiovascular Medicine:Question 9**
A 60-year-old man comes to your office for evaluation. He had a myocardial infarction 2 years ago. He is inactive and has recently noticed that he has difficulty walking more than one block. He has hypertension and a 50-pack-year history of cigarette smoking. Medications include lisinopril and hydrochlorothiazide.
What is the prevalence of peripheral arterial disease in patients with this type of background?
A. 1%
B. 5%
C. 10%
D. 20%
E. 29%

**Cardiovascular Medicine:Question 10**
A 78-year-old woman with a history of systolic hypertension and chronic obstructive pulmonary disease presents with progressive shortness of breath over the past 6 months. She notes dyspnea walking across the room and she has begun waking up at night coughing. She has increased use of her inhaler without any improvement. She denies fever and chills. Her outpatient medications include amlodipine 10mg daily, hydrochlorothiazide 12.5 mg daily, prednisone 5mg daily, and albuterol inhaler. Her social history is notable for a single glass of wine a day and no prior
history of smoking. Her blood pressure is 145/70 mm Hg and her heart rate is 82/min. On examination, she has mild jugular venous distension. She has clear lung fields. She has a regular rhythm, a grade 2/6 holosystolic murmur at the apex, and no S3. Laboratory data include a normal complete blood count, serum sodium 138 mg/dL, potassium 3.8 mg/dL, glucose 95 mg/dL, and creatinine 1.4 mg/dL. Chest radiograph shows mild cardiomegaly with mild increase in interstitial markings but no infiltrates. An electrocardiogram shows normal sinus rhythm and left ventricular hypertrophy. Her pulmonary function tests show a mixed restrictive and obstructive pattern. An echocardiogram shows concentric hypertrophy, left atrial enlargement, a left ventricular ejection fraction of 65%, and moderate mitral and tricuspid regurgitation.

Which of the following is the most likely cause of this patient’s dyspnea and nocturnal cough?
A. Pneumonia
B. Worsened chronic obstructive pulmonary disease
C. Heart failure
D. Acute coronary syndrome
E. Pulmonary fibrosis

Cardiovascular Medicine: Question 11
A 25-year-old pregnant woman is referred to you for evaluation of a heart murmur that was noted during the second trimester of this pregnancy, which is her first. The patient has no history of cardiovascular disease, and the murmur was not heard during previous medical evaluations. She is asymptomatic. Examination shows a mildly displaced apical impulse and lower extremity edema. S1 and S2 are normal, and S3 is noted at the apex. A grade 2/6 early to mid-peaking systolic murmur is audible at the left sternal border. Based on the patient’s history and physical findings, which of the following is the most likely cause of the murmur?
A. Bicuspid aortic valve with mild to moderate stenosis
B. Congenitally abnormal pulmonary valve with moderate stenosis
C. Physiologic murmur related to pregnancy
D. Mitral valve regurgitation related to mitral valve prolapse
E. Bicuspid aortic valve with moderate regurgitation

Cardiovascular Medicine: Question 12
A 46-year-old man begins an exercise training program that involves jogging on a treadmill for 40 minutes three times per week. Before beginning the program, he underwent exercise testing that showed a peak heart rate of 120/min and a peak estimated metabolic equivalent level of 7. After 6 months of training, he undergoes another treadmill test that shows a peak heart rate of 120/min and a peak metabolic equivalent level of 9. Both tests were terminated because of patient fatigue. He had no ischemic responses on either test.

Which of the following best describes the results of this training program?
A. The finding of no change in peak heart rate indicates that no training benefit was achieved.
B. The findings indicate that the patient did not exercise to exhaustion during the first test.
C. Achievement of a higher peak metabolic equivalent level is primarily caused by a greater level of effort on the second test.
D. The heart rate response to submaximal levels of exercise is now lower.
E. Changes in the peak metabolic equivalent level are most likely caused by changes in pulmonary ventilation that occur with exercise training.
Cardiovascular Medicine: Question 13
A 47-year-old woman is evaluated for palpitations that occur intermittently during the day, vary in severity, and cause a sensation of skipped beats. She has no other associated symptoms. She had a similar episode 2 years ago while undergoing a stressful job relocation, but did not seek medical attention at that time. She is now under pressure at work, and her son is leaving for college in 1 week.
On physical examination, her blood pressure is 160/90 mm Hg and her heart rate is 80/min. Cardiac examination shows normal heart sounds and no murmurs. Electrocardiogram shows sinus rhythm with premature atrial contractions, and a 24-hour ambulatory monitor shows 5673 premature atrial contractions, 127 premature ventricular contractions, and no runs of arrhythmias. Results of laboratory tests, including thyroid function tests and complete blood count, are normal. The patient remains highly symptomatic, despite reassurance.
Which of the following is the most appropriate next step in the management of this patient?
A. Perform an electrophysiologic study
B. Start β-blocker therapy
C. Start disopyramide therapy
D. Perform an exercise treadmill test
E. Start diuretic therapy

Cardiovascular Medicine: Question 14
A 68-year-old man has stable mild exertional angina. He underwent coronary artery bypass graft surgery 2 years ago. His heart rate is 60/min, blood pressure is 120/60 mm Hg, and left ventricular function and hemoglobin are normal. He takes maximally tolerated doses of nitrates and β-blockers.
Which of the following medications would decrease the likelihood of a cardiovascular event in this patient?
A. Angiotensin-converting enzyme inhibitors
B. Angiotensin receptor blockers
C. Digoxin
D. Dihydropyridine calcium blockers
E. Calcium channel blockers

Cardiovascular Medicine: Question 15
A 21-year-old woman is referred for evaluation of a murmur that was detected during an athletic screening examination. She has no significant medical history. As part of the training for her college cross-country program, she runs 3 to 8 miles daily and participates in moderate-intensity resistance training. She has no exertional chest pain or episodes of lightheadedness or syncope. She has shortness of breath only during wind sprints, when she runs short intervals faster than competition pace. She has no family history of premature cardiac disease or sudden cardiac death.
On physical examination, her heart rate is 52/min and blood pressure 98/60 mm Hg. Cardiac auscultation shows a 2/6 crescendo-decrescendo murmur that is loudest in the left upper sternal border.
Which of the following findings would suggest that an echocardiogram is warranted?
A. A murmur that decreases in intensity during Valsalva maneuver
B. Shortness of breath during unusual exertion
C. A soft S3
D. A murmur that peaks in intensity in the latter half of systole
E. A split S1
Cardiovascular Medicine: Question 16
A 72-year-old man is hospitalized because of precordial discomfort radiating to his left arm and neck for 3 hours. He has a history of longstanding diabetes, hypertension, and chronic renal insufficiency (serum creatinine 2.8 mg/dL). His medications include aspirin, 325 mg daily; atenolol, 100 mg daily; and insulin. On physical examination, his pulse rate is 60/min, and blood pressure is 170/90 mm Hg. There is no jugular venous distention, and his chest is clear. An S1 is present without any murmurs. An electrocardiogram shows diffuse 1-mm ST-segment depression, and a troponin I level is elevated (3 ng/mL).
Which of the following medications may require dose adjustment because of this patient’s renal insufficiency?
A. Unfractionated heparin
B. Enoxaparin
C. Abciximab
D. Clopidogrel
E. Intravenous nitroglycerin

Cardiovascular Medicine: Question 17
A 35-year-old woman was diagnosed with idiopathic dilated congestive cardiomyopathy as an outpatient 3 months ago. She had mild congestion at that time, but improved rapidly over a 2-week period after treatment with furosemide, 40 mg/d; digoxin, 125 μg/d; and enalapril, 5 mg twice a day. Carvedilol, 3.125 mg twice a day, was added, and the dosage was slowly increased to 25 mg twice a day over a few weeks. Furosemide was discontinued at week 8, and the dosage of enalapril was decreased to 5 mg/d because of symptomatic orthostatic hypotension. At follow-up 1 month later, the patient is feeling well, with no congestion. Blood pressure is 90/60 mm Hg and heart rate is 60/min and regular. However, she has a barking cough that awakens her from sleep and disturbs her husband at night. The patient says that the cough has been present for 2 months. Enalapril therapy is discontinued, and at follow-up 2 weeks later, the cough has disappeared. Which of the following is the most appropriate next step in the management of this patient?
A. Resume treatment with enalapril.
B. Initiate treatment with valsartan, 40 mg twice a day.
C. Initiate treatment with spironolactone, 25 mg/d.
D. Initiate treatment with ramipril, 5 mg/d.
E. Continue the current treatment with digoxin and carvedilol.

Cardiovascular Medicine: Question 18
A 24-year-old woman who recently emigrated from the Philippines is referred by a nurse practitioner at a family planning clinic for evaluation of a murmur. The patient was never told that she has a murmur. She has mild exercise intolerance, with shortness of breath after climbing three flights of stairs. She has never participated in athletics by choice. Her only medication is oral contraceptives. Physical examination shows a heart rate of 82/min, and oxygen saturation is 97%. Jugular venous pressure is normal. Carotid pulses are brisk, with rapid upstroke. Lungs are clear to auscultation. Cardiac examination shows a sustained apical impulse in the sixth left intercostal space, 2 cm lateral to the midclavicular line. S1 is normal. S2 is physiologically split, with a normal P2. A soft S3 is audible. A continuous murmur with a crescendo-decrescendo quality is heard throughout the precordium and is loudest over the third left intercostal space. Findings on abdominal examination are unremarkable. The extremities show no clubbing, cyanosis, or edema. An echocardiogram is performed.
Which of the following is the preliminary diagnosis?
A. Mitral regurgitation
B. Mitral stenosis and insufficiency
C. Pulmonary stenosis and insufficiency
D. Patent ductus arteriosus

**Cardiovascular Medicine: Question 19**
An inactive overweight 43-year-old man with a strong family history of type 2 diabetes mellitus seeks advice to help prevent diabetes. His blood pressure is 138/86. His fasting plasma glucose is 104 mg/dL. Which of the following interventions is associated with a decreased incidence of new-onset diabetes mellitus?
A. Atenolol therapy
B. Amlodipine therapy
C. Ramipril therapy
D. Hydrochlorothiazide therapy
E. Exercise and low-calorie, low-fat diet

**Cardiovascular Medicine: Question 20**
A 28-year-old woman is referred for evaluation of persistent dyspnea related to mitral stenosis. The patient is 30 weeks’ pregnant, and her dyspnea persists despite treatment with metoprolol, furosemide, and digoxin. Her heart rate is 70/min. An echocardiogram shows severe mitral valve stenosis, with a mean gradient of 14 mm Hg and a mitral valve area of 1 cm2. Trivial mitral valve regurgitation is noted. The estimated right ventricular systolic pressure is 50 mm Hg. She has crackles in both lung bases and bilateral lower extremity edema. Which of the following interventions do you recommend?
A. Surgical mitral valvotomy
B. Urgent delivery of the fetus followed by reassessment of maternal cardiac status
C. Transesophageal echocardiography followed by percutaneous mitral balloon valvuloplasty
D. Diagnostic cardiac catheterization
E. Fetal echocardiogram

**Cardiovascular Medicine: Question 21**
A 68-year-old man presents for evaluation of progressive fatigue, dyspnea, and edema that have occurred over the past 12 months; he has also noticed significant weight gain. He has New York Heart Association class III dyspnea on exertion. He underwent two-vessel coronary artery bypass grafting 10 years ago and has not had recurrence of his angina symptoms. He also has longstanding rheumatoid arthritis, a history of “rheumatoid lung,” and mild renal insufficiency. He has never smoked and does not drink alcohol. His current medications include furosemide, 60 mg twice a day; metoprolol, 25 mg twice a day; potassium, 20 meq/d; and hydroxychloroquine, 200 mg/d. Physical examination shows blood pressure of 97/70 mm Hg, heart rate of 90/min, and jugular venous pressure of 20 cm H2O with rapid descents, poor air movement, and dull sounds in the bases. Cardiac examination shows regular heart rhythm. S1 is normal, and S2 shows a grade INI systolic ejection murmur at the left sternal border that peaks early in systole. No diastolic sounds are noted. The abdomen is distended, with shifting dullness and a fluid wave. The lower extremities show normal pulses and 2 to 3+ pitting edema below the knees. Chest radiograph shows bilateral pleural effusions and normal heart size. Electrocardiogram shows normal sinus rhythm, with occasional premature atrial contractions and nonspecific ST-T-wave changes. Hemoglobin is 11.5 g/dL, leukocyte count is 6400/µL, and
platelet count is 255,000/μL. Serum sodium is 135 meq/L, potassium is 3.8 meq/L, and creatinine is 1.8 mg/dL. Total bilirubin is 0.5 mg/dL, alanine aminotransferase is 85 U/L, and aspartate aminotransferase is 92 U/L. Dipyridamole sestamibi scan shows a first-pass ejection fraction of 55%, with no evidence of infarction or ischemia. Electrocardiogram obtained during a pharmacologic stress test shows no ischemia.

Which of the following would confirm the diagnosis in this patient?
A. Echocardiography
B. Abdominal ultrasound
C. Hepatitis serology
D. Chest radiograph showing pericardial calcification
E. Repeated physical examination specifically looking for pulsus paradoxus

**Cardiovascular Medicine: Question 22**
The following electrocardiogram shown below was obtained in a 17-year-old male high school athlete who has syncope.

Which of the following is the most appropriate next step in evaluating this condition?
A. Two-dimensional echocardiography to exclude structural heart disease
B. Electrophysiologic testing
C. Tilt-table testing
D. Electrocardiogram stress test
E. Cardiac magnetic resonance imaging

**Cardiovascular Medicine: Question 23**
A 76-year-old man comes to your office for a yearly examination. For the past 6 months, he has noticed decreasing exercise tolerance. He has dyspnea with chest tightness when he walks briskly or uphill. He has no shortness of breath at rest, and he denies lightheadedness or syncope. He has a history of hyperlipidemia and coronary artery disease. He underwent single-vessel percutaneous transluminal coronary angioplasty 3 years ago. Medications include aspirin, 81 mg/d, and atorvastatin, 20 mg/d.
Physical examination shows heart rate of 82/min and blood pressure of 142/84 mm Hg. A harsh 3/6 crescendo-decrescendo systolic murmur is noted at the right upper sternal border and radiates to the carotids. Peripheral pulses are diminished, and upstrokes are delayed. Echocardiography shows left atrial enlargement and left ventricular hypertrophy. Left ventricular diameter and systolic function are normal. The aortic valve is calcified and immobile, suggesting aortic stenosis. Mean and peak aortic gradients are 44 mm Hg and 86 mm Hg, respectively. Heart catheterization confirms normal left ventricular systolic function. The mid-right coronary artery shows 70% stenosis. No other hemodynamically significant coronary artery lesions are seen. The aortic valve area calculated with the Gorlin equation is 0.7 cm².

Which of the following is the best course of action for this patient?
A. Referral for aortic valve replacement and coronary artery bypass surgery
B. Referral for aortic balloon valvotomy and percutaneous transluminal coronary angioplasty of the mid-right coronary artery stenosis
C. Referral for dipyridamole myocardial perfusion scintigraphy
D. Referral for exercise testing
E. No intervention is indicated

**Cardiovascular Medicine: Question 24**
A 70-year-old man with type 2 diabetes mellitus, hypertension, and hypercholesterolemia comes to the emergency department because of fulminant acute pulmonary edema and chest pressure. He was doing well previously and had no previous hospitalizations. Blood pressure is 180/100 mm Hg. Electrocardiogram shows normal sinus rhythm and left ventricular hypertrophy with strain. An echocardiogram performed in the emergency room was technically limited, but the ejection fraction was moderately reduced and there was mild mitral regurgitation. After his condition is stabilized, the patient is admitted to a telemetry unit. Myocardial infarction is excluded by measurement of serial cardiac enzyme levels. His pulmonary edema responds rapidly to intravenous administration of diuretics and nitroglycerin.

During this patient’s hospital stay, which of the following diagnostic tests should be performed?
A. Right ventricular endomyocardial biopsy
B. Exercise electrocardiographic test
C. Measurement of B-type natriuretic peptide level
D. Coronary angiography with left ventriculography
E. 24-hour Holter monitoring and signal-averaged electrocardiography

**Cardiovascular Medicine: Question 25**
A 56-year-old man is referred for a disability examination. He underwent coronary artery bypass surgery 1 year ago and has no angina on full physical activity. His left ventricular function is normal, and his serum cholesterol level and blood pressure are controlled with medication. He currently takes a statin, an angiotensin-converting enzyme inhibitor, and a β-blocker. He also has well-controlled diabetes. Findings on physical examination are unremarkable. He works as a sales representative for a communications company. However, he cannot perform the usual tasks associated with his job. He leaves important details out of proposals and often cannot perform the rapid mental arithmetic needed at sales negotiation meetings. As a result, he has lost some of his company’s accounts and is applying for disability.
Which of the following is the best next step in the evaluation of this patient?
A. Coronary artery Doppler flow velocity
B. Formal neurocognitive testing
C. Echocardiography
D. Magnetic resonance imaging scan of the brain
E. Carotid artery Doppler studies

**Cardiovascular Medicine: Question 26**
A 65-year-old obese woman who takes a β-adrenergic blocker for hypertension comes to your office for advice on beginning an exercise program to help her lose weight. Which of the following is the best advice for this patient?
A. A program of walking for 30 minutes 2 days per week
B. A program of stationary cycling for 20 minutes 2 days per week
C. A program of exercising at an intensity of 70% to 80% of the maximum heart rate (220 - age) 3 to 5 days per week
D. Referral for an exercise test before she begins any exercise program
E. A program of resistance training 2 to 3 days per week

**Cardiovascular Medicine: Question 27**
A 53-year-old man has had symptoms of intermittent claudication that involve the left calf only for 7 years. The pain resolves within 10 minutes of resting and returns on resumption of exercise. His risk factors include smoking (80 pack-years), hypertension, and dyslipidemia (low-density lipoprotein (LDL) cholesterol level of 165 mg/dL, high-density lipoprotein (HDL) cholesterol level of 26 mg/dL, triglyceride level of 270 mg/dL). He has no history of diabetes. Physical examination shows blood pressure of 160/90 mm Hg in both arms, a right carotid artery bruit, and clear lung fields. Cardiac examination shows an S4 gallop. Vascular examination shows a left femoral bruit, a diminished left femoral pulse, and absent pedal pulses. In the right leg, no bruits are noted, and femoral and pedal pulses are normal. What are the target blood pressure and LDL cholesterol level in this patient?
A. Blood pressure <140/90 mm Hg; LDL cholesterol level <160 mg/dL
B. Blood pressure <140/90 mm Hg; LDL cholesterol level <130 mg/dL
C. Blood pressure <140/90 mm Hg; LDL cholesterol level <100 mg/dL
D. Blood pressure <120/80 mm Hg; LDL cholesterol level <75 mg/dL

**Cardiovascular Medicine: Question 28**
A 72-year-old man comes to the emergency room with severe lower back pain of several days duration that did not respond to treatment with a nonsteroidal anti-inflammatory drug. He underwent an uncomplicated inferior myocardial infarction 2 years ago. His medications include metoprolol, 50 mg twice a day; simvastatin, 40 mg/d; aspirin, 325 mg/d; and ramipril, 10 mg/d. He stopped smoking after his myocardial infarction and has glucose intolerance that is treated with diet alone. On physical examination, blood pressure is 160/70 mm Hg and heart rate is 66/min, with occasional extra systoles. Jugular venous pressure is normal. The lungs are clear. An apical impulse is noted 1 cm lateral to the midclavicular line. An S4 is present. No auditory murmurs are noted. Pulses are intact and equal in the upper and lower extremities. The total cholesterol level is 202 mg/dL, with a low-density lipoprotein cholesterol level of 94 mg/dL. Laboratory findings show a blood urea nitrogen level of 42 mg/dL, creatinine level of 2.1 mg/dL, and serum glucose level of 230 mg/dL. His hemoglobin level is 14.4 g/dL, with a hematocrit of 41%. The troponin I level is <0.3 jg/L. Electrocardiogram shows sinus rhythm, with occasional premature ventricular
contractions and inferior Q-wave progression consistent with a previous inferior myocardial infarction. This finding is unchanged from the one obtained 1 year earlier. Chest radiograph shows a midline retrocardiac density. The lung fields are unremarkable, and the cardiac silhouette is normal. The patient is given morphine for pain relief and referred for further testing.

Which of the following is the most appropriate initial diagnostic study?
A. Helical chest computed tomography scan with contrast
B. Magnetic resonance angiography
C. Cardiac catheterization
D. Dipyridamole myocardial perfusion scan

Cardiovascular Medicine: Question 29
A 70-year-old woman is referred for primary care after recovering from a hip fracture. She is a lifelong smoker and has not seen a physician in 20 years. She is overweight (body mass index 29), and her blood pressure is 162/92 mm Hg. Laboratory evaluation shows a fasting plasma glucose level of 116 mg/dL, serum total cholesterol of 220 mg/dL, LDL cholesterol of 130 mg/dL, HDL cholesterol of 39 mg/dL, and triglyceride level of 251 mg/dL. She agrees to go on a lifestyle diet. Therapy with ramipril is initiated.

Which of the following agents would help prevent myocardial infarction in this patient?
A. Folic acid
B. B vitamins
C. Vitamins E and C
D. Simvastatin
E. Low-dose aspirin

Cardiovascular Medicine: Question 30
A 28-year-old woman who is 29 weeks pregnant is referred to you for evaluation of progressive dyspnea. She has mitral valve stenosis and a history of rheumatic fever. Over the last 4 weeks, she has had progressive dyspnea with minimal activity, but no palpitations. Cardiovascular examination shows elevated jugular venous pressure and a heart rate of 100/min. The apical impulse is prominent (tapping), and a parasternal impulse is present. An opening snap and a grade 2 diastolic rumble with presystolic accentuation are noted. The S2 opening snap interval is approximately 60 msec. No systolic murmur is noted. S2 is somewhat accentuated. An electrocardiogram shows sinus tachycardia, left atrial enlargement, and right axis deviation.

Which of the following agents would you recommend for use in this patient?
A. Digoxin
B. Metoprolol
C. Warfarin
D. Ramipril
E. Amlodipine

Cardiovascular Medicine: Question 31
A 78-year-old man comes to the emergency department because of chest pain and lightheadedness persisting for the last 4 hours. He has a history of hypertension, hyperlipidemia, and diverticulosis. Medications include aspirin, 325 mg daily; atenolol, 50 mg daily; and fluvastatin, 40 mg at night. On admission to the emergency department, his pulse rate is 70/min and regular, and blood pressure is 90/70 mm Hg. Chest and cardiac examinations are normal. Rectal examination shows brown stool positive for occult blood. The electrocardiogram shows normal
sinus rhythm with diffuse nonspecific ST-T wave abnormalities. An initial troponin I determination is normal, but a value obtained 6 hours later is elevated at 8 ng/mL. His hematocrit is 27%.

Which of the following should you do next?
A. Schedule urgent coronary angiography.
B. Begin heparin and tirofiban.
C. Begin intravenous nitroglycerin.
D. Transfuse packed erythrocytes.
E. Begin clopidogrel.

**Cardiovascular Medicine:Question 32**
A 70-year-old woman comes to your office for a routine annual physical examination. She reports mild effort intolerance over the last several months, but has continued her usual active lifestyle. She has a history of hypertension that is well controlled with diuretic therapy. Findings on physical examination and electrocardiography are consistent with atrial fibrillation, with a ventricular rate of 100/min, but were otherwise normal. Echocardiogram shows a left ventricular ejection fraction of 55%, with left atrial enlargement, mild mitral annular calcification, and mild mitral regurgitation. She has no history of stroke or ulcer disease.

Which of the following would be the most appropriate therapy for this patient?
A. Aspirin and a β-blocker
B. Aspirin and amiodarone
C. Aspirin and digoxin
D. Warfarin and a β-blocker
E. Warfarin and amlodipine

**Cardiovascular Medicine:Question 33**
A 38-year-old woman who is undergoing chemotherapy for Hodgkin’s lymphoma presents with new-onset shortness of breath, orthopnea, and lower extremity edema. She has completed three courses of chemotherapy including doxorubicin to a total dose of 250 mg/m^2^. Her prechemotherapy echocardiogram was normal. She had no significant medical history until her diagnosis of Hodgkin’s lymphoma. Her family history is unremarkable. She has no history of alcohol or smoking.

Her blood pressure is 110/60 mm Hg and her heart rate is 88/min. On examination, she has jugular venous pressure of 14 cm. She has bibasilar rales. She has a regular rhythm, a 3/6 holosystolic murmur at the apex, and an S3. She has 2+ pitting lower extremity edema. Laboratory data include a hemoglobin of 11.1 g/dL, serum sodium 142 mg/dL, potassium 4.2 mg/dL, glucose 80 mg/dL, and creatinine 1.1 mg/dL. Her chest radiograph shows cardiomegaly with pulmonary vascular redistribution and a small bilateral pleural effusion. Electrocardiogram shows normal sinus rhythm, poor R wave progression, and nonspecific ST and T wave changes. Repeat echocardiogram now shows a left ventricular ejection fraction of 25% with moderate mitral regurgitation.

Which of the following options would you recommend to her oncologist?
A. Continue current regimen of chemotherapy.
B. Continue current regimen of chemotherapy but add an ACE inhibitor.
C. Continue current regimen of chemotherapy but add an ACE inhibitor and β-blocker.
D. Change to nonanthracycline chemotherapy regimen.
E. Discontinue all chemotherapy.
**Cardiovascular Medicine:** Question 34

A 52-year-old woman presents for evaluation of recurrent episodes of chest pain that have occurred over the last year. The initial episode was believed to be consistent with idiopathic pericarditis, and the patient was initially treated successfully with corticosteroid therapy. However, the chest pain has recurred every 4 to 6 weeks. Each time, the pain is pleuritic and associated with a low-grade fever and an elevated erythrocyte sedimentation rate. The patient is receiving prednisone, 20 mg/d, and is asymptomatic. Blood pressure is 110/60 mm Hg, heart rate is 80/min and regular, and jugular venous pressure is normal. Findings on cardiac examination are unremarkable. Findings of hematology and chemistry profiles are normal. The blood urea nitrogen concentration is 21 mg/dL. Tests for antinuclear antibody and rheumatoid factor are negative.

What is the next best step in the long-term management of this patient’s recurrent pericarditis?

A. Increase the dosage of prednisone to 40 mg/d.
B. Start treatment with colchicine, 1 mg/d in divided doses.
C. Start treatment with ketorolac, 10 mg every 6 hours orally.
D. Refer the patient for pericardiectomy and pericardial stripping.

**Cardiovascular Medicine:** Question 35

A 28-year-old man seeks your advice because he was told that he has Marfan syndrome. His mother recently died at age 52 years after surgery for a “burst aorta.” He is asymptomatic. He has a history of pneumothorax, which occurred after a soccer game when he was 13 years old. He was hospitalized and required a chest tube for 1 week, and has had no recurrence. Physical examination shows a tall, thin man with long arms. Findings on physical examination are normal. Echocardiogram shows mild dilation of the aortic root, measuring 4.1 cm at the sinuses of Valsalva, with mild aortic insufficiency. Otherwise, findings of the examination are normal. You refer the patient to an ophthalmologist and prescribe prophylactic antibiotics.

Which of the following is the best management plan for this patient?

A. Provide reassurance and advise the patient to return for another echocardiogram in 2 years.
B. Initiate treatment with atenolol, 25 mg/d orally, and advise the patient to return for another echocardiogram in 5 years.
C. Initiate treatment with atenolol, 25 mg/d orally, and advise the patient to return for another echocardiogram in 1 year.
D. Initiate treatment with diltiazem CD, 240 mg/d orally, and advise the patient to return for echocardiogram in 1 year.
E. Initiate treatment with atenolol and refer the patient for prophylactic aortic root replacement.

**Cardiovascular Medicine:** Question 36

A 48-year-old woman comes to your office as a new patient. She weighs 82 kg (180 lb) and has an abdominal girth of 91.5 cm (36 inches). Her body mass index is 30. She has a family history of diabetes and premature coronary artery disease. She smokes one pack of cigarettes a day. Her chest radiograph is normal, and blood pressure is 135/86 mm Hg. Which of the following is the most important screening laboratory test to use to evaluate this patient’s vascular risk?

A. Fasting lipid profile (serum total cholesterol, LDL and HDL cholesterol, and triglycerides)
B. Postprandial plasma glucose level
C. Postprandial triglyceride level
D. Stress test, with or without imaging
E. High-sensitivity measurement of C-reactive protein
**Cardiovascular Medicine: Question 37**

A 76-year-old man is evaluated for refractory angina. He underwent coronary artery bypass surgery and two percutaneous procedures. He is not considered a candidate for revascularization. His medications include metoprolol, 100 mg twice a day; isosorbide mononitrate, 120 mg/d; and felodipine, 10 mg/d. In addition, he often takes sublingual nitroglycerin. On physical examination, blood pressure is 110/60 mm Hg and heart rate is 70/min.

Which of the following actions is most likely to improve this patient's angina?

A. Increase the dosage of metoprolol.
B. Add diltiazem to the medication regimen.
C. Reduce the dosage of isosorbide mononitrate and felodipine.
D. Increase the dosage of isosorbide mononitrate.
E. Increase the dosage of felodipine.

**Cardiovascular Medicine: Question 38**

A 35-year-old woman who is 39 weeks' pregnant comes to your office because of progressive dyspnea. She was previously asymptomatic and has no history of cardiovascular disease. This pregnancy is her first. Physical examination shows a jugular venous pressure of 13 cm H2O, a diffuse apical impulse, and an apical systolic murmur. S3 and S4 are noted at the apex. Crackles are noted in both lungs. An electrocardiogram shows sinus tachycardia, but is otherwise normal.

Based on this patient's findings and history, which of the following is the most likely diagnosis?

A. Severe aortic valve stenosis
B. Severe tricuspid valve regurgitation
C. Atrial septal defect
D. Peripartum cardiomyopathy
E. Pulmonary embolism

**Cardiovascular Medicine: Question 39**

A 66-year-old male with idiopathic dilated cardiomyopathy and heart failure presents for a follow-up visit. He was diagnosed with heart failure 2 years ago, and his coronary angiogram showed normal coronary arteries and left ventricular ejection fraction of 25%. His symptoms worsened over the past 3 months and he was hospitalized with an acute decompensation 6 weeks ago. He was discharged on therapy with lisinopril, 20 mg daily, furosemide, 80 mg twice daily, carvedilol, 3.125 mg twice daily, and potassium supplementation. In the 6 weeks since discharge his carvedilol dose was titrated to 25 mg twice daily. He currently can walk one block before dyspnea and notes no orthopnea and trace lower extremity edema. He is on a 2-gram sodium diet and he is monitoring his weight daily. His blood pressure is 125/65 mm Hg and his heart rate is 78/min. On examination, he has mild jugular venous distension. He has clear lung fields. He has a regular rhythm, a 2/4 holosystolic murmur at the apex, and no S3. Laboratory data include a normal complete blood count, serum sodium 140 mg/dL, potassium 4.0 mg/dL, glucose 95 mg/dL, and creatinine 1.3 mg/dL.

Which of the following medications could you add to his regimen to reduce his risk of death?

A. Amlodipine
B. Magnesium sulfate
C. Digoxin
D. Isosorbide mononitrate
E. Spironolactone
Cardiovascular Medicine: Question 40

A 65-year-old woman presents to the emergency room with a presyncopal episode that occurred while she was preparing dinner. She felt lightheaded but had enough warning to brace herself to keep from falling. She never lost consciousness and the episode resolved within several minutes. Her physical examination was normal. While monitored, she had a recurrent episode. Which of the following electrocardiograms would likely warrant admission for pacemaker insertion?

A. Figure A

B. Figure B

C. Figure C

D. Figure D

E. Figure E
Cardiovascular Medicine: Question 41
A 72-year-old woman comes to the emergency department with several episodes of substernal chest pressure over the past 24 hours. She has a history of hypertension, diabetes, and current smoking. Her medications include aspirin, 325 mg daily; hydrochlorothiazide, 25 mg daily; and glyburide 5 mg twice daily. Over the past day, she has had four episodes of chest pain occurring at rest and lasting 20 to 40 minutes. On admission to the emergency department, her pulse rate is 80/min and regular, and blood pressure is 146/74 mm Hg. Chest and cardiac examinations are normal. The electrocardiogram shows 2-mm ST-segment depression in leads II, III, and aVF. Serum troponin I is elevated at 3.4 ng/mL. Therapy with aspirin, sublingual nitroglycerin, and a β-blocker is begun, and the patient is admitted to the coronary care unit.
Which of the following should you do next?
A. Schedule an exercise stress test within 48 hours.
B. Begin intravenous heparin.
C. Begin intravenous heparin and eptifibatide.
D. Begin intravenous heparin and eptifibatide, and schedule coronary angiography within 48 hours.
E. Begin intravenous heparin and eptifibatide, and schedule an exercise stress test within 48 hours.

Cardiovascular Medicine: Question 42
A 38-year-old man asks for a recommendation about an exercise program. He now lifts weights at the local gym and would like to continue weight training. He has no known coronary artery disease. His body mass index is 35, blood pressure is 150/90 mm Hg, and fasting blood glucose concentration is 116 mg/dL. Which of the following is the best recommendation for this patient?
A. Discontinue weight training
B. Perform weight training for 30 minutes 5 days per week
C. Discontinue weight training and begin endurance training 3 to 5 days per week
D. Start a combined program of endurance training 3 to 5 days per week and weight training 2 to 3 days per week
E. Discontinue exercise until an exercise test is performed

Cardiovascular Medicine: Question 43
A 26-year-old man seeks your advice because he was diagnosed as having a heart murmur as a baby. At that time, his parents were told that he would likely outgrow the murmur, but no specific recommendations were made. The patient participated in sports during high school and did not have shortness of breath, chest pain, or syncope. He has no known allergies. Physical examination shows blood pressure of 120/80 mm Hg and heart rate of 64/min. Lungs are clear to auscultation, and no jugular venous distension is noted. The apical impulse is nondisplaced. S1 is normal, and S2 is physiologically split. A thrill is noted in the third left intercostal space, and a 4/6 holosystolic murmur is noted along the left sternal border, radiating to the right. No S3 or S4 is audible. Echocardiogram shows a small perimembranous ventricular septal defect. The dimensions of the cardiac chambers and the estimated pulmonary artery pressure are normal.
Which of the following is the most appropriate feature of the management of this patient?
A. Referral to a cardiothoracic surgeon for surgical closure of the ventricular septal defect
B. Recommendation for treatment with amoxicillin, 2 g orally 1 hour before dental procedures
C. Referral to an interventional cardiologist for percutaneous closure of the defect
D. Initiation of treatment with lisinopril, 10 mg/d orally

**Cardiovascular Medicine: Question 44**
A 63-year-old man has intermittent claudication in the right calf only. The pain resolves within 10 minutes of resting and returns on resumption of exercise. The patient has no pain in the distal foot at night. Physical examination shows a right femoral bruit, a diminished femoral pulse, and absent pedal pulses. In the left leg, no bruits are noted, and femoral and pedal pulses are normal. The patient's ankle-brachial index is 0.51 on the right and 1.00 on the left (normal >0.90). The patient's main concern is to relieve his claudication symptoms and improve his ability to walk.
Which of the following would provide the greatest increase in walking ability in this patient?
A. Pentoxifylline therapy
B. Cilostazol therapy
C. A supervised exercise training program
D. Aspirin therapy

**Cardiovascular Medicine: Question 45**
A 53-year-old woman with hypertension and a 12-year history of type 2 diabetes mellitus is evaluated. She is overweight but has lost 4.4 kg (10 lb) on a heart-healthy, low-sodium diet. Her blood pressure is 158/90 mm Hg. Her hemoglobin A1c is 8.6%, serum creatinine is 1.4 mg/dL, and blood urea nitrogen level is 28 mg/dL.
Which of the following agents should be included in this patient's initial drug therapy?
A. Amlodipine
B. Extended-release metoprolol
C. Low-dose hydrochlorothiazide
D. Ramipril
E. Transdermal clonidine

**Cardiovascular Medicine: Question 46**
A 60-year-old woman who has diabetes mellitus comes to your office for a routine 6-month office visit. Her disease is controlled with diet and insulin. She had a remote myocardial infarction and was hospitalized 2 years ago because of congestive heart failure. Coronary angiography performed on that admission showed inoperable three-vessel coronary artery disease. Other than fatigue, she is asymptomatic. An echocardiogram obtained 1 year ago showed a left ventricular ejection fraction of 30%, a left ventricular internal dimension in diastole of 6 cm, and anterior left ventricular wall hypokinesis compatible with the old anterior Q waves on her electrocardiogram and a previous myocardial infarction.
In addition to insulin, her medications include lisinopril, 40 mg/d; furosemide, 20 mg/d; atorvastatin, 20 mg/d; and aspirin, 160 mg/d. Physical examination shows a lean patient with no evidence of fluid retention. Blood pressure is 110/75 mm Hg and heart rate is 90/min and regular. She has a soft S1 and S2 with no gallops or murmurs.
The patient is classified as New York Heart Association symptomatic class I/II, does
not have congestive heart failure, and tolerates her medications well. Her hemoglobin A1C is 6.9%, and her lipid profile reveals an LDL cholesterol level of 98 mg/dL and an HDL cholesterol level of 43 mg/dL.

Which of the following is the most appropriate recommendation for this patient?

A. Increase the atorvastatin dosage to 40 mg/d.
B. Perform an echocardiogram to determine whether the ejection fraction has improved.
C. Perform an exercise test to determine whether the patient has asymptomatic myocardial ischemia.
D. Start treatment with spironolactone, 12.5 mg twice daily.
E. Start treatment with long-acting metoprolol, 50 mg/d.

Cardiovascular Medicine: Question 47
A 26-year-old woman who is 30 weeks pregnant is referred to you because of a murmur that was noted during her current pregnancy as well as intermittently in the past. The patient is asymptomatic. Physical examination shows slight elevation of the jugular venous pressure, with an A wave. A parasternal lift is also noted. S1 is normal, and S2 is somewhat prominent, fixed, and split. A grade 2 mid-peaking ejection systolic murmur is noted at the left sternal border.

Which of the following is the most likely diagnosis?

A. Physiologic murmur related to pregnancy
B. Atrial septal defect with associated volume overload
C. Pulmonary valve stenosis
D. Aortic valve regurgitation
E. Mitral valve stenosis

Cardiovascular Medicine: Question 48
A 67-year-old man has persistent exertional angina despite treatment with a β-blocker and a calcium channel blocker. He also has well-controlled diabetes. Echocardiography shows an old anterior myocardial infarction and a left ventricular ejection fraction of 35%. Physical examination shows a blood pressure of 130/80 mm Hg, heart rate of 62/min, and no signs of heart failure. Cardiac catheterization shows 95% narrowing of the proximal left anterior descending coronary artery, 70% lesion of the proximal circumflex artery, 90% narrowing of the obtuse marginal artery, and 85% lesion of the proximal posterior descending artery.

Which of the following is the most appropriate next step in the management of this patient?

A. Add long-acting nitrates to the drug regimen.
B. Add a statin to the drug regimen.
C. Add an ACE inhibitor to the drug regimen.
D. Perform percutaneous transluminal coronary angioplasty.
E. Perform coronary artery bypass surgery.

Cardiovascular Medicine: Question 49
A 42-year-old woman comes to your office for evaluation of progressive angina and dyspnea on exertion that she has noticed for the past 6 months. She has no history of cardiovascular disease, other than a longstanding murmur. She has never smoked, has no family history of coronary artery disease, does not have diabetes or hypertension, and has normal serum lipid levels. On physical examination, blood pressure is 112/70 mm Hg; heart rate is 86/min, with a regular rhythm; jugular venous pressure is normal; carotid upstrokes are brisk, without bruits; and lung fields are clear. Cardiac examination shows normal S1 and S2. An S4 is also noted. She has a grade II/VI late-peaking systolic ejection murmur that increases with the
strain phase of the Valsalva maneuver as well as when she rises from squatting to standing. The apical impulse is bifid. The abdomen and extremities appear normal. Chest radiograph shows a mild increase in pulmonary vascularity. The heart is of normal size. Electrocardiogram shows left ventricular hypertrophy, with deep T-wave inversions in the precordial leads. Echocardiogram shows asymmetric septal hypertrophy, with a maximum septal thickness of 22 mm. Significant systolic anterior motion of the mitral valve is noted and causes moderate mitral regurgitation. The patient has a left ventricular outflow tract obstruction of 64 mm Hg.

Which of the following is the best initial management of this patient’s condition?
A. Isosorbide mononitrate, 30 mg/d
B. Lisinopril, 5 mg/d
C. Metoprolol, 25 mg twice a day
D. Furosemide, 40 mg twice a day
E. Sustained-release nifedipine, 60 mg/d

Cardiovascular Medicine: Question 50
A 35-year-old man is evaluated for palpitations that occur several times daily and feel like skipped heartbeats. He has no associated shortness of breath, dizziness, chest pain, or lightheadedness. He has no history of significant medical problems and no family history of heart disease. He does not smoke and drinks one glass of wine with dinner. He recently moved to the area and started a new job. On his own, he stopped drinking coffee, but his symptoms did not improve.

Findings on physical examination and electrocardiogram are normal. Blood pressure is 130/80 mm Hg, and heart rate is 75/min. Laboratory studies show hematocrit of 49% and normal electrolyte values.

What is the best next step in the evaluation of this patient?
A. 24-hour ambulatory electrocardiographic monitoring
B. Electrocardiography stress test
C. Two-dimensional echocardiography
D. Signal-averaged electrocardiography
E. Measurement of serum thyroid-stimulating hormone

Cardiovascular Medicine: Question 51
A 54-year-old woman is evaluated for exertional dyspnea. She reports dyspnea on climbing a half-flight of stairs and notes that she has had two- to three-pillow orthopnea for the last several months. The patient had rheumatic fever as a child, but she has no history of palpitations.

On physical examination, heart rate is 86/min and blood pressure is 124/76 mm Hg. Jugular venous pressure is 14 cm H2O. Bibasilar rales are noted. Cardiac examination shows a normal left ventricular point of maximum impulse. Rhythm is regular, with a diminished S1 and a widely split. There is a 3/6 holosystolic murmur at the apex radiating to the axilla, a grade 2/6 holosystolic murmur at the left lower sternal border that increases with inspiration, and a 2/6 decrescendo diastolic rumble at the apex without radiation. Hepatojugular reflux is noted.

Electrocardiogram shows sinus rhythm at 84/min, with bialtrial enlargement and evidence of right ventricular hypertrophy. Echocardiography with Doppler shows bialtrial enlargement, normal left ventricular size and systolic function, and right ventricular enlargement with normal systolic function. The mitral valve leaflet tips are thickened and restricted, consistent with rheumatic mitral stenosis. Minimal leaflet calcification and mild to moderate subvalvular thickening are noted. The mean transmitral gradient is 11 mm Hg, and the estimated mitral valve area is 0.9 cm2. Severe mitral regurgitation and moderate tricuspid regurgitation are noted. The
estimated right ventricular systolic pressure is 62 mm Hg.
Which of the following is the best course of action for this patient?
A. Initiate therapy with digoxin.
B. Initiate therapy with aspirin, 650 mg/d.
C. Initiate therapy with long-term anticoagulation, with a target international normalized ratio of 2.0 to 3.0.
D. Refer the patient for percutaneous balloon mitral valvotomy.
E. Refer the patient for mitral valve repair or replacement.

**Cardiovascular Medicine:Question 52**
A 68-year-old man comes to the emergency room because of pain and numbness of his right great toe. He had an inferior myocardial infarction 5 years earlier. Since that time, he has been clinically stable, without angina or claudication. His cardiac risk factors include hypertension and hypercholesterolemia. He stopped smoking after his myocardial infarction and does not have diabetes. He does not have fever or chills. Medications include atenolol, 100 mg/d; hydrochlorothiazide, 25 mg/d; atorvastatin, 40 mg/d; and aspirin.

Physical examination shows blood pressure of 125/70 mm Hg and heart rate of 66/min. His jugular venous pressure is normal. Lungs are clear to auscultation. An apical impulse is noted 1 cm lateral to the midclavicular line. An S4 is present. His abdomen is protuberant, but no masses are palpable. Pulses are intact throughout, and no femoral or carotid bruits are found. His right great toe is cyanotic and cool. The rest of his foot appears normal.

The total plasma cholesterol level is 178 mg/dL, with LDL cholesterol level of 89 mg/dL. Results of laboratory studies are normal. Electrocardiogram shows sinus rhythm with inferior Q waves, consistent with his previous myocardial infarction. This finding is unchanged from an electrocardiogram obtained 1 year earlier. A transthoracic echocardiogram shows mild left ventricular hypertrophy and mild left atrial enlargement. Overall left ventricular systolic function is normal. Akinesis of the basal inferior wall is noted. No significant valvular disease is found, and no intracardiac thrombus is seen.

Which of the following is the most appropriate next course of action?
A. Initiate treatment with heparin to maintain partial thromboplastin time at twice the control value, and order a transesophageal echocardiogram.
B. Measure the level of hemoglobin Alc, and initiate treatment with ramipril, 5 mg/d.
C. Hospitalize the patient and perform an urgent arteriogram.
D. Measure serum antiphospholipid antibodies, lupus anticoagulant, homocysteine, and protein C, and then initiate treatment with warfarin.

**Cardiovascular Medicine:Question 53**
A 61-year-old man with a history of myocardial infarction, paroxysmal atrial fibrillation, ischemic cardiomyopathy, and heart failure presents for further management. He had a myocardial infarction 8 years ago and another 4 years ago. He underwent percutaneous revascularization 4 years ago. He has not had chest pain and he had undergone an exercise scintigraphic study 2 months ago without stress-induced ischemia. His left ventricular ejection fraction was estimated to be 35%. He has had NYHA Class II symptoms with mild dyspnea on moderate exertion. He had multiple episodes of atrial fibrillation starting 4 years ago. His last recurrence of atrial fibrillation was 4 months ago. At that time he was started on anticoagulation with warfarin and amiodarone. He has been tolerating his medications well. He has had no palpitations in the past 4 months. He is being treated with lisinopril, 20 mg/d, carvedilol, 25 mg/d, digoxin, 0.125 mg/d, atorvastatin, 10 mg/d, amiodarone 200 mg/d, and warfarin 5 mg/d. His INR has been in the 2.1 to 2.7 range.
His electrocardiogram on this visit shows normal sinus rhythm and evidence of a prior anterior myocardial infarction. A 24-hour Holter monitor performed last week showed no evidence of atrial fibrillation and occasional premature ventricular contractions.

Which of the following treatment options would you recommend?

A. Discontinue warfarin, continue amiodarone.
B. Discontinue amiodarone, start procainamide.
C. Discontinue amiodarone and warfarin.
D. Continue amiodarone and warfarin.
E. Refer patient for atrial fibrillation ablation.

**Cardiovascular Medicine: Question 54**

A 56-year-old postmenopausal woman is brought to the emergency department by ambulance because of the onset of severe substernal burning pain and progressive dyspnea beginning 3 hours ago. She has taken four sublingual nitroglycerin tablets belonging to her husband, and continues to have severe chest pain. On physical examination, her respiration rate is 30/min, her pulse rate is 108/min, her blood pressure is 80/60 mm Hg, and her oxygen saturation is 90% on an oxygen face mask. She appears anxious. Her jugular venous pressure is 15 mm Hg. She has inspiratory crackles three-quarters up both lung fields. She has an S3 gallop with no murmur. Her electrocardiogram shows sinus tachycardia with 3-mm ST-segment elevation in leads V2-6. She is given a chewable aspirin and intravenous heparin, and is started on dopamine.

What is the most appropriate management for this patient?

A. Urgent coronary angiography and possible coronary revascularization.
B. Immediate thrombolysis.
C. Placement of an intra-aortic balloon pump.
D. Intravenous nitroglycerin.
E. Intravenous β-blocker.

**Cardiovascular Medicine: Question 55**

A 60-year-old man comes to your office because of claudication in both thighs and calves. He works as a postman, and his specific concern is to relieve his claudication symptoms and improve his ability to walk. The ankle-brachial index is 0.66 in the right ankle and 0.55 in the left ankle (normal, >0.90). After exercise, both values drop to 0.20. After the patient was enrolled in an exercise program and given a course of cilostazol, he noted an improvement in walking distance, but still could not walk long distances. He was sent to a vascular laboratory for measurement of segmental limb pressures to localize the site of the occlusions. Segmental pressures and duplex ultrasound show bilateral iliac artery occlusive disease.

Which of the following revascularization options would provide the most durable improvement in blood flow at the lowest risk in this patient?

A. Bilateral iliac artery angioplasty
B. Popliteal and tibial artery angioplasty
C. Aortobifemoral bypass surgery
D. Bilateral femoral-popliteal bypass surgery
E. Bilateral femoral-tibial bypass surgery
Cardiovascular Medicine: Question 56
Which one of the following statements about atrial fibrillation is correct?
A. Lone atrial fibrillation is a common cause of atrial fibrillation.
B. Atrial fibrillation is more common in older women than in older men.
C. Anticoagulation is not indicated in patients who have nonrheumatic heart disease and atrial fibrillation.
D. Many patients who have atrial fibrillation do not require antiarrhythmic therapy.
E. Atrial fibrillation is a serious and common problem in patients who have Wolff-Parkinson-White syndrome.

Cardiovascular Medicine: Question 57
A 50-year-old man seeks your advice to “stay healthy.” He has no significant prior medical history other than recurrent urinary tract infections. He is a long-term smoker. After his close friend had a myocardial infarction at age 45 years, the patient went on a low-fat diet, started exercising 3 times a week, and lost 4.4 kg (10 lb). Findings on physical examination are normal. His blood pressure is normal. His body mass index is 26.
You order laboratory tests and strongly advise him to stop smoking.
Which of the following test results would indicate increased risk for coronary artery disease-related morbidity and mortality in this patient?
A. Total fasting serum cholesterol of 199 mg/dL, LDL cholesterol level of 120 mg/dL, HDL cholesterol of 50 mg/dL, and triglyceride level of 90 mg/dL
B. Hemoglobin A1c of 6.9%
C. Serum creatinine of 2.1 mg/dL
D. Serum uric acid of 9.2 mg/dL
E. Platelet count of 490,000/μL

Cardiovascular Medicine: Question 58
You are asked to evaluate a 35-year-old woman who has progressive dyspnea that was noted several days after delivery. An echocardiogram shows diffuse global left ventricular dysfunction, with an ejection fraction of 20%. The patient is treated with ACE inhibitors, β-blockers, and diuretics. Her symptoms resolve completely.
Twelve months after delivery, she returns for counseling because she wishes to have another pregnancy. Her left ventricular function is 50%. She is asymptomatic and is no longer taking any medications.
Which of the following is the most appropriate next step?
A. Advise the patient that she may proceed with another pregnancy at this time.
B. Resume therapy with an ACE inhibitor during pregnancy.
C. Advise the patient not to become pregnant because of the risk of recurrent peripartum cardiomyopathy, which may be fatal.
D. Advise the patient to wait 6 months; if her ventricular function is normal at that time, she may proceed with another pregnancy.
E. Evaluate the patient for another cause of reversible cardiomyopathy because the diagnosis of peripartum cardiomyopathy is now in question.

Cardiovascular Medicine: Question 59
A 45-year-old man who has Eisenmengers syndrome because of an unrepaired ventricular septal defect is referred to your practice for primary care. He reports increased lethargy and occasional frontal headaches. He works as a computer programmer and recently has had difficulty concentrating at work. His previous physician, a general practitioner who just retired, phlebotomized 1 unit every 3 months. The patient has a history of gout and takes allopurinol, 300 mg/d.
Physical examination shows a cyanotic man with blood pressure of 95/65 mm Hg and heart rate of 95/min. Oxygen saturation in the right hand is 84%. Digital clubbing of the upper and lower extremities is noted. Lungs are clear to auscultation, and jugular venous pressure is normal. On cardiac examination, the apical impulse is nondisplaced. S2 is widely, but physiologically, split, with a loud F. A holosystolic murmur is noted at the left parasternal border, and a high-pitched diastolic murmur is noted at the upper left parasternal border. A right-sided 84 is audible. The abdomen is normal.

Laboratory findings show hematocrit of 56%, mean corpuscular volume of 72 fL, leukocyte count of 5600/μL, and platelet count of 11 0,000/μL. Chest radiograph shows dilated main pulmonary arteries, pruning of the peripheral vasculature, and normal lung fields.

The electrocardiogram demonstrates a QRS axis of +110, peaked P waves in 2, 3, and aVF, and a tall R wave in V1. Byechocardiography, the estimated pulmonary artery systolic pressure is 120mm Hg.

Which of the following is the most appropriate management of this patient?
A. Order phlebotomy of 500 mL and isovolumic volume replacement with normal saline.
B. Order home oxygen therapy.
C. Refer the patient for cardiac catheterization in preparation for surgery.
D. Initiate treatment with ferrous sulfate, 325 mg/d, and measure the hematocrit in 1 week.
E. Refer the patient to a hematologist for bone marrow biopsy.

Cardiovascular Medicine: Question 60
A 35-year-old woman presents for evaluation. She is upset because she had electron-beam computed tomography at a local imaging center after her 55-year-old father had a myocardial infarction. She measured her blood pressure at 129/90 mm Hg. She is asymptomatic. Her calcium score is 40, which puts her at the 80th percentile for women her age who have coronary artery disease.

In your office, her blood pressure is 122/85 mm Hg and findings on physical examination are normal. A lipid panel shows a serum total cholesterol level of 190 mg/dL, LDL cholesterol of 110 mg/dL, HDL cholesterol of 70 mg/dL, and triglyceride level of 130 mg/dL. She does not smoke.

What is the best next step in the management of this patient?
A. Provide reassurance.
B. Order an electrocardiogram.
C. Order an exercise electrocardiogram.
D. Order an exercise echocardiogram.
E. Measure serum homocysteine.

Cardiovascular Medicine: Question 61
A 58-year-old man who has longstanding diabetes mellitus and peripheral vascular disease involving the left leg comes to your office for a routine follow-up visit. He has intermittent claudication when he plays golf. He is obese, with a body mass index of 40, and his blood pressure is 160/95 mm Hg.

Physical examination shows normal jugular venous pressure. Cardiac examination is normal. Examination of the extremities shows no edema and absent left pedal pulses. The left leg ankle-brachial index is 0.8. Electrocardiogram obtained 1 year ago showed no significant findings. His last lipid profile showed a total serum cholesterol of 260 mg/dL, HDL cholesterol of 25 mg/dL, LDL cholesterol of 165 mg/dL, and triglyceride level of 250 mg/dL. His hemoglobin A1c level was 8%. Heart failure has not been suspected or diagnosed. The patient smokes and is sedentary.
However, he works and is apparently compliant with his medication regimen. He was taking simvastatin, 40 mg/d, last year, but discontinued this medication because of diffuse muscle and joint aches that have since resolved. He takes rosiglitazone, 4 mg/d; atenolol, 50 mg/d; hydrochlorothiazide, 50 mg/d; and aspirin, 80 mg/d. You suggest smoking cessation, weight loss, and physical conditioning.

Which of the following interventions would prevent the progression of complications of diabetes and atherosclerosis in this patient?
A. Prescribe a nonstatin lipid-lowering agent.
B. Recommend vitamin E, 500 IU/d.
C. Substitute insulin for rosiglitazone.
D. Start treatment with amlodipine.
E. Start treatment with ramipril.

Cardiovascular Medicine: Question 62

A 72-year-old woman is evaluated for recurrent palpitations that occur sporadically and are associated with a general sense of fatigue. Near-syncope occurs with some episodes. She had an episode of profound fatigue 3 weeks ago, but did not seek medical attention. Her history is notable for hypertension and diabetes.

Physical examination shows blood pressure of 105/60 mm Hg. Bibasilar crackles are present. Cardiac examination shows normal S1 and S2 and a soft S3. Her electrocardiogram is shown.

Which of the following tests would provide the most important prognostic information in this patient?
A. 24-hour ambulatory monitoring
B. Exercise electrocardiographic stress test
C. Electrophysiologic study
D. Signal-averaged electrocardiography
E. Echocardiography
**Cardiovascular Medicine: Question 63**

An 18-year-old male high school senior comes to your office for evaluation because of a family history of hypertrophic cardiomyopathy. The family history was discovered with the death of the patient’s paternal uncle at age 42 years. Later, the patient’s brother died suddenly while playing soccer at age 17 years. The patient is asymptomatic and has noticed no abnormalities.

Physical examination shows blood pressure of 100/50 mm Hg, heart rate of 80 beats/min in, and clear lung fields. The rest of the findings on physical examination are unremarkable.

Cardiac examination shows normal S1 and S2, with no gallops. The patient has a bifid carotid upstroke, with no bruits. A grade II/VI systolic ejection murmur that increases with the strain phase of the Valsalva maneuver is noted. The apex is bifid. Echocardiogram shows asymmetric septal hypertrophy, with a maximal thickness of 32 mm. Left ventricular outflow tract obstruction is noted, with a peak velocity of 45 mm Hg. On a treadmill exercise test, the patient achieves 80% of age-predicted exercise time.

The electrocardiogram is nondiagnostic because of left ventricular hypertrophy and preexisting ST-T-wave segment changes. Blood pressure is 110/60 mm Hg at rest, increases to 125/50 mm Hg at 3 minutes of exercise, and decreases to 105/50 mm Hg at peak exercise. A 24-hour Holter monitor shows rare isolated premature ventricular contractions.

Which of the following is the best course of action in managing this patient’s risk of sudden cardiac death?

A. Treatment with metoprolol, 25 mg twice a day orally
B. Placement of an implantable cardioverter defibrillator
C. Referral for surgical septal myectomy
D. Referral for catheter-based septal ablation
E. Referral for electrophysiology testing

**Cardiovascular Medicine: Question 64**

A 68-year-old man is evaluated because of the sudden onset of severe substernal chest pain that has persisted for the past 45 minutes. He has a 20-year history of hypertension, but has no history of angina, myocardial infarction, heart failure, diabetes, or tobacco use.

He describes severe chest pain that began suddenly and radiates to the back and jaw. Physical examination shows a diaphoretic, anxious man. His pulse rate is 94/min and regular, respiration rate is 28/min, and blood pressure is 170/90 mm Hg.

His chest is clear to auscultation. Cardiac examination shows a diffuse point of maximal impulse, normal S1, and an S4.

The electrocardiogram is shown.
A chest radiograph reveals mediastinal widening, mild cardiomegaly, and clear lung fields. Intravenous morphine is prescribed for pain.

Which of the following is the most appropriate initial management?

A. Begin thrombolytic therapy.
B. Request emergency coronary angiography.
C. Begin intravenous nitroglycerin.
D. Begin intravenous heparin.
E. Begin intravenous β-blocker.

**Cardiovascular Medicine: Question 65**

In which of the following patients would implantation of a permanent pacemaker be appropriate?

A. A 47-year-old man who is taking a β-blocker for hypertension and has symptomatic sinus bradycardia (heart rate 45/min)
B. A 20-year-old college student who has syncope after prolonged standing at band practice and has sinus bradycardia (heart rate 45/min) on evaluation
C. A 57-year-old man with exercise intolerance and an average heart rate of 45/min and a peak rate of 60/min on an ambulatory monitor
D. A 75-year-old woman who has transient heart block in the hours after an acute inferior myocardial infarction

A 36-year-old man is transferred to the intensive care unit because of abrupt onset of hypotension and hypoxemia. He was admitted to the hospital earlier in the day with a 1-week history of fever and night sweats that occurred after dental cleaning. After endotracheal intubation and initiation of mechanical ventilation, physical examination shows a temperature of 38.1 °C (100.4 °F), heart rate of 121/min, and blood pressure of 88/30 mm Hg. Diffuse pulmonary crackles are noted. Heart sounds are regular, with a summation gallop. No murmurs are heard. Electrocardiogram shows sinus tachycardia.

The hemoglobin level is 14.2 g/dL, and leukocyte count is 18,100/μL. The serum creatinine level is 2.1 mg/dL. Transthoracic echocardiography provides inadequate
images, but transesophageal echocardiography shows a bicuspid aortic valve with associated oscillating soft tissue densities that suggest vegetations. Partial destruction of both cusps is seen, with severe aortic regurgitation. Left ventricular size and systolic function are normal. You order blood cultures and initiate broad-spectrum antimicrobial therapy.

Which of the following interventions is indicated?
A. Initiate treatment with a β-blocker.
B. Initiate treatment with nitroprusside.
C. Insert an intra-aortic balloon counterpulsation catheter.
D. Refer the patient for heart catheterization with coronary arteriography.
E. Transfer the patient to surgery for emergent aortic valve replacement.

**Cardiovascular Medicine: Question 67**
A 73-year-old man with coronary artery disease that led to a myocardial infarction several years ago is hospitalized because of 9-kg (20-lb) weight gain and symptoms and physical findings of congestive heart failure. Previous studies showed a dilated left ventricle with an ejection fraction of 15%. No ischemia was seen on a scintigraphic study. He had previous successful coronary bypass graft surgery. His condition has been fairly stable, with symptoms of fatigue and weakness while taking digoxin, 0.25 mg/d; lisinopril, 10 mg/d; carvedilol, 12.5 mg twice a day; furosemide, 40 mg/d; spironolactone, 25 mg/d; potassium chloride elixir, 10 meq/d; atorvastatin, 10 mg/d; and aspirin 325 mg/d.

At a surveillance visit 2 months ago, he had minimal jugular venous distension, no hepatojugular reflex, and trace pedal edema. His weight had not changed. Blood pressure was 120/80 mm Hg and heart rate was 59/min and regular. He had always been in sinus rhythm. Laboratory studies showed normochromic, normocytic anemia, with hemoglobin of 12 g/dL and hematocrit of 35%. Serum potassium level was 5.8 mg/dL, blood urea nitrogen level was 40 mg/dL, and creatinine level was 1.7 mg/dL. The patient requested a simplified treatment protocol, and concern arose about renal insufficiency, hyperkalemia, and bradycardia. Digoxin and spironolactone were discontinued, with routine follow-up scheduled in 3 months.

In the hospital, the patient quickly responded to supplemental intravenous diuretics. After repletion, his potassium level was 4.0 mg/dL. Blood urea nitrogen and creatinine levels were unchanged from outpatient levels. Long-term treatment with an angiotensin-converting enzyme inhibitor, β-blockers, potassium supplementation, a statin, and aspirin was continued throughout his hospitalization. The patient is ready for discharge, and you are considering several changes in his drug regimen.

Which of the following strategies is most likely to prevent worsening congestive heart failure and future admissions for heart failure decompensation?
A. Discontinuing the β-blocker
B. Increasing the maintenance dosage of the diuretic
C. Increasing the dosage of atorvastatin
D. Discontinuing aspirin
E. Resuming treatment with digoxin and spironolactone

**Cardiovascular Medicine: Question 68**
A 26-year-old woman who is 30 weeks’ pregnant is referred to you for a murmur that was noted during her current pregnancy. She is asymptomatic. Physical examination shows slight elevation of jugular venous pressure. A parasternal lift is noted. S1 is normal, and S2 is somewhat prominent, fixed, and split. A grade 2 mid-peaking ejection systolic murmur is noted at the left sternal border. Echocardiogram shows a secundum atrial septal defect with enlargement of the right side of the heart. No other cardiac malformations are identified. She continues her pregnancy...
uneventfully and is admitted to the hospital in labor 8 weeks after your initial evaluation. The obstetrician calls you for recommendations.
Which of the following is the most appropriate management of this patient?
A. Full anticoagulation therapy during the postpartum period
B. Hemodynamic monitoring during delivery
C. Antibiotic prophylaxis during delivery
D. Early postpartum ambulation
E. Delivery by cesarean section

Cardiovascular Medicine: Question 69
A 56-year-old man who has a significant family history of premature coronary artery disease comes to your office for coronary risk evaluation. He is physically active, is not overweight, and appears healthy. He does not smoke. His blood pressure is 138/88 mm Hg. The total serum cholesterol level is 262 mg/dL, LDL cholesterol is 181 mg/dL, HDL cholesterol level is 32 mg/dL, and triglyceride level is 238 mg/dL. Liver function is normal. Fasting plasma glucose level is 117 mg/dL.
He is treated with simvastatin, 40 mg/d. A lipid profile obtained 8 weeks later shows a total serum cholesterol level of 211 mg/dL, LDL cholesterol of 128 mg/dL, HDL cholesterol level of 29 mg/dL, and triglyceride level of 210 mg/dL. His liver function remains normal.
Which of the following is the most appropriate next therapeutic step?
A. Add gemfibrozil.
B. Add niacin.
C. Increase the dosage of simvastatin.
D. Continue current therapy.
E. Reduce the dosage of simvastatin and add fenofibrate.

Cardiovascular Medicine: Question 70
A 26-year-old woman comes to your office for advice. When she was a child, her parents were told that she had a heart murmur, but would outgrow it. However, she never did. She was recently married and would like to have children. She has never been athletic, but considers herself mildly limited. She has a mild cough and shortness of breath when she walks up hills, especially at high altitude.
Physical examination shows blood pressure of 110/70 mm Hg, heart rate of 86/min, and oxygen saturation of 99%. Her jugular venous pressure is normal, and her carotids show good upstrokes bilaterally. Lungs are clear to auscultation. Cardiac examination shows a right ventricular lift. The apical impulse is not displaced, S1 is normal, and S2 shows wide and fixed splitting. A grade 3/6 early to mid-peaking systolic murmur is noted at the left upper sternal border. The rest of the findings are normal. Laboratory findings are normal. Electrocardiogram shows sinus rhythm, a QRS axis of +90, a normal P-wave axis, and an incomplete right bundle branch block. Chest radiograph shows pulmonary plethora with prominent main pulmonary arteries. Transthoracic echocardiogram shows right ventricular enlargement, right atrial enlargement, and high pulmonary flow, but no atrial septal defect. Estimated pulmonary artery pressure is 45 mm Hg by the tricuspid regurgitant jet. The heart valves are normal. What is the next step in the patients management?
A. Order a transesophageal echocardiogram
B. Prescribe antibiotic prophylaxis with no further treatment
C. Advise the patient to proceed with her plans to have a family and to consider surgical c’osure of the defect after she has her children
D. Order diagnostic cardiac catheterization
E. Provide reassurance and advise the patient that no further treatment is indicated
Cardiovascular Medicine: Question 71
A 72-year-old woman is referred for perioperative risk assessment before she undergoes a cholecystectomy. Three years ago, she underwent three-vessel coronary artery bypass graft surgery. She has no cardiovascular symptoms and is fully active on aspirin alone. Examination shows normal blood pressure. Her serum cholesterol level is controlled with atorvastatin therapy, and she does not smoke. Electrocardiographic findings are unchanged from results obtained 6 months earlier.

Which of the following is the most appropriate action to minimize this patient's risk during surgery?
A. Prescribe perioperative ACE inhibitor
B. Prescribe perioperative angiotensin receptor blocker
C. Prescribe perioperative calcium channel blocker
D. Prescribe perioperative β-blocker
E. Administer nitroglycerin intravenously during surgery

Cardiovascular Medicine: Question 72
A 76-year-old man comes to your office for consultation after he has three emergency department visits because of sudden-onset dyspnea associated with wheezing. He was reasonably well until 2 months ago. He does not smoke and has no history of asthma. He has diet-controlled type 2 diabetes mellitus and hypertension treated with long-acting diltiazem. In the emergency room, he received bronchodilators and furosemide with some improvement. Since then, he has been fatigued with progressive exertional dyspnea. On physical examination, his blood pressure is 105/85 mm Hg and heart rate is 95/min. He has jugular venous distension; a positive hepatojugular reflex; a nondisplaced apical impulse, soft heart sounds, with a loud S3, soft holosystolic murmur at the lower left sternal border; a pulsatile, slightly tender, and enlarged liver and 1+ pedal edema. His electrocardiogram shows sinus tachycardia, diffusely diminished voltage in the limb and precordial leads and a nonspecific interventricular conduction defect with the QRS of 135 msec. Chest radiograph shows pulmonary edema and borderline cardiomegaly with a left ventricular configuration. Laboratory evaluation shows a nonfasting plasma glucose level of 200 mg/dL, hemoglobin of 9.8 g/dL, hematocrit of 30%, leukocyte count of 4100/μL, platelet count of 105,000/μL, blood urea nitrogen level of 35 mg/dL, creatinine level of 1.9 mg/dL, and total protein level of 8.5 mg/dL. Echocardiogram shows a left ventricular ejection fraction of 60%, and normal left ventricular size with severely increased left ventricular wall thickness. There is moderate tricuspid regurgitation with an estimated right ventricular systolic pressure of 60 mm Hg and mild right ventricular dilatation and systolic dysfunction. Which of the following studies could definitively establish the cause of this patient's heart failure?
A. Exercise scintigraphic scan
B. Right heart catheterization with pulmonary vasodilator trial
C. Right ventricular endomyocardial biopsy
D. Bone marrow aspiration and biopsy
E. Coronary angiography

Cardiovascular Medicine: Question 73
A 63-year-old non-English-speaking woman comes to the emergency department because of severe, steady precordial discomfort that began 14 hours ago. She thought that the chest pain may have been indigestion, but she had no relief with an antacid. She has a history of hypertension. She is taking no medication. Her heart rate is 92/min, and her blood pressure is 150/90 mm Hg. Her chest and cardiac examination is normal. Her electrocardiogram shows 3-mm ST-segment elevation in
leads V2-6. She is given a chewable aspirin, morphine 4 mg intravenously, metoprolol 5 mg intravenously, and nitroglycerin 20 1g/min intravenously with a decrease in her chest pain intensity from severe to moderate. A hospital in the next county (1.5 hours away by ambulance) recently established a program that provides 24-hour angioplasty services. Which of the following should be considered in the decision of whether to refer this patient for treatment?
A. Angioplasty (with or without stenting) has a better outcome than thrombolysis in this patient.
B. Thrombolysis has a better outcome than angioplasty (with or without stenting) in this patient.
C. Thrombolysis and angioplasty (with or without stenting) are equivalent in outcome for this patient.
D. Neither thrombolysis nor angioplasty (with or without stenting) should be performed in this patient.

**Cardiovascular Medicine: Question 74**

A 74-year-old man who recently had an acute myocardial infarction reports fatigue after climbing one flight of stairs or walking more than one block. He has no orthopnea, and his lungs are clear. Echocardiogram shows a left ventricular ejection fraction of 25%, with a large septal infarction. Medications include an angiotensin-converting enzyme inhibitor, a β-adrenergic blocking agent, aspirin, and nitroglycerin as needed. You decide that the patient would benefit from an exercise program and order an exercise test.

Which of the following is the most appropriate recommendation for this patient?
A. The patient should start an exercise program at home or at a local gym
B. The patient should not take his medications until after he completes the exercise session
C. The patient does not need a cool-down period after exercise because his intensity is likely to be low
D. The patient should start a program of supervised exercise at 50% to 70% of the peak heart rate attained on treadmill testing
E. The patient should start a program of treadmill exercise at 5 metabolic equivalents for 30 minutes 3 to 5 days per week

**Cardiovascular Medicine: Question 75**

A 28-year-old woman has palpitations that she describes as a “heavy beat” associated with a pause. They have occurred sporadically over the past several years, but have become more frequent in the last few months. She has no associated lightheadedness or syncope. Heart rate is 72/min and blood pressure is 108/68 mm Hg. Physical examination shows a mid-systolic nonejection click. A surface 12-lead electrocardiogram shows sinus rhythm with a normal axis and intervals and no evidence of ventricular preexcitation. Transthoracic echocardiography shows posterior leaflet mitral valve prolapse with mild late-systolic mitral regurgitation. Left atrial size and left ventricular size and systolic function are normal. A 24-hour Holter monitor shows a total of 728 isolated, unifocal premature ventricular complexes without couplets or ventricular tachycardia. Which of the following is the most appropriate next step in the management of this patient?
A. Obtain a follow-up history and physical examination in 1 to 2 years
B. Order transesophageal echocardiography
C. Initiate treatment with lisinopril, 10 mg/d
D. Order another echocardiogram in 6 months
E. Initiate treatment with propafenone
**Cardiovascular Medicine: Question 76**

A 17-year-old girl is evaluated for a routine precollege physical examination. She is not athletic but has no effort intolerance to usual activities. She has no history of heart disease but has been told that her heart rate is slow. On physical examination, blood pressure is 102/60 mm Hg and heart rate is 40/min. Cardiac examination shows S1 that varies in intensity and is occasionally booming. The rest of the findings are normal. A rhythm strip from her electrocardiogram is shown.

![Rhythm strip from electrocardiogram](image)

What is the most likely cause of bradycardia in this patient?

A. Excess vagal tone  
B. Autonomic dysfunction  
C. Congenital complete heart block  
D. Use of the drug ecstasy  
E. Sick sinus syndrome

**Cardiovascular Medicine: Question 77**

A 58-year-old man comes to your office for evaluation because of progressive and worsening dyspnea. He cannot walk across the room without panting. He has been followed for many years after myocardial infarction that was caused by single-vessel disease of the proximal left anterior descending artery. He is a former smoker. He has an ejection fraction of 30%, with a 7-cm left ventricular internal dimension in diastole and anterior akinesis with apical dyskinesis. A thallium scan obtained last year showed no ischemia. He takes an ACE inhibitor, a β-blocker, digoxin, spironolactone, and furosemide. He has been receiving long-term amiodarone therapy ever since he had atrial fibrillation 4 years ago. He had successful cardioversion at that time. He has not been congested during routine office visits. Heart rate is 70/min and regular and blood pressure is 115/75 mm Hg. Soft heart sounds are noted, with a grade 1 systolic ejection murmur. No jugular venous distension or peripheral edema is noted, but the patient has diffusely decreased breath sounds with a prolonged expiratory time. The patient does not wheeze, but has very fine bibasilar crackles. B-type natriuretic peptide level is 250 pg/mL, and a metabolic exercise treadmill test shows that the patient can achieve a peak \( \dot{V}O_2 \) of 18.1 mL/kg per min at a respiratory exchange ratio of 0.90. The VE-VCO2 ratio is 42. He asks whether cardiac transplantation would relieve his symptoms. Which of the following is the most appropriate intervention at this time?

A. Refer the patient for evaluation for cardiac transplantation.  
B. Refer the patient for complete pulmonary function testing.  
C. Increase the dosage of diuretics.  
D. Order a rest-redistribution thallium myocardial perfusion study.  
E. Refer for right heart catheterization.

**Cardiovascular Medicine: Question 78**

A 67-year-old woman has a 3-month history of chest discomfort that is caused by emotional stress. The patient is obese and has diabetes, hypercholesterolemia, poorly controlled hypertension, and rheumatoid arthritis. Her medications include metoprolol, 50 mg/d, and hydrochlorothiazide, 25 mg/d. Resting electrocardiogram shows nonspecific T-wave changes.
Which of the following tests is most appropriate to determine the cause of her chest discomfort?
A. Exercise electrocardiogram
B. Exercise echocardiogram
C. Exercise sestamibi
D. Cardiac catheterization
E. Dipyridamole sestamibi

**Cardiovascular Medicine: Question 79**
A 67-year-old woman comes to your office because of intermittent lower back pain of 4 weeks duration. The pain is dull, nonradiating, and nonpositional, and is unrelated to meals or exertion. She has no dyspnea, chest pain, or dysuria, and no history of trauma. She has a history of hypercholesterolemia and underwent a cholecystectomy at age 45 years. She also has a history of recurrent urinary tract infections. She stopped smoking 10 years ago. Her only medication is simvastatin, 20 mg every night orally.

On physical examination, blood pressure is 145/85 mm Hg and heart rate is 86/min and regular. The patient is afebrile. Jugular venous pressure is normal. Carotid pulses are 2+ bilaterally, without bruits. Cardiac examination shows S4; the findings are otherwise normal. The lungs are clear to auscultation. Abdominal examination shows a midline pulsatile mass. No spinal or costovertebral angle tenderness is noted. Distal pulses are normal.

Laboratory findings include hematocrit of 36%, leukocyte count of 9500/μL, platelet count of 290,000/μL, and serum creatinine level of 1.5 mg/dL. Results of urinalysis are normal. The LDL cholesterol level is 115 mg/dL. Abdominal ultrasound shows a 4.8-cm abdominal aortic aneurysm that originates from the celiac trunk and extends below the renal arteries.

Which of the following is the most appropriate next step?
A. Initiate treatment with metoprolol, 25 mg twice a day orally, and schedule a follow-up visit with ultrasound in 6 months.
B. Increase the dose of simvastatin to 40 mg/d and schedule a follow-up visit with ultrasound in 3 months.
C. Hospitalize the patient; increase her simvastatin dose to 40 mg/d; initiate treatment with metoprolol, 25 mg twice a day; and order a high-resolution computed tomography scan.
D. Hospitalize the patient; initiate treatment with metoprolol, 25 mg twice a day; and refer the patient to a vascular surgeon.
E. Initiate treatment with metoprolol, 25 mg twice a day orally, and order magnetic resonance imaging of the spine.

**Cardiovascular Medicine: Question 80**
A 36-year-old Vietnamese woman is evaluated because of severe substernal chest pain. She has not had previous medical care, but has no known medical problems and takes no medication. Over the past 2 months, she has noted progressive fatigue, dyspnea, and palpitations. Two hours ago, she noted the onset of severe 9/10 substernal chest pain radiating to the jaw with moderate shortness of breath. Her blood pressure is 110/90 mm Hg and her heart rate is 110/min and irregular.

On examination, she has jugular venous distension. She has crackles one third of the way up both lung fields. There is a parasternal heave. She has a rapid, irregularly irregular rhythm, accentuated P2, and a II/V1 early diastolic rumble at the apex. Chest radiograph shows right ventricular and left atrial enlargement with moderate pulmonary edema.
Her electrocardiogram shows atrial fibrillation with rapid ventricular response, right bundle branch block, right axis deviation, and 3-mm ST-segment elevation in leads V2-5.

Which of the following is the most likely cause of this patient’s chest pain?
A. Coronary atherosclerosis with plaque rupture.
B. Coronary thromboembolism from a left ventricular thrombus.
C. Coronary thromboembolism from a left atrial thrombus.
D. Coronary arteritis.
E. Coronary vasospasm.

**Cardiovascular Medicine:Question 81**
Which one of the following statements about sudden cardiac death is correct?
A. The most likely underlying cause of cardiac arrest is ischemic heart disease.
B. The most likely arrhythmia associated with sudden death is asystole.
C. Most patients with sudden death survive until hospital admission.
D. Pharmacologic therapy with antiarrhythmic drugs has been largely effective in preventing sudden death.
E. Cardiac arrest in the first 24 hours after myocardial infarction predicts late sudden death.

**Cardiovascular Medicine:Question 82**
A 70-year-old woman who is new to your practice is evaluated because of progressive exertional dyspnea for 3 months. She reports recent onset of orthopnea and paroxysmal nocturnal dyspnea. On physical examination, blood pressure is 150/80 mm Hg, and heart rate is 95/min. She has normal sinus rhythm, an S3 and an S4, no murmur, fine bibasilar crackles, and 1 + edema.

Which of the following is the most important test in the evaluation of this patient to guide initial therapy?
A. Electrocardiography
B. Chest radiography
C. Echocardiography
D. Coronary angiography
E. Measurement of the plasma B-type natriuretic peptide

**Cardiovascular Medicine:Question 83**
A 20-year-old woman who has a family history of Marfan syndrome comes to you for prepregnancy counseling. Echocardiogram and CT scan of the chest show 42-mm dilation of the aortic sinuses. The patient is asymptomatic and does not have mitral valve prolapse.

Which of the following is the most appropriate recommendation?
A. Avoid pregnancy at this time because of the size of the aorta, and initiate treatment with a β-blocker.
B. Proceed with pregnancy, preferably sooner rather than later because of the size of the aorta.
C. Avoid pregnancy because of the autosomal dominant nature of Marfan syndrome.
D. Recommend urgent aortic surgical intervention now.
E. Initiate treatment with a β-blocker, and proceed with pregnancy.

**Cardiovascular Medicine:Question 84**
A 60-year-old woman has longstanding type 2 diabetes mellitus. She has reasonably good glycemic control with a hemoglobin A1C level of 7.4%. She has no obvious microvascular or macrovascular disease. She has hypertension, with blood pressure of 150/90 to 160/96 mm Hg. Antihypertensive pharmacotherapy is initiated.
What is the target blood pressure for this patient?
A. ≤1 40/90mm Hg
B. ≤1 30/85mm Hg
C. ≤125/85 mm Hg
D. ≤120/80 mm Hg

**Cardiovascular Medicine:Question 85**
An 86-year-old woman is evaluated for recent abrupt onset of dyspnea. She underwent bioprosthetic aortic valve replacement 16 years ago because of calcific aortic stenosis. She has no history of recent febrile illness, and she has had no recent medical or dental procedures. Physical examination shows a harsh, crescendo-decrescendo systolic murmur at the right upper sternal border, radiating to the carotids.
Which of the following is the most likely cause of the patient's symptoms?
A. Prosthetic valve failure
B. Paraprosthetic leak
C. Thrombus formation
D. Mitral stenosis and mitral regurgitation
E. Infective endocarditis

**Cardiovascular Medicine:Question 86**
A 73-year-old woman comes to the emergency department because of a 2-hour history of severe precordial chest pain and dyspnea. She has no significant past medical history, and is taking no medication. An electrocardiogram shows 2-mm ST-segment elevation in leads V3-6. The patient is promptly treated with chewable aspirin, intravenous heparin, and fibrinolysis with front-loaded tissue plasminogen activator, following which her symptoms resolve and the ST segments return to normal. She is admitted to the coronary care unit.
On physical examination, her pulse rate is 78/min and regular, and blood pressure is 120/76 mm Hg. There are bibasilar crackles, and an S4 is present at the apex. She is prescribed aspirin, 325 mg daily, atenolol, 50 mg daily, isosorbide mononitrate, 30 mg daily, furosemide, 40 mg orally, and intravenous heparin with a goal of achieving an activated partial thromboplastin time of 55 to 80 seconds. Laboratory studies 12 hours after admission show a markedly elevated serum troponin I level (50 ng/mL). A repeat electrocardiogram shows evidence of an evolving anterolateral myocardial infarction with Q waves and ST-segment depression in leads V3-6. Telemetry over the first 12 hours shows four episodes of asymptomatic, monomorphic nonsustained ventricular tachycardia, each episode lasting 6 to 15 beats. A transthoracic echocardiogram shows a large anterior wall motion abnormality and an ejection fraction of 35%.
Which of the following should you also prescribe?
A. Amiodarone
B. Sotalol
C. Amlodipine
D. Captopril
E. Diltiazem

**Cardiovascular Medicine:Question 87**
A 74-year-old man is resuscitated after an out-of-hospital cardiac arrest. He does not have a myocardial infarction, but had two earlier myocardial infarctions. His left ventricular ejection fraction is 32%. An adenosine thallium scan shows anterior and inferior scarring, but no ischemia. Telemetry shows that he has three to four episodes of nonsustained ventricular tachycardia daily. He has moderately severe
postanoxic encephalopathy. On medical therapy, he has no signs of heart failure. His laboratory findings are normal. His family would like reasonable steps to be taken, but do not wish him to undergo surgery, including placement of an implantable cardioverter defibrillator.

Which of the following drugs would be most effective in this patient?

A. Amiodarone  
B. Sotalol  
C. Carvedilol  
D. Procainamide  
E. Diltiazem

**Cardiovascular Medicine:Question 88**

A 70-year-old man comes to your office for evaluation before transurethral resection of the prostate gland. He has a history of hypertension, feels well, leads an active life, and has no symptoms. On physical examination, blood pressure is 140/70 mm Hg, and heart rate is 70/min and regular. Jugular venous pressure and carotid upstroke are normal, and an S4 is heard. The patient has no S3, no murmurs, and no peripheral edema. A preoperative chest radiograph shows cardiomegaly. Echocardiogram performed to evaluate cardiomegaly shows left ventricular hypertrophy, with global left ventricular dysfunction and an ejection fraction of 33%. No valvular abnormalities are noted. ACE inhibitor therapy is initiated.

Which of the following medications should also be given to this patient?

A. Diuretic  
B. Digoxin  
C. Angiotensin receptor blocker  
D. Spironolactone  
E. β-blocker

**Cardiovascular Medicine:Question 89**

A 35-year-old woman who emigrated to the United States is referred to you by her gynecologist for evaluation of hypertension that was noted 1 week ago, when she sought an evaluation for infertility. She was first told that she had hypertension at 20 years of age, but did not follow up with a physician until recently. On your advice, her gynecologist initiated treatment with amlodipine, 5 mg, after obtaining a blood pressure of 200/100 mm Hg. The patient has frequent headaches and also has cold feet and leg cramping when she walks long distances. Physical examination shows blood pressure of 160/90 mm Hg in the left arm while sitting and heart rate of 70/min. Jugular venous pressure is normal. Carotid pulses are brisk bilaterally. Cardiac examination shows a sustained apical impulse. S1 is normal and S2 is physiologically split. An early systolic ejection sound is noted, and an early peaking murmur is noted at the second right intercostal space. A short diastolic murmur is audible along the left sternal border. Lungs are clear to auscultation. Electrocardiogram shows left ventricular hypertrophy. Findings on urinalysis are normal.

Which of the following is the most appropriate next step in the evaluation of this patient?

A. Measure serum thyroid-stimulating hormone.  
B. Measure the blood pressure in the lower extremities.  
C. Order an echocardiogram.  
D. Order a 24-hour urine test for metanephrine and vanillylmandelic acid.  
E. Obtain a chest radiograph.
Cardiovascular Medicine: Question 90
A 47-year-old postmenopausal woman is admitted to the coronary care unit with an acute inferior myocardial infarction. After presenting with 3 hours of severe left anterior chest pain and ST-segment elevation on her electrocardiogram, she was treated with aspirin, intravenous heparin, and fibrinolysis with front-loaded tissue plasminogen activator. She had resolution of her chest pain and ST-segment elevation 45 minutes after treatment. Thirty minutes later, her heart rate decreases to 40/min with sinus bradycardia; her blood pressure decreases to 84/50 mm Hg. Which one of the following would be the most appropriate next step?
A. Immediate insertion of a temporary transvenous pacemaker.
B. Administration of normal saline, 500 mL over 15 minutes.
C. Intravenous administration of dopamine, 5 μg/kg/min.
D. Intravenous administration of isoproterenol, 5 μg/min.
E. Intravenous administration of atropine sulfate, 0.5 mg.

Cardiovascular Medicine: Question 91
A 20-year-old woman who is in the first trimester of her first pregnancy is referred to you because of progressive dyspnea that was noted during her pregnancy. She has no history of illness or hospitalization. Physical examination shows an acyanotic woman with a prominent parasternal lift and a loud pulmonary component of S2. No S3 or S4 is noted. No murmur is noted. The electrocardiogram shows tall P waves in leads 2, 3, F, a tall R wave in V1 and right axis deviation. Which of the following is the most likely diagnosis?
A. Severe pulmonary valve stenosis, resulting in right ventricular pressure overload
B. Primary pulmonary hypertension
C. A large atrial septal defect, causing right ventricular enlargement and pulmonary hypertension
D. A ventricular septal defect, causing secondary pulmonary hypertension
E. Severe mitral valve stenosis

Cardiovascular Medicine: Question 92
A 70-year-old man who has cough, shortness of breath, chronic cardiomyopathy, and an ejection fraction of 30% is hospitalized with an exacerbation of pulmonary edema. He takes digoxin, an ACE inhibitor, and a diuretic. On physical examination, blood pressure is 110/70 mm Hg, and heart rate is 70/min and regular. He has bibasilar crackles, an S3, and 1 + edema of the leg. Which of the following is the most appropriate next step in the management of this patient?
A. Increase diuresis.
B. Discontinue the ACE inhibitor and start treatment with an angiotensin receptor blocker.
C. Start treatment with a β-blocker.
D. Increase the dosage of digoxin.
E. Start long-term treatment with dobutamine.

Cardiovascular Medicine: Question 93
A 58-year-old man presents to the emergency department after the acute onset of chest pain. The episode began 6 hours ago, lasted 3 hours, and then resolved spontaneously. The patient has a history of hyperlipidemia and cigarette smoking.
On physical examination, he has a heart rate of 54/min, and his blood pressure is 82/52 mm Hg. He has jugular venous distention to the angle of the jaw, clear lung fields, regularly irregular bradycardia without murmur, and an S3 gallop at the left lower sternal border. His electrocardiogram is shown.

Because of his hypotension, a pulmonary artery catheter is placed. Right atrial pressure is 16 mm Hg, pulmonary artery pressure is 20/16 mm Hg, pulmonary capillary wedge pressure is 8 mm Hg, and the cardiac output is 2.0 L/min.

What is the most likely diagnosis?
A. Right ventricular infarction.
B. Constrictive pericarditis after acute myocardial infarction.
C. Ruptured mitral leaflet.
D. Pericardial tamponade after acute myocardial infarction.
E. Anterior wall myocardial infarction.

Cardiovascular Medicine: Question 94
A 67-year-old woman is admitted to the emergency room because of sudden onset of chest pain and rapid pulse. She has no history of similar occurrences. Physical examination reveals a pale diaphoretic woman in moderate respiratory distress. Her blood pressure is palpable at 75 mm Hg systolic. Lungs show bibasilar crackles. There is no jugular venous distention and heart sounds are distant with a variable S1. A 12-lead electrocardiogram is shown.
What is the appropriate immediate therapy?
A. Rapid infusion of 250 mL of normal saline
B. Diltiazem, 20 mg intravenously, followed by 10 mg/hr infusion
C. Digoxin, 0.50 mg intravenously
D. Direct current cardioversion
E. Procainamide, 500mg intravenously over 20 min

Cardiovascular Medicine: Question 95
A 55-year-old woman is hospitalized because of orthopnea and paroxysmal nocturnal dyspnea. Echocardiography shows an ejection fraction of 20%, and a diagnosis of dilated cardiomyopathy is made. Diuretic treatment is initiated, beginning with furosemide administered intravenously and followed by furosemide, 40 mg twice a day orally. Treatment with an ACE inhibitor is also initiated. On admission, the blood urea nitrogen level is 25 mg/dL and serum creatinine level is 1.6 mg/dL. After the dose of captopril is increased from 6.25 mg three times a day to 12.5 mg three times a day on hospital day 2, the blood urea nitrogen level is 42 mg/dL, creatinine level is 2.0 mg/dL, and potassium level is 4.6 meq/L. Net diuresis in the hospital is 2.4 L over 36 hours. On physical examination, blood pressure is 105/85 mm Hg, and heart rate is 88/min. The crackles have resolved, and jugular venous pressure is normal. Trace pedal edema is noted.

Which of the following is the most appropriate next step in the management of this patient?
A. Decrease the dosage of the diuretic
B. Discontinue captopril
C. Decrease the dosage of captopril
D. Start treatment with low-dose dobutamine
E. Administer a fluid bolus
Cardiovascular Medicine:Question 96
An active 40-year-old premenopausal woman is seen in the emergency department because of substernal chest pressure. The pressure started during an argument with her husband, decreased as she was transported to the hospital, and was gone by the time she was examined. She has not had this symptom before. Her heart rate is 90/min and blood pressure is 150/90 mm Hg. Findings on physical examination are otherwise normal. The findings on electrocardiogram and chest radiograph are normal. Serum creatine kinase-MB and troponin I levels are normal at baseline and 6 hours later. Her only risk factor for coronary artery disease is mild obesity. Her body mass index is 31.
Which of the following is the best course of action?
A. Discharge the patient and recommend follow-up with her primary care physician
B. Discharge the patient and perform an exercise electrocardiogram within 72 hours
C. Discharge the patient and perform an exercise nuclear perfusion study within 72 hours
D. Discharge the patient and perform an exercise echocardiogram within 72 hours
E. Admit the patient to the cardiac care unit for monitoring

Cardiovascular Medicine:Question 97
A 74-year-old woman is admitted with 3 hours of crushing substernal chest pain. She has a history of left carotid occlusion with hemiparesis occurring 3 months ago. She also has a history of mild hypertension, hyperlipidemia, and diabetes mellitus complicated by neuropathy and retinopathy. Her medications include warfarin, 5 mg/d; atenolol, 25 mg/d; and pravastatin 20 mg/d. In the emergency department, she has a ventricular fibrillation arrest. She is successfully cardioverted to sinus rhythm after receiving 2 minutes of cardiopulmonary resuscitation. Her electrocardiogram shows sinus rhythm with 3-mm ST-segment elevation in V2-6. The results of initial laboratory tests are within normal limits, except for an elevated prothrombin time with an INR of 1.8.
Which of the following represent an absolute contraindication to the use of a thrombolytic agent in this patient?
A. Left carotid occlusion with hemiparesis 3 months ago
B. Cardiopulmonary resuscitation for 2 minutes
C. Patient age >70 years
D. Patient on warfarin, with an INR of 1.8
E. Diabetic retinopathy

Cardiovascular Medicine:Question 98
A 20-year-old woman who is in the first trimester of her first pregnancy is referred to you because of progressive dyspnea. An echocardiogram shows findings consistent with severe pulmonary hypertension. The right ventricular systolic pressure is 90 mm Hg, and systemic blood pressure is 110 mm Hg. Further studies show no evidence of pulmonary embolism. Transesophageal echocardiogram excludes an intracardiac shunt.
Which of the following is associated with the lowest risk of maternal mortality?
A. Termination of pregnancy
B. Initiation of prostacyclin therapy
C. Initiation of bosentan therapy
D. Initiation of anticoagulation therapy
E. Initiation of ACE inhibitor therapy
Cardiovascular Medicine: Question 99
A 56-year-old woman who is new to your practice is evaluated for recent exacerbation of dyspnea and fatigue. She has idiopathic dilated cardiomyopathy and receives a stable heart failure regimen, including lisinopril, 20 mg/d; digoxin, 125 mg/d; furosemide, 40 mg/d; and metoprolol XL, 50 mg/d. She also takes alendronate, hormone replacement therapy, glipizide, folic acid, and ibuprofen because of rheumatoid arthritis. Thyroid hormone suppressive therapy with thyroxin was initiated because of the finding of an elevated serum thyroid-stimulating hormone level 4 months earlier. The thyroid-stimulating hormone level returned to normal after therapy.
On physical examination, blood pressure is 110/72 mm Hg, and heart rate is 82/min. Jugular venous pressure is estimated at 10 cm H2O. The lungs are clear. Cardiac examination shows an S3 gallop and 2+ pitting edema.
Which of the following is most likely to be causing the exacerbation of congestive heart failure in this patient?
A. Alendronate
B. Glipizide
C. Ibuprofen
D. Thyroxin
E. Estrogen

Cardiovascular Medicine: Question 100
A 35-year-old woman comes to your office for follow-up after aortic valve replacement surgery, which was performed 3 months ago. A bileaflet mechanical prosthesis was used to treat aortic regurgitation associated with a congenitally bicuspid aortic valve. The postoperative course has been unremarkable. She has no history of atrial fibrillation or thromboembolic events. Echocardiography performed before hospital discharge showed a normally functioning mechanical aortic valve prosthesis, a mildly enlarged left ventricle, and normal left ventricular systolic function.
What is the best long-term anticoagulation regimen for this patient?
A. Warfarin (target INR 2.0 to 3.0)
B. Warfarin (target INR 2.5 to 3.5)
C. Warfarin (target INR 2.0 to 3.0) plus aspirin, 100 mg/d
D. Warfarin (target INR 2.5 to 3.5) plus aspirin, 100 mg/d
E. Aspirin, 650 mg/d

Cardiovascular Medicine: Question 101
A 64-year-old woman is evaluated for acute dyspnea 3 days after discharge following an inferior myocardial infarction. When she was hospitalized, urgent coronary angiography showed single-vessel coronary artery disease with occlusion of her mid-right coronary artery. She underwent successful stenting of her right coronary artery, and was discharged on her third hospital day. Her ejection fraction was 50% with inferior wall hypokinesis before discharge.
The patient's dyspnea began 30 minutes ago. On physical examination, her pulse rate is 110/min, respiration rate is 34/min, and blood pressure is 100/60 mm Hg. Jugular venous pressure is elevated at 10 cm H2O, crackles are heard halfway up both lung fields, a parasternal lift is appreciated, and there is a new grade 3/6 systolic murmur at the left sternal border with an S3 gallop. The electrocardiogram shows sinus tachycardia with Q waves and T wave inversions in leads II, III, and aVF, and is unchanged from the discharge electrocardiogram.
A pulmonary artery catheter is placed, which shows the following:

<table>
<thead>
<tr>
<th></th>
<th>Pressure (mm Hg)</th>
<th>Oxygen Saturation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right atrium</td>
<td>12 (normal 2-7)</td>
<td>49 (normal 60-75)</td>
</tr>
<tr>
<td>Right ventricle</td>
<td>60/12 (normal 20-30/2-7)</td>
<td>78 (normal 60-75)</td>
</tr>
<tr>
<td>Pulmonary artery</td>
<td>60/32 (normal 20-30/10-15)</td>
<td>80 (normal 60-75)</td>
</tr>
<tr>
<td>Pulmonary capillary wedge</td>
<td>24 (normal &lt;14)</td>
<td>98 (normal &gt;93)</td>
</tr>
</tbody>
</table>

Which of the following is the most likely diagnosis?
A. Papillary muscle rupture
B. Ventricular septal defect
C. Pericardial tamponade
D. Recurrent myocardial infarction
E. Atrial septal defect

**Cardiovascular Medicine: Question 102**

Which one of the following patients is at high risk and should be treated with an implantable cardioverter defibrillator?
A. A 47-year-old man has had an anterior wall myocardial infarction. Echocardiogram shows a large anteroseptal wall motion abnormality and an ejection fraction of 30%. A 24-hour ambulatory monitor shows an average of 15 premature ventricular contractions per hour.
B. A 50-year-old man had a previous lateral wall myocardial infarction. Echocardiogram shows a limited area of lateral wall hypokinesis and an ejection fraction of 50%. A 24-hour ambulatory monitor shows two episodes of nonsustained ventricular tachycardia.
C. A 30-year-old woman has palpitations. Her electrocardiogram is normal. Her echocardiogram is normal with an ejection fraction of 60%. A 24-hour ambulatory monitor shows three episodes of ventricular tachycardia, each 10 beats long.
D. A 33-year-old woman has hypertrophic cardiomyopathy. She has no obstruction and has minimal symptoms. She has no family history of sudden death. A 24-hour ambulatory monitor shows 550 premature ventricular contractions.

**Cardiovascular Medicine: Question 103**

A 35-year-old man who underwent closure of an atrial septal defect at age 5 years was asymptomatic and physically active until 3 months ago, when he began to have exertional dyspnea and fatigue. He smokes one pack of cigarettes daily and drinks a six-pack of beer daily. He is a bricklayer and had to stop working for the last 2 weeks. He takes no medications. On physical examination, blood pressure is 105/80 mm Hg, and heart rate is 100/min, with an occasional extra systole. Jugular venous pressure is 11 cm H2O. The point of maximal impulse is displaced. The patient has a soft S1, a split S2, and a grade 2/6 apical holosystolic murmur. The abdomen is distended, the liver is palpable 1 cm below the right costal margin, and 2+ pedal edema is noted.

Laboratory tests show a total serum cholesterol of 180 mg/dL, serum thyroid-stimulating hormone of 2.5 μU/mL, blood urea nitrogen of 32 mg/dL, serum creatinine of 1.3 mg/dL, alkaline phosphatase of 220 U/L, aspartate aminotransferase of 60 U/L, alanine aminotransferase of 75 U/L, and serum bilirubin of 1.2 mg/dL. Electrocardiogram shows nondiagnostic ST changes, with occasional premature ventricular contractions.

Gated single-photon emission tomography scan shows an ejection fraction of 34%, with global hyperkinesis.
Which of the following is the most likely cause of this patient's heart failure?
A. Atrial septal defect patch dehiscence
B. Late heart failure as a result of repair of an atrial septal defect
C. Alcohol consumption
D. Familial dilated cardiomyopathy
E. Coronary artery disease

**Cardiovascular Medicine: Question 104**
A 28-year-old woman with aortic and mitral mechanical valve prostheses that were placed for congenital heart disease comes to your office for a prepregnancy consultation. She is active and asymptomatic. Physical examination shows normal prosthetic, aortic, and mitral valve prosthesis auscultation. Results of laboratory studies are normal, except for a therapeutic international normalized ratio on warfarin anticoagulation.

Which of the following recommendations is appropriate for the management of this patient during pregnancy?
A. Discontinue warfarin anticoagulation and initiate treatment with aspirin and dipyridamole for the first trimester
B. Continue warfarin administration throughout pregnancy and start heparin 5,000 U subcutaneously three times daily, plus aspirin
C. Discontinue warfarin administration and initiate treatment with enoxaparin, 30 mg subcutaneously twice daily for the rest of the pregnancy
D. Discontinue warfarin and initiate dose-adjusted unfractionated heparin subcutaneously during the first trimester and resume treatment with warfarin for the rest of the pregnancy until shortly before delivery
E. Discontinue warfarin anticoagulation and initiate treatment with clopidogrel and aspirin during the first trimester and resume treatment with warfarin for the rest of the pregnancy until shortly before delivery

**Cardiovascular Medicine: Question 105**
A 67-year-old man with a history of hypertension and hyperlipidemia is hospitalized for acute ST-segment elevation myocardial infarction. He presents after 2 hours of crushing substernal chest pain. His electrocardiogram shows 3-mm ST-segment elevation in leads V2-5. The patient is treated with aspirin, t-PA, and intravenous heparin, with resolution of the chest pain and ST-segment elevation within 40 minutes.

The patient is treated in the coronary care unit with aspirin, metoprolol, lisinopril, and pravastatin. Over the next 2 days, he denies any intercurrent chest pain, dyspnea, or palpitations. Daily electrocardiograms are unremarkable. A repeat electrocardiogram 2 days later shows new 1.5- to 2-mm horizontal ST-segment depression with T wave inversions in leads V4-6. His echocardiogram shows mild anteroapical hypokinesis with an ejection fraction of 45%.

Which of the following is the most appropriate management at this point?
A. Perform an exercise echocardiographic stress test before discharge.
B. Perform coronary angiography before discharge.
C. Discharge on hospital day 3 and schedule an exercise echocardiographic stress test in 3 weeks.
D. Discharge on hospital day 3 with a follow-up appointment in 1 week.
E. Begin isosorbide dinitrate.
**Cardiovascular Medicine: Question 106**  
A 27-year-old woman is evaluated on follow-up examination. She has a history of syncope and has been treated with a β-blocker. She had discontinued β-blocker therapy while she was pregnant, but recently resumed therapy. She has had no recent syncopal episodes, but she has been having palpitations. Her sister died suddenly at age 32 years. Her physical examination is normal. Her electrocardiogram is shown.

![Electrocardiogram](image)

She is on no other medications.

What is the most likely diagnosis in this patient?
A. Wolff-Parkinson-White syndrome  
B. Hypertrophic cardiomyopathy  
C. Long QT syndrome  
D. Familial dilated cardiomyopathy

**Cardiovascular Medicine: Question 107**  
A 72-year-old woman who has a history of type 2 diabetes mellitus, ischemic cardiomyopathy, and chronic obstructive pulmonary disease is hospitalized because of palpitations that have occurred for the past 2 days. Outpatient medications include aspirin, 81 mg/d; furosemide, 20 mg/d; digoxin, 0.25 mg/d; lisinopril, 20 mg/d; insulin; prednisone, 10 mg/d; and an albuterol inhaler. Electrocardiogram shows atrial fibrillation with a ventricular rate of 110/min. The serum troponin I level is normal. Echocardiogram shows anteroapical hypokinesis, mild mitral regurgitation, and an left ventricular ejection fraction of 35%. Treatment is initiated with warfarin, 5 mg/d, and amiodarone, 200 mg twice a day, and the patient is discharged.

She is rehospitalized 2 weeks later with a 2-day history of nausea, clear emesis, and lightheadedness. Blood pressure is 100/80 mm Hg and heart rate is 70/min. On examination, she has mild jugular venous distension and scant bibasilar crackles. She has a regular rhythm, a grade 2/6 holosystolic murmur at the apex, and a soft S3.
Laboratory findings include a normal complete blood count, normal serum troponin I level, INR of 2.6, serum sodium of 130 meq/L, serum potassium of 4.8 meq/L, plasma glucose of 220 mg/dL, and serum creatinine level of 1.5 mg/dL. Chest radiograph shows mild cardiomegaly and mild pulmonary edema. Her electrocardiogram is shown.

Which of the following is the most likely cause of this patient's symptoms of nausea, vomiting, and lightheadedness?
A. Digoxin toxicity
B. Diabetic ketoacidosis
C. Exacerbation of heart failure
D. Adrenal insufficiency
E. Acute coronary syndrome

Cardiovascular Medicine:Question 108
A 57-year-old woman with newly diagnosed diabetes mellitus has the following lipid profile: total serum cholesterol of 250 mg/dL, LDL cholesterol level of 148 mg/dL, HDL cholesterol of 37 mg/dL, and triglyceride level of 376 mg/dL. Which of the following is the recommended initial drug therapy for this patient?
A. A fibric acid agent
B. A statin
C. Niacin
D. A bile acid resin
E. Ezetimibe

Cardiovascular Medicine:Question 109
A 49-year-old postmenopausal woman is hospitalized because of new-onset chest discomfort. The patient has a history of hypertension and hyperlipidemia, and has no other medical problems. Medications include aspirin, 81 mg/d; hydrochlorothiazide, 25 mg/d; and simvastatin, 10 mg/d. She described the onset of 5/10 substernal chest burning while watching television, with no associated symptoms. The symptom
lasted 15 mm and resolved after she took one of her husband's sublingual nitroglycerin tablets, and she has not had recurrent symptoms. On evaluation in the emergency department, her pulse rate is 70/min, and blood pressure is 130/82 mm Hg. Chest and cardiac examinations are normal. The electrocardiogram shows normal sinus rhythm with left ventricular hypertrophy and associated repolarization abnormality. Her chest radiograph is normal. The first two troponin I determinations are normal.

**What is the most appropriate management?**
A. Discharge and schedule a follow-up exercise thallium stress test in 2 to 3 weeks.
B. Discharge and schedule follow-up exercise electrocardiography stress test in 2 to 3 weeks.
C. Perform an exercise thallium stress test during her hospitalization.
D. Perform exercise electrocardiography stress test during her hospitalization.
E. Perform electron-beam computed tomography coronary angiography during her hospitalization.

**Cardiovascular Medicine:Question 110**
A 56-year-old man who has a history of mild hypertension comes to your office because of fatigue and dyspnea that have occurred over the last several weeks. He works as a bricklayer and cannot perform his normal daily activities. He had a severe episode of bronchitis approximately 3 months ago, but it resolved with antibiotic therapy. He has palpitations at night, but is not aware of his heartbeat during the day. On physical examination, heart rate is 136/min and irregular, and blood pressure is 98/60 mm Hg. He has bibasilar crackles, jugular venous distension, an, and 2+ peripheral edema. Electrocardiogram shows atrial fibrillation with rapid ventricular response, minimal left ventricular hypertrophy, and a Q wave in lead III. Chest radiograph shows cardiomegaly, small bilateral pleural effusions, and pulmonary venous hypertension. Echocardiogram shows global hypokinesia, moderate mitral regurgitation, and an ejection fraction of 30%.

**What is the most likely cause of congestive heart failure in this patient?**
A. Mitral regurgitation
B. Coronary artery disease
C. Tachycardia-mediated cardiomyopathy
D. Myocarditis
E. Hypertensive heart disease

**Cardiovascular Medicine:Question 111**
A 46-year-old man slips on ice and falls, injuring his lower back. That evening, he awakens to urinate and falls in the bathroom. His wife finds him unconscious, with a scalp wound. She calls an ambulance, and on arrival, the paramedics find him awake and oriented, with a heart rate of 90/min and blood pressure of 140/85 mm Hg. An electrocardiogram is normal. Other than headache and minor back pain, he has no discomfort. Physical examination shows no abnormalities. He has no significant medical history. He has a family history of hypertension. His electrocardiogram is normal. Which of the following is the most appropriate next step in the management of this patient?
A. No further treatment or investigation
B. CT scan of the head
C. Exercise electrocardiography stress test
D. CT scan of the chest
E. Initiation of β-blocker therapy
Cardiovascular Medicine: Question 112
An active 63-year-old woman is evaluated because her cholesterol was measured at 268 mg/dL during a screening at a shopping mall. She has no history of vascular disease, does not smoke, and does not have diabetes or hypertension. She has no family history of coronary artery disease or stroke. A lipid panel shows a total cholesterol of 251 mg/dL, LDL cholesterol of 166 mg/dL, HDL cholesterol level of 53 mg/dL, and triglyceride level of 90 mg/dL.
Which of the following is the target LDL cholesterol level for this patient?
A. <190 mg/dL
B. <160 mg/dL
C. <130 mg/dL
D. <100 mg/dL

Cardiovascular Medicine: Question 113
A 65-year-old man who had an acute myocardial infarction 10 years ago is reevaluated. Despite diet and exercise therapy, he has had recurrent ischemic events, and over the past 2 years, he has been hospitalized several times for exacerbations of congestive heart failure. Six months ago, a dipyridamole thallium scan showed no ischemia and echocardiogram showed anterior akinesia, global hypokinesia, and moderate to severe mitral regurgitation, with an ejection fraction of 28%. Medications include ramipril, carvedilol, furosemide, aspirin, digoxin, and spironolactone. His condition is classified as New York Heart Association functional class III. On physical examination, heart rate is 62/min and blood pressure is 96/60 mm Hg. He has bibasilar crackles and jugular venous distention. A summation gallop and a 3/6 holosystolic murmur at the apex and radiating to the axilla are present. Electrocardiogram shows left bundle branch block and first-degree atrioventricular block. Which of the following is the most appropriate next step in the management of this patient?
A. Coronary artery bypass graft surgery
B. Left ventricular aneurysmectomy
C. Implantation of a cardiodefibrillator/atrioventricular sequential biventricular pacemaker
D. Mitral valve repair
E. Transmyocardial laser revascularization

Cardiovascular Medicine: Question 114
A 52-year-old man who presented 7 days ago with stable angina refractory to aggressive medical therapy undergoes successful stenting of the right coronary artery. Coronary angiography showed single-vessel coronary artery disease, with a 90% stenosis of the mid-right coronary artery. He was discharged without complications the next day. He was discharged on clopidogrel, 75 mg/d, in addition to his previous outpatient regimen of aspirin 325 mg/d, atenolol 100 mg/d, amlodipine 10 mg/d, isosorbide mononitrate 60 mg/d, and fluvastatin 40 mg/d. Three days after being discharged, he developed a red rash over his chest and back, and he stopping taking all his medications. Three days later (1 week after his coronary stent procedure), he developed severe 10/10 crushing substernal chest pain that was not relieved after three sublingual nitroglycerin tablets. He was brought to the emergency department by paramedics. His physical examination was unremarkable except for a faint diffuse macular-papular rash over his chest and trunk. His electrocardiogram showed 3-mm ST-segment elevations in leads II, III, and aVF. Emergency coronary angiography showed intracoronary thrombosis at the site of the previously placed stent. He underwent successful angioplasty of the right coronary artery, with restoration of normal blood flow and resolution of the patients
chest pain and ST-segment elevation. In addition to aspirin, what other antiplatelet or antithrombotic regimen should be prescribed?
A. Clopidogrel
B. Ticlopidine
C. Warfarin
D. Dipyridamole
E. Enoxaparin

**Cardiovascular Medicine:** Question 115
A 55-year-old woman comes to your office because of cramping in the right calf that forces her to stop walking after one block. The cramping is relieved by resting 3 to 5 minutes. The patient has a 5-year history of dyslipidemia and 40 pack-year history of cigarette smoking, but no history of stroke or myocardial infarction. What is this patient’s estimated annual risk of myocardial infarction, ischemic stroke, or vascular death?
A. 1%
B. 2%
C. 5%
D. 10%
E. 12%

**Cardiovascular Medicine:** Question 116
A 71-year-old man is being evaluated for symptoms of congestive heart failure. On physical examination, the left ventricular point of maximum impulse is enlarged and displaced laterally. Cardiac auscultation shows a crescendo-decrescendo systolic murmur at the right upper sternal border, peaking in the latter half of systole. Echocardiography with Doppler shows left atrial and left ventricular enlargement and global left ventricular hypokinesis, with an estimated left ventricular ejection fraction of 20% to 25%. The aortic valve has heavy calcification, with diminished cusp mobility. The mean and peak pressure gradients in the aortic valve are 16 mm Hg and 26 mm Hg, respectively. Which of the following tests should be performed next?
A. Transesophageal echocardiography
B. Exercise stress test with electrocardiogram
C. Dobutamine stress echocardiography
D. Adenosine myocardial perfusion scintigraphy

**Cardiovascular Medicine:** Question 117
An exercise prescription to walk briskly 2 miles per day 5 days per week is given to the following patients: a healthy 20-year-old woman; a 50-year-old man who takes β-blockers for hypertension; and a healthy 70-year-old woman. Which of the following statements about this prescription in these patients is true?
A. The absolute intensity of exercise is nearly the same in these patients.
B. The exercise dose differs among the patients because of the differences in their ages.
C. This exercise prescription lacks sufficient information about modality and frequency.
D. This exercise prescription is inadequate to provide significant health benefits.
E. A walking program is unlikely to provide benefit in the 20-year-old woman.
Cardiovascular Medicine: Question 1

The correct answer is A

Educational Objectives
Identify the most appropriate and cost-effective screening test for coronary artery disease in a low-risk patient.

Critique
Standard guidelines for risk assessment in adults include a routine fasting lipid profile. This profile includes measurements of total cholesterol, LDL and HDL cholesterol, and triglyceride levels. This patient's lipid profile findings are unremarkable. Some experts recommend a measurement of serum lipoprotein (a) especially in patients with a strong positive family history. Significant elevation of this lipoprotein is associated with an increased risk for coronary artery disease (CAD). The current NCEP-ATP III guidelines recommend repeating the fasting lipoprotein profile every 5 years. An elevated plasma homocysteine level is a possible risk marker for CAD. However, therapy for hyperhomocysteinemia has not been tested in completed randomized trials. The benefits of folic acid and B vitamins are not known; therefore, routine measurement of the plasma homocysteine level is not recommended for risk assessment. High-sensitivity measurement of C-reactive protein is not recommended for routine risk assessment but may be adjunctive for patients in an intermediate risk category. Nevertheless, evidence of systemic inflammation suggests increased vascular risk in patients who have established CAD and in those without overt vascular disease. Observational data show a positive correlation between C-reactive protein levels and CAD events, even when the LDL cholesterol level is normal. Stress (exercise) testing is not recommended for routine assessment of CAD risk in healthy persons, except in those who have a strong risk factor profile or those with high-risk jobs, such as police, firefighters, and pilots.

Cardiovascular Medicine: Question 2

The correct answer is D

Educational Objectives
Recognize the best strategy for drug implementation at discharge in a patient who is hospitalized because of decompensated congestive heart failure.

Critique
Although this patient requires therapy with multiple drugs, treatment with an ACE inhibitor should be initiated. ACE inhibitors are root agents to which β-blockers are added to reduce the rates of mortality and morbidity in patients who have congestive heart failure and systolic left ventricular dysfunction. β-blockers are usually started on an outpatient basis once the dose of ACE inhibitor is optimized and the patient is considered euvolemic. More recently, efforts have been mounted to validate the safety of also starting β-blockers in the hospital. This patient requires diuretics to achieve and maintain euvolemia but diuretics do not improve survival. Long-term treatment with a cardiac glycoside, such as digoxin, has no apparent effect on mortality in this situation. However, when coupled with ACE inhibitors, these agents reduce the incidence of deterioration and hospitalization associated with heart failure. Aldosterone antagonists should be reserved for older patients who have persistent New York Heart Association class 3/4 symptoms and are receiving an aggressive baseline protocol, including digoxin, a diuretic, an ACE inhibitor, and a β-blocker. Because calcium channel blockers have no proven benefit in reducing morbidity and mortality rates in patients with systolic left ventricular dysfunction, amlodipine is not a first-line drug in this patient. Amlodipine can be an adjunctive antihypertensive agent if blood pressure is not controlled after the patient is given
the target doses of an ACE inhibitor and a β-blocker in combination with a diuretic.

**Cardiovascular Medicine:Question 3**
The correct answer is D

**Educational Objectives**
Recognize the optimal medical management for non-ST-segment elevation acute coronary syndrome.

**Critique**
This patient presents with non-ST-segment elevation myocardial infarction (NSTEMI). The medical therapy of this disorder has evolved considerably over the past several years. First-line antianginal medications include β-blockers and nitrates. Calcium channel antagonists are reserved for patients who have contraindications to β-blockers or nitrates, and those patients who remain symptomatic and/or hypertensive on appropriate doses of these agents. Because the pathophysiology of the disorder involves formation of both platelet and fibrin thrombi, therapy with antiplatelet and antithrombotic agents is indicated. Studies have demonstrated that treatment with a combination of heparin (or low-molecular-weight heparin) and a small molecule glycoprotein IIb/IIIa receptor inhibitor (such as tirofiban or eptifibatide) is superior to heparin therapy alone in these patients (PRISM-PLUS and PURSUIT studies). In patients with acute coronary syndrome (unstable angina or NSTEMI), therapy with clopidogrel and aspirin is superior to aspirin alone. In patients without a contraindication to anticoagulation, beginning clopidogrel in addition to aspirin is an appropriate strategy and is associated with a lower incidence of subsequent myocardial infarction and stroke (CURE study). Lastly, evidence from both observational and randomized clinical trials shows that the early initiation of a statin in patients hospitalized with an acute coronary syndrome is associated with a reduction in ischemic complications (MIRACL study). Based on recent clinical trial data (TACTICS TIMI-1 8), coronary angiography would be indicated in this patient with NSTEMI, as she has elevated tropon in and ST-segment depression.

**Cardiovascular Medicine:Question 4**
The correct answer is C

**Educational Objectives**
Recognize the clinical presentation of paroxysmal supraventricular tachycardia.

**Critique**
The abrupt onset and regularity of this patient's symptoms strongly suggest paroxysmal reentrant supraventricular arrhythmia. Resolution of the episodes may appear gradual because the arrhythmia may convert to sinus tachycardia that gradually slows. The most common type of paroxysmal reentrant supraventricular arrhythmia is atrioventricular nodal reentrant tachycardia, which involves reentry within atrioventricular nodal tissue. The patient's awareness of the palpitations as a pounding sensation in the neck is a common finding in supraventricular tachycardia. It likely is related to nearly simultaneous contractions of the atria and ventricles during supraventricular tachycardia, when the ventricular-atrial ratio is 1:1. Palpitations that are associated with premature ventricular contractions feel like skipped beats or an irregular pulse. Although palpitations are sometimes associated with mitral valve prolapse, this patient has no findings that suggest a structural abnormality. Paroxysmal supraventricular tachycardia is much more common in this age group than is ventricular tachycardia, and atrial flutter is very uncommon in a young, healthy person who has a structurally normal heart. In a young person who has exercise-induced palpitations, a catecholamine-sensitive tachycardia, such as right ventricular outflow tract ventricular tachycardia, must be considered.
Cardiovascular Medicine: Question 5

The correct answer is D

Educational Objectives
Understand the indications for surgical intervention in patients who have chronic severe mitral regurgitation.

Critique
Surgery is indicated in patients who have chronic severe mitral regurgitation and symptoms of heart failure, evidence of left ventricular systolic dysfunction (left ventricular ejection fraction <60% or left ventricular internal diameter in systole >45 mm), atrial fibrillation, or pulmonary hypertension. Surgery should be considered earlier if the mitral valve is amenable to repair. Although this patient has no symptoms of heart failure, he has evidence of left ventricular systolic dysfunction. Surgery is indicated, regardless of the valve anatomy. ACE inhibitor therapy does not play a role in the treatment of severe mitral regurgitation other than its use in primary cardiomyopathy with secondary (functional) mitral regurgitation. Because of the high operative risk, surgical intervention is contraindicated in patients who have severe left ventricular systolic dysfunction (ejection fraction <30%), unless mitral repair is likely. Myocardial perfusion imaging plays no role in the assessment of the appropriateness or timing of intervention in patients who have chronic severe mitral regurgitation. Because of his age, this patient should undergo preoperative heart catheterization with coronary angiography to identify coronary artery disease. Surgical revascularization should be performed at the time of valve surgery.

Cardiovascular Medicine: Question 6

The correct answer is C

Educational Objectives
Understand appropriate secondary prevention for patients who have coronary artery disease.

Critique
Folic acid therapy reduces high serum homocysteine levels, which are correlated with outcomes in patients who have coronary artery disease. Small trials have shown a reduction in the incidence of clinically apparent restenosis after stenting, but no reduction in the incidence of myocardial infarction or death. Several well-done clinical trials have shown no benefit of high-dose vitamin E. Although nitrates are sometimes given after angioplasty to prevent coronary vasospasm, with the advent of stents, this use has declined and there is no evidence that it has any long-term prophylactic value. Although frequent premature ventricular contractions are cause for concern in an asymptomatic patient who has normal left ventricular function, studies show an increase in the mortality rate as a result of the proarrhythmia effects of type Ia agents. Although propafenone is a class Ic antiarrhythmic, the incidence of proarrhythmia is probably similar in this group of patients. In randomized clinical trials, the angiotensin- converting enzyme inhibitor ramipril reduced the incidence of cardiac events in patients with coronary artery disease. The mechanism of this effect is unclear and seems unrelated to either left ventricular function or blood pressure control.
Cardiovascular Medicine: Question 7
The correct answer is D

Educational Objectives
Recognize an acute aortic dissection.

Critique
This patient has no evidence of myocardial ischemia. The most likely diagnosis is acute dissection of the ascending aorta. This patient's previous diagnosis of mitral valve prolapse raises the question of a connective tissue disorder, such as Marfan syndrome. A negative family history does not exclude the diagnosis because more than half of cases are sporadic. A diastolic murmur in a patient who has chest pain is highly suggestive of ascending aortic dissection, and this life-threatening diagnosis must be excluded. In rare cases, a pregnant woman has a myocardial infarction as a result of spontaneous coronary dissection or acute intracoronary thrombosis. In this case, the normal finding on electrocardiogram makes this diagnosis unlikely. Further testing should not be delayed pending measurement of the troponin level. A transthoracic echocardiogram is likely to show mitral valve prolapse and mitral regurgitation. Aortic insufficiency is likely to cause dilation of the aortic root. However, the sensitivity of this test for detecting aortic dissection is only approximately 65%. Given the potential gravity of waiting because of the high mortality rate in the first 24 hours, a more accurate test is preferred. Magnetic resonance angiography is usually a good choice for diagnosing aortic dissection, which is the most likely diagnosis in this patient. This test is considered safe for the fetus; no harmful effects have been attributed to magnetic resonance imaging. However, it is difficult to monitor the patient in the magnet, and this patient's aortic insufficiency and severe chest pain warrant rapid diagnosis and close monitoring. Although helical computed tomography scanning is rapid and accurate, it is best to avoid radiation to the fetus. With transesophageal echocardiography, the patient can safely be sedated with midazolam and fentanyl, β-blockers can be administered, and the diagnosis can be confirmed and the site of aortic dissection identified within minutes of esophageal intubation. The information that is obtained is usually adequate for surgical intervention, and surgery rarely needs to be delayed for confirmatory studies. One exception is suspected involvement of the great vessels. Preeclampsia does not cause chest pain. The patient is not hypertensive. Occasionally, chest pain occurs in patients who have hemolytic anemia, abnormal liver function, and low platelet count (HELLP syndrome). However, this syndrome usually occurs in the third trimester and is associated with a platelet count <100,000/μL.

Cardiovascular Medicine: Question 8
The correct answer is D

Educational Objectives
Recognize the clinical presentation of acute pericarditis.

Critique
This patient has the classic presentation of acute pericarditis associated with upper respiratory tract infection. This diagnosis is suggested by the clinical history of associated illness and positional exacerbation of pain and confirmed by the physical findings of pericardial friction rub, elevated erythrocyte sedimentation rate, and diffuse ST-segment elevation on the electrocardiogram. An echocardiogram is not needed for the diagnosis of pericarditis. Echocardiography is needed only if the patient has evidence of hemodynamic compromise. In this situation, pericardial effusion with tamponade must be excluded. Nonsteroidal anti-inflammatory drugs are the treatment of choice for acute
pericarditis. β-Adrenergic antagonists do not have a role in the direct management of acute pericarditis. Colchicine offers benefit in patients who have recurrent or relapsing pericarditis, but is not necessary in most cases of primary acute pericarditis. Corticosteroids may provide symptomatic relief, but are associated with recurrent pericarditis. Thrombolytic therapy can cause hemorrhagic pericardial effusion.

**Cardiovascular Medicine: Question 9**
The correct answer is E

**Educational Objectives**
Recognize the prevalence of peripheral arterial disease in patients who have cardiovascular risk factors or other manifestations of cardiovascular disease.

**Critique**
Peripheral arterial disease (PAD) of the lower extremities is a major manifestation of systemic atherosclerosis. PAD causes atherosclerotic occlusions of the arterial circulation that supplies the lower extremities. Epidemiologic studies show that the age-adjusted prevalence of PAD is approximately 12%, but increases to more than 20% in patients who are older than 70 years. PAD affects men and women equally. In the PARTNERS study, patients from primary care clinics who were considered at high risk for PAD were screened for PAD. This high-risk population included patients aged 50 to 69 years who had a history of smoking or diabetes and all patients older than age 70 years. In this clinic population, the prevalence of PAD was 29%.

**Cardiovascular Medicine: Question 10**
The correct answer is C

**Educational Objectives**
Recognize diastolic dysfunction as a cause of heart failure symptoms.

**Critique**
This patient presents with heart failure due to diastolic dysfunction. The patient's symptoms of dyspnea with exertion create a broad differential diagnosis. The nocturnal cough suggests heart failure is a more likely cause. She has risk factors for heart failure by virtue of her age and history of systolic hypertension. Her electrocardiogram shows left ventricular hypertrophy. The echocardiogram shows normal systolic function and it is not uncommon for there to be no description of diastolic function parameters as in this case. However there were moderate mitral regurgitation and left atrial enlargement, findings consistent with elevated left ventricular filling pressures. When heart failure is chronic, the examination of the lung fields commonly does not reveal rales, due to dilation of pulmonary lymphatics. The patient never smoked and the prior diagnosis of chronic obstructive pulmonary disease is perhaps a misclassification of heart failure symptoms. An acute coronary syndrome would not present with worsening over 6 months. Pulmonary fibrosis is a possible diagnosis but less common than heart failure and would not explain the left-sided findings on the echocardiogram. The B-natriuretic peptide assay may have been helpful in establishing the diagnosis in this case. If the B-natriuretic peptide result was <100 pg/mL, the diagnosis would be unlikely to be heart failure. In this case the B-natriuretic peptide result would be expected to be in the 400 to 600 pg/mL range.

Management would include administration of a loop diuretic, the addition of an ACE inhibitor and β-blocker to her regimen, discontinuing prednisone with taper, and discontinuing the albuterol inhaler.
Cardiovascular Medicine: Question 11

The correct answer is C

Educational Objectives

Recognize the physiologic murmur that is related to pregnancy.

Critique

During normal pregnancy, the physical findings may mimic those of heart disease. An ejection systolic murmur is audible in more than 80% of normal pregnant women. An early peaking ejection systolic murmur is audible in more than 90% of normal pregnant women and is caused by a pulmonary outflow murmur. Left ventricular apical displacement is common because of the increase in blood volume that occurs during pregnancy. Later in pregnancy, apical displacement is accentuated as a result of cardiac displacement caused by increasing abdominal distension. Lower extremity edema is common during pregnancy and is caused by the increase in lower extremity venous pressure from the gravid uterus as well as the hormonal changes that occur during pregnancy. In a patient in this age group, aortic valve stenosis would most likely be caused by a bicuspid aortic valve, and an ejection sound may be noted with this murmur. An aortic outflow murmur is usually best heard over the aortic area. Pulmonary valve stenosis is also commonly associated with a pulmonary ejection sound that decreases in intensity with inspiration. In addition, the right ventricle may be palpable in a patient who has pulmonary valve stenosis. The murmur associated with mitral valve regurgitation is usually best heard at the apex. When associated with mitral valve prolapse, it often causes one or more systolic clicks. Aortic valve regurgitation is a diastolic murmur that does not correlate with the findings described in this patient.

Cardiovascular Medicine: Question 12

The correct answer is D

Educational Objectives

Understand the physiologic exercise training effect that occurs as a result of an exercise training program.

Critique

An exercise training effect is achieved with regular training at moderate intensity 3 to 5 days per week. The training effect is shown by the ability to attain higher peak levels of exercise at a similar peak heart rate, with blunting of the heart rate at submaximal levels of stress. This patient improved his metabolic equivalent level from 7 to 9 and attained a peak heart rate of 120/min during both tests. Therefore, the heart rate response curve shifted downward and is now blunted during submaximal levels of stress. Attainment of a heart rate of 120/min with symptoms of fatigue on both tests implies that the patient exerted similar levels of effort during both tests. Improvements in peak metabolic equivalent levels are usually caused by improvements in cardiac output as well as by increased extraction of oxygen at the peripheral levels (arteriovenous oxygen difference). The training effect is usually not caused by changes in pulmonary ventilation.
**Cardiovascular Medicine:Question 13**

The correct answer is B

**Educational Objectives**
Recognize the appropriate therapy for premature atrial contractions.

**Critique**
This patient is having benign cardiac arrhythmia in the form of premature atrial contractions (PACs). She has two possible contributing factors, stress and hypertension. As in many patients, her symptoms are episodic and have occurred previously. Reassurance is an appropriate first step, but because the patient has hypertension, starting therapy with a β-blocker is the most appropriate action. A β-blocker can suppress PACs and may reduce blood pressure and decrease the stimulus for PACs. A diuretic would be less useful because it does not suppress PACs, although it may help to control blood pressure. Hypokalemia caused by diuretic therapy may worsen symptoms. This patient has no indication of structural heart disease or ischemia, and further workup with electrophysiologic testing or exercise testing is not indicated. Antiarrhythmic therapy, such as disopyramide, is rarely used to treat benign PACs.

**Cardiovascular Medicine:Question 14**

The correct answer is A

**Educational Objectives**
Understand the pharmacologic treatment of chronic coronary artery disease.

**Critique**
Angiotensin-converting enzyme inhibitors reduce the incidence of cardiac events in patients who have coronary artery disease, independent of their effects on blood pressure and left ventricular function. Angiotensin receptor blockers do not have these effects and do not relieve the symptoms of angina, except indirectly, by reducing blood pressure. Digoxin does not relieve angina unless angina is being aggravated by rapid atrial fibrillation. Digoxin does not reduce the incidence of cardiac events or prolong life. Calcium channel blockers are excellent antianginal agents, although they do not reduce the incidence of cardiac events or prolong life.

**Cardiovascular Medicine:Question 15**

The correct answer is D

**Educational Objectives**
Recognize an innocent murmur and understand the indications for additional testing.

**Critique**
This patient likely has a flow murmur, an innocent murmur that reflects normal cardiac outflow without concomitant cardiac disease. Flow murmurs may be more prominent in young, thin patients, in whom heart sounds are well heard, and in athletes, in whom stroke volume may be increased. The decision to perform echocardiography is affected by the characteristics of the murmur and the presence of accompanying symptoms or signs. A late-peaking systolic murmur suggests left ventricular outflow obstruction, and further testing should be considered. In this patient, symptoms of dyspnea are not inappropriate if they occur only during extreme physical activity during which the patient likely exceeds the anaerobic threshold. A soft S3 is common in children and young adults and does not indicate underlying cardiac disease. Similarly, dynamic splitting of S1 is normal and does not suggest underlying disease. Murmurs of dynamic subvalvular left ventricular outflow obstruction associated with hypertrophic cardiomyopathy increase during Valsalva maneuver. Murmurs of aortic and pulmonic stenoses and those of mitral and tricuspid regurgitation diminish during Valsalva maneuver. The intensity of an innocent flow murmur also diminishes during Valsalva maneuver. Flow murmurs peak in the first half of systole.
**Cardiovascular Medicine:Question 16**
**The correct answer is B**

**Educational Objectives**
Recognize that low-molecular-weight heparin may require dose adjustment in renal insufficiency.

**Critique**
This patient with history of renal failure presents with non-ST-segment elevation acute coronary syndrome. Low-molecular-weight heparin, such as enoxaparin, is excreted by the kidneys. The optimal dosage of enoxaparin has not been established in patients with various degrees of renal insufficiency. Some investigators have recommended decreasing the dosage of enoxaparin to 0.64 mg/kg subcutaneously every 12 hours (instead of the typical 1 mg/kg) if the creatinine clearance is <30 mL/min. If this agent is used in patients with renal insufficiency, monitoring of anti-Xa activity is recommended. Unfractionated heparin is not contraindicated in renal insufficiency. Small molecule glycoprotein IIb/IIIa receptor inhibitors, such as tirofiban or eptifibatide, generally should be avoided in patients with a serum creatinine >4 mg/dL because these agents are cleared by the kidneys. The large molecule antibody fragment glycoprotein IIb/IIIa receptor inhibitor abciximab is not cleared by the kidneys, and this agent may be used in patients with renal failure. Antianginal medications, such as nitrates, β-blockers, and calcium antagonists, as well as oral antiplatelet agents, such as aspirin, clopidogrel, and ticlopidine, do not require dose adjustment in patients with renal failure.

**Cardiovascular Medicine:Question 17**
**The correct answer is B**

**Educational Objectives**
Recognize the side effects of angiotensin-converting enzyme inhibitors in patients who have heart failure as a result of left ventricular systolic dysfunction, and understand the treatment options.

**Critique**
This patient, although apparently responsive to therapy, has cough as a side effect of an angiotensin-converting enzyme (ACE) inhibitor. In the absence of significant pulmonary congestion or other acute bronchitic symptoms, the most common reason for ACE inhibitor intolerance is barking, nonproductive cough that disappears when the ACE inhibitor is discontinued. Although cough is the most common reason for intolerance, other side effects that might require discontinuation of an ACE inhibitor include angioneuropathic edema, problematic hyperkalemia, worsening renal function, and symptomatic orthostatic hypotension. In this case, initiating treatment with an angiotensin-receptor blocker is the preferred approach. The assertion that angiotensin-receptor blockers are as effective as ACE inhibitors in patients who have congestive heart failure with systolic left ventricular dysfunction is controversial. Angiotensin-receptor blockers are indicated in patients who cannot tolerate ACE inhibitors and have heart failure as a result of systolic left ventricular dysfunction, so treating with digoxin and carvedilol alone is suboptimal. Valsartan has been approved for this indication based on a subset analysis of a recent trial (ValHeft). Interestingly, approximately 80% of patients who cannot tolerate ACE inhibitors tolerate an angiotensin-receptor blocking agent. Resuming treatment with enalapril or initiating treatment with another ACE inhibitor may delay the initiation of potentially beneficial therapies, and most believe that ACE inhibitor cough is a generic side effect. Spironolactone is not indicated in this mildly symptomatic patient.
Cardiovascular Medicine:Question 18
The correct answer is D
Educational Objectives
Recognize the physical findings of patent ductus arteriosus.
Critique
Although left ventricular enlargement and the soft S3 are compatible with a diagnosis of mitral regurgitation, the location of the murmur and its persistence in diastole do not support this diagnosis. Moreover, with significant mitral regurgitation, the carotid upstrokes are rarely brisk because forward flow is reduced. In combined mitral valve disease, systolic and diastolic murmurs are heard, but are not continuous because they are separated by the isovolumic relaxation period. An opening snap should be audible. The finding of an 83 excludes the diagnosis of mitral stenosis. This patient’s murmur is best heard at the apex, and the diastolic component is rarely audible throughout the precordium. This location is compatible with a pulmonary valve murmur. However, this type of murmur typically causes right ventricular hypertrophy and dilation, with a prominent impulse at the right parasternal border. A systolic ejection click is common as well. P2 is rarely audible, and S3 is unusual. Patent ductus arteriosus causes a continuous murmur in the left parasternal location. Left ventricular volume overload is common, and an S3 gallop may occur as a result. In the absence of pulmonary hypertension, P2 is normal. Carotid pulses are brisk as a result of increased stroke volume, and pulse pressure is increased as a result of diastolic runoff into the pulmonary artery. This patient has no evidence of pulmonary hypertension. After the diagnosis is confirmed by echocardiography, she should be referred for closure of the patent ductus arteriosus.

Cardiovascular Medicine:Question 19
The correct answer is E
Educational Objectives
Recognize the treatment options for the prevention of diabetes.
Critique
In the Diabetes Prevention Project, a prospective randomized trial, a combination of regular exercise and a low-calorie, low-fat diet significantly decreased the incidence of new-onset diabetes in overweight patients who lost 7% of body weight and exercised regularly. β-Blockers may increase the likelihood of developing diabetes. Amlodipine does not affect the onset of diabetes. Diuretics may worsen glucose tolerance and do not decrease the onset of diabetes. In the HOPE study, ramipril, an ACE inhibitor, decreased the incidence of new-onset diabetes, but this patient would not have met inclusion criteria for HOPE.

Cardiovascular Medicine:Question 20
The correct answer is C
Educational Objectives
Recognize the appropriate management of a pregnant patient who has mitral valve stenosis.
Critique
This patient has progressive symptoms of mitral stenosis despite appropriate medical therapy. The treatment of choice is transesophageal echocardiogram to exclude left atrial thrombus and further assess the mitral valve apparatus, followed by percutaneous mitral balloon valvuloplasty. To minimize fetal radiation exposure, this procedure can be done with abdominal shielding. The procedure should be avoided during the first trimester. Cardiac surgery can be performed during pregnancy, but should be avoided unless
absolutely necessary. Because the patient is only 30 weeks’ pregnant, delivery of the fetus is not the ideal management option. Fetal echocardiography is usually reserved for evaluation of patients who have abnormal findings on obstetric ultrasound or a personal or family history of congenital heart disease. Mitral stenosis is usually an acquired form of valve disease that is related to rheumatic fever.

**Cardiovascular Medicine: Question 21**
**The correct answer is A**
**Educational Objectives**
Recognize the clinical presentation and evaluation of constrictive pericarditis.

**Critique**
This patient has constrictive pericarditis as a result of longstanding rheumatoid arthritis. The diagnosis was confirmed by the finding of characteristic changes on Doppler echocardiography. Constrictive pericarditis results in fixed cardiac volume with respiratory-dependent preferential filling of one ventricle over the other. Constrictive pericarditis is suspected when the signs and symptoms of heart failure are out of proportion to the degree of systolic dysfunction or valvular heart disease. Most patients who have constrictive pericarditis have a normal left ventricular ejection fraction. In this patient, it is important to exclude ischemia. Although the serum aminotransferase concentrations are elevated, the combination of left- and right-sided heart failure and the characteristic jugular venous findings suggest a cardiac rather than hepatic cause. Therefore, abdominal ultrasound and hepatitis serology would not be necessary in the initial evaluation of this patient. Pericardial calcification and pulsus paradoxus may be present in patients who have constrictive pericarditis; however, the findings are unremarkable or nonspecific in a significant number of patients.

**Cardiovascular Medicine: Question 22**
**The correct answer is B**
**Educational Objectives**
Recognize the electrocardiographic features of preexcitation (Wolff-Parkinson-White) conduction.

**Critique**
This patient has Wolff-Parkinson-White (WPW) syndrome. In affected patients, preexcitation is related to the presence of an accessory pathway that can carry electricity from the atrium to the ventricle by a route that bypasses the atrioventricular node. Accessory pathways straddle the atrioventricular groove on either the mitral or the tricuspid annulus. Like most patients with an accessory pathway, he has manifest preexcitation (delta waves on the electrocardiogram). In WPW syndrome, the sequence of ventricular activation is altered, depending on the anatomic site of the accessory conduction pathway. This alteration may cause pseudoventricular hypertrophy or pseudomyocardial infarction patterns on electrocardiogram. See figure.

The most common arrhythmia in WPW syndrome is atrioventricular reentrant tachycardia, where the pathway serves as one limb and the atrioventricular node serves as the second. The percentage of patients who have WPW syndrome and atrial fibrillation is difficult to determine, but some studies estimate that it may be as high as 8%. The overall incidence of sudden death in patients who have WPW syndrome is estimated at 0.15%, and most cases of sudden death are probably related to degeneration of rapid atrial fibrillation.

Given the association between symptomatic accessory pathways and sudden death, it would not be prudent to assume a benign mechanism for this patient’s syncope, such as benign supraventricular tachycardia or vasovagal syncope. Therefore, tilt-
table testing is not required. Unless physical examination shows an abnormality, echocardiography is not indicated. Cardiac MRI would be indicated to exclude right ventricular dysplasia if the ECG was normal or had changes consistent with this diagnosis such as a right bundle branch block or an “epsilon wave”. Exercise testing would be indicated if there was no manifest WPW and the syncope was exercise induced.

**Cardiovascular Medicine: Question 23**
The correct answer is A  
**Educational Objectives**
Understand the natural history of aortic stenosis and the nature and timing of intervention for aortic stenosis.  
**Critique**
This otherwise healthy patient has single-vessel coronary artery disease and severe calcific aortic stenosis. Because severe symptomatic aortic stenosis is associated with a poor 3- to 5-year prognosis, intervention is warranted. Percutaneous balloon aortic valvotomy is associated with a high rate of procedural complications and rapid restenosis, and is not a substitute for surgical aortic valve replacement. Severe symptomatic aortic stenosis is a relative contraindication to exercise testing, although exercise testing may be useful in asymptomatic patients who have moderate or severe aortic stenosis. Because aortic valve replacement is indicated, coronary stenosis should be treated at the time of surgery. Further evaluation of the right coronary artery stenosis is not warranted.

**Cardiovascular Medicine: Question 24**
The correct answer is D  
**Educational Objectives**
Understand the appropriate diagnostic tests in patients who have symptomatic congestive heart failure as a result of systolic left ventricular dysfunction.  
**Critique**
Identifying the cause of heart failure is critical because some disorders can be reversed or treated easily. An important example is heart failure caused by coronary artery disease and resulting in ischemia. This condition can be treated with percutaneous or surgical revascularization. Although this patient did not have an obvious myocardial infarction, he had flash pulmonary edema with chest pressure, which is often a manifestation of severe left ventricular ischemia. A patient who has diabetes may not have typical angina. Although this patient had no previous diagnosis of coronary artery disease, this problem is common, whereas diseases that are diagnosed by endomyocardial biopsy are not. Routine heart biopsy is discouraged in this setting. Further, routine ambulatory monitoring and signal-averaged electrocardiography are not recommended. Measurement of the natriuretic peptide level may be helpful when the cause of dyspnea is not clearly due to congestive heart failure, but in this patient there was clear evidence of heart failure. Exercise electrocardiography is likely to be abnormal, but findings will be non-specific and independent of the test results, a catheterization is indicated, If a stress test is performed, imaging would be preferred with appropriate modifications of the test to examine for myocardial viability.
Cardiovascular Medicine: Question 25
The correct answer is B
Educational Objectives
Understand the risk of cognitive defects after coronary artery bypass graft surgery.
Critique
Neurologic defects and cognitive deficits can occur after mechanical heart-lung bypass, although many patients have no obvious abnormalities on neurologic examination. Formal cognitive testing is indicated to detect, quantify, and document this patient’s problem for disability purposes. Coronary artery Doppler flow velocity is not indicated because the patient has no cardiac symptoms. Unless neurologic examination shows focal deficits, imaging of the brain is usually not helpful. An echocardiogram is not indicated in an asymptomatic patient unless physical examination shows left ventricular dysfunction. Although multiple small emboli to the brain could cause this patient’s cognitive deficits, carotid Doppler studies are likely to be low yield because the patient has no transient neurologic symptoms and no carotid artery abnormalities were found on physical examination. Minimally invasive approaches that permit surgery to be performed on the beating heart have been developed and are improving rapidly. Theoretically, these procedures should decrease the incidence of neurologic complications after bypass graft surgery associated with mechanical heart-lung bypass. It is less clear whether they will decrease the incidence of cerebral emboli as a result of aortic manipulation.

Cardiovascular Medicine: Question 26
The correct answer is D
Educational Objectives
Understand and apply an exercise prescription to a patient who takes cardioactive medications that may affect heart rate.
Critique
Because this patient is taking β-adrenergic blockers, it is expected that her heart rate will be lower at rest, during submaximal levels of exercise, and at peak exercise. Therefore, the generic formula used to estimate maximum heart rate (220 - age) does not apply to this patient. Exercise intensity can be prescribed more precisely with the heart rate reserve method derived from the resting and peak heart rates attained during an exercise test. Because this patient has at least three risk factors for coronary artery disease (age, obesity, and hypertension), an exercise test has the added benefit of providing screening for asymptomatic coronary disease. The efficacy of resistance training has not been well studied as a single exercise modality for weight loss. Neither the walking program nor the cycling program includes intensity, and both are prescribed only 2 days per week. Therefore, the weekly caloric expenditure during exercise is unlikely to be adequate to promote weight loss or other health benefits.

Cardiovascular Medicine: Question 27
The correct answer is C
Educational Objectives
Recognize the role of aggressive management of risk factors in patients who have peripheral arterial disease.
Critique
Current recommendations for the management of lipid disorders in patients with peripheral arterial disease (PAD) include achieving a serum LDL cholesterol level of less than 100 mg/dL. Other goals are to decrease the elevated triglyceride level and raise the decreased HDL cholesterol level. Recent data from the Heart Protection Study provided important new information about the role of reducing the LDL
cholesterol level in patients with PAD. This study enrolled more than 20,500 patients who were at high risk for cardiovascular events, including 6748 patients who had PAD. Treatment with simvastatin, 40 mg, was associated with a 12% reduction in the total mortality rate, a 17% reduction in the vascular mortality rate, a 24% reduction in the incidence of coronary artery disease events, a 27% reduction in the incidence of stroke, and a 16% reduction in the incidence of noncoronary revascularizations. The results were similar in the PAD subgroup, regardless of whether the patients had evidence of coronary disease at baseline. Thus, in this study, in patients with PAD, even without a history of myocardial infarction or stroke, aggressive reduction of the low-density lipoprotein cholesterol level was associated with a marked reduction in cardiovascular events (myocardial infarction, stroke, and vascular death). This study is the first large, randomized trial of statin therapy to show that aggressive lipid modification can significantly improve outcome in patients with PAD. Hypertension is an independent risk factor for PAD, and current guidelines support aggressive treatment of hypertension in patients with PAD, with a treatment goal of reducing blood pressure to <140/90 mm Hg. ACE inhibitors also show benefit beyond reducing blood pressure in high-risk groups. In a subgroup of 4046 patients with PAD from the HOPE study, there was a 22% reduction in risk for cardiovascular events in patients who received ramipril compared with placebo. This effect was independent of the reduction in blood pressure. Based on this finding, the US Food and Drug Administration has approved ramipril for its cardioprotective benefits in patients who are at high risk, including those with PAD. This patient should also be given antiplatelet therapy.

**Cardiovascular Medicine: Question 28**

**The correct answer is B**

**Educational Objectives**

Identify a patient who is at high risk for rupture of a thoracic aortic aneurysm.

**Critique**

This patient's back pain and the retrocardiac density that is seen on chest radiograph suggest the diagnosis of an aneurysm of the descending thoracic aorta. The presence of back pain is worrisome and warrants prompt diagnosis and therapeutic intervention, probably surgical. This patient has renal insufficiency, no evidence of rupture, a normal blood count, absence of pleural effusion, and normal blood pressure. A helical computed tomography scan is an excellent and rapid means of diagnosing a suspected thoracic aortic aneurysm, especially if rupture is suspected. However, given this patient's renal insufficiency, magnetic resonance angiography is the procedure of choice. Gadolinium, the contrast agent used for magnetic resonance angiography, is not nephrotoxic, whereas the iodinated contrast agents that are used for computed tomography scanning may result in contrast-induced nephropathy. Appropriate management in this patient includes admission to a monitored setting, achieving better control of blood pressure with up-titration of β-blocker therapy, and consideration of early surgery if the diagnosis of thoracic aortic aneurysm is confirmed. Cardiac catheterization is indicated if the patient has evidence of myocardial ischemia. Although back pain may be an anginal equivalent, the pattern is atypical with pain of 3 days duration. The troponin I level is not elevated, and the electrocardiogram shows no evidence of ischemia or new infarction. Acute coronary syndrome is less likely than an aneurysm, despite the patient's risk factors and history of myocardial infarction. The diagnosis of a thoracic aortic aneurysm with pain suggests that surgical intervention cannot be safely delayed. Therefore, a noninvasive study to exclude coronary ischemia, such as a dipyridamole perfusion scan, is not indicated for risk stratification before surgery.
Cardiovascular Medicine: Question 29

The correct answer is E

Educational Objectives

Assess and modify the risk of coronary artery disease in a healthy elderly woman.

Critique

This patient has significant risk factors for coronary artery disease (CAD). These risk factors include hypertension, an elevated fasting plasma glucose level that does not meet the criteria for diabetes, a mildly depressed HDL cholesterol level, and an elevated triglyceride level. She meets the criteria for metabolic syndrome. According to the Framingham scoring system, this patient's risk of having a CAD event over 10 years is 1% a year. A recent analysis of metabolic syndrome suggests a significant increase in CAD risk in these patients. Recent guidelines suggest the use of low-dose aspirin in patients who have a yearly CAD event risk rate >1.5%. The metabolic syndrome does not contribute to the risk score in the Framingham scoring system, but it is reasonable to consider this patient's annual risk as >1% because of factors that are not included in the calculation of her Framingham 10-year risk. Thus, it is reasonable to add low-dose aspirin for prophylaxis of vascular events. Some authorities advocate the use of folic acid for preventive therapy or for patients who have elevated plasma homocysteine levels, usually >12 mg/dL. However, current guidelines do not suggest the use of folic acid or B vitamins for routine primary prevention. In several very large studies, including HOPE, the Heart Protection Study, and an Italian postinfarction trial (GISSI-P), antioxidant vitamins, such as vitamins E and C, did not reduce vascular risk. Although the Heart Protection Study showed a clinical benefit of simvastatin in patients who had diabetes without vascular disease, this patient does not meet the criteria for diabetes. In TexCAPS-AFCAPS, a study of a healthy population with mild dyslipidemia and a low HDL cholesterol level, baseline LDL cholesterol levels were higher than in this patient. Thus, a statin is not indicated as her LDL level is already at what would be a target level.

Cardiovascular Medicine: Question 30

The correct answer is B

Educational Objectives

Determine the appropriate treatment for a pregnant patient who has mitral stenosis and sinus rhythm.

Critique

This patient has symptoms of mitral stenosis as a result of the increases in blood volume and cardiac output that are associated with pregnancy. Most of these medications are reasonable choices for use in patients who have progressive symptoms of mitral stenosis. Given the low risk of embolic events in presence of sinus rhythm and the safety issues associated with the use of anticoagulation during pregnancy, warfarin should not be initiated. Adequate control of the heart rate with a β-blocker would be the first-line treatment in this patient. If symptoms persist, diuretics should be added to the regimen. Digoxin is unlikely to significantly improve the current symptoms. Ramipril and other angiotensin-converting enzyme inhibitors as well as angiotensin receptor blockers are contraindicated in pregnancy because of their teratogenic potential. Amlodipine, which is used to treat hypertension and angina, would have little effect on the symptoms of mitral stenosis in pregnancy and may actually worsen the symptoms because of its potential to increase heart rate.
**Cardiovascular Medicine:Question 31**
The correct answer is D

**Educational Objectives**
Recognize that anemia is a secondary cause of acute coronary syndrome.

**Critique**
The majority of acute coronary syndrome cases are caused by atherosclerotic coronary artery disease involving plaque rupture, formation of platelet and fibrin thrombi, and release of locally-active vasoactive substances. A minority of cases are triggered by a precipitating condition that is extrinsic to the coronary arteries, such as hypotension, hypoxemia, anemia, tachycardia, or thyrotoxicosis. In this case, the patient developed severe anemia, possibly from diverticulosis. The patient is diagnosed with a non-ST-segment elevation myocardial infarction with enzymatic evidence of myocyte necrosis and no frank ST-segment elevation. Management should first be aimed at correcting the severe anemia with erythrocyte transfusion. After stabilization, a stress test may be appropriate to assess the extent of stress-induced myocardial ischemia. Coronary angiography may be considered in cases of extrinsic acute coronary syndrome, particularly in patients with ST-segment elevation who likely have severe atherosclerotic coronary artery disease.

In this case, urgent coronary angiography is not indicated because the patient does not have ST-segment elevation or persistent ST-segment depression. If ST-segment depression persists after correction of the anemia, coronary angiography may be indicated. It should be realized that percutaneous coronary intervention typically is not performed in patients who are actively bleeding, because the administration of antiplatelet and antithrombotic agents is contraindicated if active bleeding is present. Similarly, administration of antiplatelet (such clopidogrel or tirofiban) and antithrombotic (such as heparin) agents should be avoided in patients with active bleeding. Intravenous nitroglycerin is not recommended in cases of extrinsic acute coronary syndrome. As the next step in this case, it is not appropriate to perform a stress test until the anemia is corrected. Prior to stress testing, it should also be shown that there is no ongoing myocardial necrosis, demonstrated by falling levels of creatine kinase.

**Cardiovascular Medicine:Question 32**
The correct answer is D

**Educational Objectives**
Recognize the treatment options for atrial fibrillation.

**Critique**
Risk factors for stroke in patients who have atrial fibrillation include a history of stroke, a history of myocardial infarction, a history of hypertension, age older than 65 years, and diabetes. Echocardiographic findings of left ventricular dysfunction and left atrial enlargement are additional risk factors. Because this patient has multiple risk factors for stroke, anticoagulation is indicated. The decision as to whether to pursue sinus rhythm must be made. Recent data suggest that clinical outcomes are similar in patients who are treated to achieve sinus rhythm compared with those who receive maintenance therapy for rate control and anticoagulation. Amiodarone may provide rate control but may also result in pharmacologic cardioversion. Therefore, initiating amiodarone therapy in the absence of established, effective anticoagulation is inappropriate. Aspirin does not provide adequate protection against thromboembolic events. Amlodipine has no effect on ventricular rate in atrial fibrillation.
Cardiovascular Medicine:Question 33
The correct answer is D
Educational Objectives
Recognize and understand treatment of anthracycline cardiomyopathy.
Critique
This patient presents with anthracycline-induced cardiomyopathy and new-onset heart failure. She should not receive any further anthracycline-based chemotherapy. Continued exposure can lead to further deterioration in ventricular function and death. The time course of presentation, the normal echocardiogram prior to the start of chemotherapy, and the lack of risk factors for other forms of cardiomyopathy make doxorubicin-induced cardiomyopathy the most likely cause for her left ventricular systolic dysfunction. Doxorubicin cardiomyopathy can occur at doses below 450 mg/m².
Treatment includes switching to a nonanthracycline chemotherapy regimen and the initiation of both ACE inhibitor and, once the patient is no longer volume overloaded, β-blocker therapy. The patient still has Hodgkin’s disease which requires an alternative chemotherapeutic regimen.

Cardiovascular Medicine:Question 34
The correct answer is B
Educational Objectives
Manage triggers of recurrent pericarditis.
Critique
This patient has recurrent pericarditis, which is associated with several systemic diseases, including autoimmune diseases, chronic uremic syndrome, and neoplastic processes. Treatment of the underlying disease may affect the recurrence of pericarditis. Corticosteroid therapy for the treatment of pericarditis is also associated with relapsing pericarditis. Recurrence often occurs as the corticosteroid dosage drops below a certain threshold, and weaning these patients can be problematic. Often, high-dose nonsteroidal anti-inflammatory drugs and colchicine can aid in this process. Long-term administration of colchicine, 0.5 mg once or twice daily, is helpful in preventing recurrence of pericarditis. Because this patient is asymptomatic, she does not need the analgesic benefits of nonsteroidal anti-inflammatory drugs. Pericardiectomy is reserved for patients with refractory pericarditis that has not responded to all options for medical management.

Cardiovascular Medicine:Question 35
The correct answer is C
Educational Objectives
Know the appropriate management of a patient who has Marfan syndrome.
Critique
With a family history of a catastrophic aortic complication and evidence of aortic dilation, this patient has a high likelihood of having Marfan syndrome. Treatment with a β-blocker is indicated to slow the rate of dilation. Although the original studies were done with propranolol, there is no evidence that one β-blocker is superior to others. This patient’s echocardiogram should be repeated yearly until the diameter of the aorta reaches 4.5 cm. At that point, echocardiography should be repeated every 6 months.
A calcium channel blocker can be substituted if the patient cannot tolerate a β-blocker. The current recommendation is to replace the aortic root when the diameter exceeds 5.5 cm. Because this patient’s aortic diameter is 4.1 cm, prophylactic aortic root replacement is not recommended, even with his family history of probable dissection.
**Cardiovascular Medicine:Question 36**
The correct answer is A

**Educational Objectives**
Assess the risk of coronary artery disease in a healthy obese woman.

**Critique**
A standard fasting lipid profile should be done in this patient. This patient may have metabolic syndrome, which is a risk factor for coronary artery disease. The NCEP-ATP III criteria for metabolic syndrome include the presence of three or more specific risk factors, which include abdominal obesity as assessed by waist circumference; triglyceride level >150 mg/dL; HDL cholesterol level <50 mg/dL in women; blood pressure >130/85 mm Hg; and fasting glucose level >110 mg/dL. This patient has abdominal obesity and high blood pressure. If she also has elevated serum triglycerides, low serum HDL, or a fasting plasma glucose >110 mg/dL, she would meet the criteria for metabolic syndrome.

If she does meet these criteria, an aggressive lifestyle approach is indicated, including adherence to the NCEP-ATP III lifestyle diet, weight loss, and regular physical activity. Lipid-modifying therapy also might be appropriate, depending on the levels of various lipoproteins. Currently, postprandial plasma glucose is not used to assess patients for the presence of metabolic syndrome or diabetes; however, such measurement is part of the standard evaluation. Elevated postprandial triglyceride is associated with increased vascular risk, but this test is not recommended as part of the routine screening for risk of coronary artery disease. Exercise testing, with or without nuclear or echocardiographic imaging, is not recommended as a screening tool for primary prevention of coronary artery disease. C-reactive protein can be a useful adjunctive test in patients who are in an intermediate category of cardiovascular risk (that is, 10% - 20% over 10 years) by the Framingham risk score. Thus, the first step is to measure LDL and risk stratify according to those criteria.

**Cardiovascular Medicine:Question 37**
The correct answer is C

**Educational Objectives**
Understand the factors that determine myocardial oxygen supply and demand.

**Critique**
The myocardium extracts almost all the oxygen presented to it. To meet increased demand for oxygen, coronary blood flow must rise. In healthy persons, this increase is produced largely by coronary vasodilation; however, patients who have extensive coronary artery disease have endothelial dysfunction and do not autoregulate adequately. Thus, they become more dependent on perfusion pressure across the coronary bed, which is largely determined by blood pressure. Low blood pressure can exacerbate angina in patients who have severe coronary disease. Decreasing the dosage of two vasodilator drugs may increase the blood pressure sufficiently to improve the angina. Increasing the dosage of the β-blocker is an option with the heart rate at 70/min, but adding more β-blockers would exacerbate hypotension. Adding a heart rate-lowering calcium channel blocker would not be helpful in this case because it would further reduce blood pressure. Increasing the dosage of the two vasodilator drugs would exacerbate hypotension.
Cardiovascular Medicine: Question 38
The correct answer is D

Educational Objectives
Recognize peripartum cardiomyopathy.

Critique
The findings on physical examination, the patient’s age, and the absence of other remarkable findings on physical examination make peripartum cardiomyopathy the most likely diagnosis. This condition usually occurs during the last trimester of pregnancy or the first 6 months postpartum. Pharmacologic management includes the usual medications for congestive heart failure, with the exception of ACE inhibitors and angiotensin receptor blockers. These medications are contraindicated in pregnancy because of their teratogenic potential. Delivery is recommended because it decreases the volume load, improves ventricular function, and simplifies the medical management of congestive heart failure. Unless there are obstetric reasons to consider cesarean delivery, the mode of delivery should be vaginal because it is associated with a lower hemodynamic burden. The risk of peripartum cardiomyopathy is increased in black women, women with multiple gestations, multiparous women, women older than 30 years of age at the time of pregnancy, and women with a history of peripartum cardiomyopathy.

Cardiovascular Medicine: Question 39
The correct answer is E

Educational Objectives
Understand the benefit of an aldosterone antagonist in treating systolic dysfunction heart failure.

Critique
Aldosterone receptor blockade with spironolactone has been demonstrated to reduce mortality in patients with heart failure due to systolic dysfunction who had symptoms at rest in the prior 2 months. The RALES trials evaluated spironolactone added to a standard heart failure medical regimen in patients over the age of 65 years. This trial demonstrated a 27% reduction in mortality. There was also a reduction in heart failure hospitalization. The calcium channel blocker amlodipine was evaluated in two trials in heart failure and did not improve clinical outcome. Digoxin was neutral with regards to mortality. Studies of magnesium in patients with heart failure and those with acute myocardial infarction have been neutral as well. Nitrates were studied in combination with hydralazine in heart failure with a marginal mortality reduction. Nitrates have not been shown to reduce mortality when used without hydralazine. Spironolactone should be started at low dose (12.5mg or 25mg daily) and with close monitoring of renal function and serum electrolytes. Caution should be used in patients with renal insufficiency. Hyperkalemia can be a problem.

Cardiovascular Medicine: Question 40
The correct answer is E

Educational Objectives
Understand the various degrees of conduction abnormalities and heart block.

Critique
The electrocardiogram in option E shows clear evidence of complete heart block, with complete dissociation between atrial and ventricular activity. This finding warrants permanent pacemaker insertion. Option A shows sinus rhythm with a marked (350 msec) first-degree atrioventricular block. This finding is not likely to be related to her symptoms. Although option B shows a 1.2 second pause, it is clearly related to a nonconducted premature atrial complex that does not conduct to the ventricle; it does not represent pathologic block and is unlikely to be symptomatic.
Option C shows classic type I second-degree atrioventricular block. Option D shows a minimally premature atrial complex that does not conduct to the ventricle. The next beat is a junctional complex and occurs before the subsequent sinus discharge arises. This occurrence does not represent heart block. The sinus P wave is seen immediately after the QRS complex.

**Cardiovascular Medicine: Question 41**
**The correct answer is D**
**Educational Objectives**
Select the appropriate management for a high-risk patient with elevated troponin levels with acute coronary syndrome.

**Critique**
This patient has several clinical features consistent with high-risk acute coronary syndrome. She has six of the seven following TIMI risk score prognostic variables: age ≥ 65 years, ≥ 3 traditional risk factors for coronary artery disease, documented coronary disease with ≥ 50% coronary artery diameter stenosis, ST-segment deviation, ≥ 2 anginal episodes within the last 24 hours, aspirin use within the last week, and elevated cardiac biomarkers. Patients with five or more such variables are characterized as having high-risk acute coronary syndrome. Studies have shown that such patients have better outcomes with an early invasive management approach, involving intravenous glycoprotein IIb/IIIa receptor inhibitors and coronary angiography within 48 hours, rather than medical stabilization and risk stratification with noninvasive stress testing. The purpose of early coronary angiography is to determine whether the patient is a suitable candidate for percutaneous coronary intervention (typically with stenting) or coronary artery bypass graft surgery. In addition to early referral for invasive coronary angiography, medical therapy includes heparin and a small molecule glycoprotein IIb/IIIa receptor antagonist (such as tirofiban or eptifibatide). Studies have demonstrated that the combination of small molecule GP IIb/IIIa antagonists with heparin is superior to heparin alone for patients with acute coronary syndromes and elevated troponins, those with dynamic ST-segment abnormalities, and those undergoing percutaneous coronary intervention.

**Cardiovascular Medicine: Question 42**
**The correct answer is D**
**Educational Objectives**
Understand the application of resistance training as part of a program of endurance training in a patient who has modifiable cardiovascular risk factors.

**Critique**
This patient has three cardiovascular risk factors that may be improved by a program of regular endurance training. These factors are obesity, hypertension, and impaired glucose tolerance. Therefore, an endurance training program is indicated for this patient. The cardiovascular risks associated with resistance training are low; however, data are limited regarding the benefits of resistance training in modifying these cardiovascular risk factors. Resistance training can improve strength and increase muscle tone and mass. Weight training should not be discouraged, but a combined program of endurance and resistance exercise offers the greatest potential benefit. Although exercise testing may be useful in this patient, he has no history or factors that require discontinuation of exercise until an exercise test is performed.
Cardiovascular Medicine: Question 43
The correct answer is B
Educational Objectives
Identify the appropriate management of a patient who has a ventricular septal defect.

Critique
The finding on echocardiogram of a small ventricular septal defect without evidence of left-sided volume overload suggests that the shunt is small (Qp:Qs < 1.8:1, where Qp is pulmonary blood flow and Qs is systemic blood flow). Surgical closure of the ventricular septal defect is not indicated. This patient has essentially no risk of pulmonary vascular disease as a result of the shunt. His only risk is for endocarditis, and he should receive antibiotic prophylaxis.

According to American Heart Association guidelines, patients who have small ventricular septal defects should have antibiotic prophylaxis during procedures associated with bacteremia. In a recent study, four episodes of endocarditis occurred among 222 patients who were followed for a mean of 8 years. One episode was related to a coexisting bicuspid aortic valve and another to mitral valve prolapse. Surgical or percutaneous closure of the ventricular septal defect is not indicated. Few studies report the results of percutaneous closure of ventricular septal defects. Most percutaneous closures are performed for muscular ventricular septal defects.

This patient has no indication for administration of an angiotensin-converting enzyme inhibitor, although this treatment would be a reasonable choice if hypertension develops.

Cardiovascular Medicine: Question 44
The correct answer is C
Educational Objectives
Recognize the role of medical management of claudication in patients who have peripheral arterial disease.

Critique
The most effective medical treatment for claudication is a supervised exercise program, as shown in more than 20 randomized trials. Exercise improves treadmill walking distance by more than 100%. It also improves quality of life and functional capacity. An exercise program to improve claudication provides clinical benefits that are comparable to those of surgical bypass therapy, and may provide greater benefits than angioplasty. A meta-analysis of randomized trials of exercise training showed a net treatment effect of 179 m on the treadmill (CI, 60-298 m). This degree of improvement may permit longer walking distances on level ground.

The two drugs that are approved for treating claudication are pentoxifylline and cilostazol. A meta-analysis concluded that pentoxifylline produced modest increases in treadmill walking distance over placebo, but overall clinical benefits were questionable. Cilostazol produced an average 50% improvement in walking distance over placebo. In four trials of 1534 patients, cilostazol, 100 mg twice daily, improved both pain-free and maximal walking distance compared with placebo.

Cardiovascular Medicine: Question 45
The correct answer is D
Educational Objectives
Recognize the importance of prescribing an angiotensin-converting enzyme inhibitor or an angiotensin receptor blocker to treat hypertension in a patient with diabetes.

Critique
This patient has two risk factors that favor the use of an angiotensin-converting enzyme (ACE) inhibitor or possibly an angiotensin receptor blocker (ARB): diabetes...
mellitus and an elevated serum creatinine. The HOPE trial in diabetics (MICRO-HOPE) and other data in patients with hypertension show the benefit of an ACE inhibitor for reducing the incidence of vascular events in patients with diabetes. The LIFE trial showed a reduction in the incidence of clinical events in patients with hypertension and diabetes who were treated with losartan (an ARB) compared with those who were treated with atenolol. Furthermore, both of these classes of agents have been shown to slow the progression of renal disease in patients with diabetes and proteinuria. There has been no progressive trial comparing the two classes of agents. Because they may sometimes worsen the serum creatinine level they must be initiated carefully in patients who have azotemia. Dihydropyridines are effective antihypertensive drugs and reduce the risk of stroke. However, there is no mandate to use these agents as first-line therapy. Both β-blockers and calcium channel blockers are appropriate agents for use in patients with diabetes, but not as first-line therapy. Similarly, randomized trials strongly support the efficacy of thiazide diuretics in patients with hypertension (ALLHAT); however, these agents offer no specific benefits in patients with diabetes. Clonidine offers no vascular or renal protection.

Cardiovascular Medicine: Question 46
The correct answer is E
Educational Objectives
Understand the long-term pharmacotherapeutic strategies for patients who have stable congestive heart failure as a result of left ventricular systolic dysfunction.

Critique
This patient has two clear indications for long-term β-blocker therapy: previous myocardial infarction and heart failure as a result of left ventricular systolic dysfunction. Diabetes is not a contraindication to the use of β-blockers in this patient. β-Blockers have been well studied in many patients with heart failure. One of the well-studied drugs, such as long-acting metoprolol, carvedilol, or bisoprolol, should be started at a low dose and then increased by doubling the dose every few weeks or months until the target dosage defined by clinical trials is reached. There is no indication to increase the atorvastatin dosage because the LDL cholesterol level is at the target level of <100 mg/dL for a patient with coronary artery disease. Although her HDL cholesterol level is low, it is unlikely that a higher dose of atorvastatin will raise this level. Spironolactone is not indicated in mildly symptomatic patients; the RALES trial showed benefit in class III/IV patients. In this asymptomatic patient with previously demonstrated inoperable coronary artery disease, there is little to be gained from a stress test. Likewise, repeat echocardiography in the absence of symptomatic deterioration would not affect therapy.

Cardiovascular Medicine: Question 47
The correct answer is B
Educational Objectives
Understand the volume overload that is associated with atrial septal defect in a pregnant patient.

Critique
The patient has a parasternal lift and fixed splitting of S2. These findings are consistent with an atrial septal defect associated with volume overload. A systolic murmur noted in the pulmonary area is related to an increase in pulmonary blood flow. The location and quality of this murmur are indistinguishable from a physiologic murmur. However, a physiologic murmur that is noted during pregnancy is not usually associated with a parasternal impulse or fixed splitting of S2. A pulmonary
stenosis murmur typically has a different location. In addition, pulmonary valve stenosis would not cause an ejection click or fixed splitting of. Mitral valve stenosis and aortic valve regurgitation are diastolic murmurs, and this patients findings are not consistent with a diastolic murmur.

Cardiovascular Medicine:Question 48
The correct answer is E
Educational Objectives
Understand the application of coronary artery bypass graft surgery in patients who have coronary artery disease.

Critique
Therapy with a statin or an ACE inhibitor will not alleviate this patients angina. The addition of long-acting nitrates could help, but this patient has several features that suggest that revascularization would provide the greatest benefit. These features include diabetes, reduced left ventricular function, and multivessel disease. Percutaneous transluminal coronary angioplasty (PTCA) would be likely to provide early success. However, the BARI trial compared PTCA without stenting with coronary artery bypass graft surgery and found a higher long-term mortality rate in patients with diabetes who underwent PTCA compared with coronary artery bypass graft surgery. The ARTS trial suggests that, even with stenting, coronary artery bypass graft surgery offers an advantage in patients who have diabetes.

Cardiovascular Medicine:Question 49
The correct answer is C
Educational Objectives
Recognize the clinical presentation and initial management of hypertrophic cardiomyopathy.

Critique
This patient has the classic symptoms of obstructive hypertrophic cardiomyopathy. In a patient who has angina, dyspnea, or presyncope, the treatment of choice is pharmacologic agents that have negative inotropic and chronotropic properties. These agents include β-blockers, verapamil, diltiazem, and disopyramide. Pure vasodilators, such as nitrates, dihydropyridine class calcium channel antagonists, and angiotensin-converting enzyme inhibitors, are likely to exacerbate the severity of the obstruction by reducing afterload. Likewise, decreasing preload with a diuretic can worsen the obstruction. Surgical or catheter-based septal debulking provides symptomatic relief in patients who have hypertrophic cardiomyopathy with obstruction. However, pharmacologic therapy is often successful and does not have the inherent risks associated with invasive procedures. Septal myectomy and alcohol septal ablation are reserved for patients who do not respond to pharmacologic treatment.

Cardiovascular Medicine:Question 50
The correct answer is A
Educational Objectives
Recognize the appropriate diagnostic evaluation of palpitation.
Cardiovascular Medicine: Question 51
The correct answer is E
Educational Objectives
Treat a patient who has rheumatic mitral stenosis.

Critique
This patient has severe mitral stenosis (mitral valve area <1.0 cm²) and New York Heart Association functional class III symptoms. Intervention is warranted with percutaneous balloon mitral valvotomy, if feasible. If the anatomy is not favorable for percutaneous balloon mitral valvotomy, surgical intervention is indicated. Although the valve anatomy in this patient is favorable for percutaneous balloon mitral valvotomy, severe mitral regurgitation is a contraindication to percutaneous intervention. Anticoagulation is indicated in patients who have mitral stenosis and atrial fibrillation or a previous thromboembolic event. Therapy with digoxin is not indicated in the absence of atrial fibrillation or left ventricular systolic dysfunction.

Cardiovascular Medicine: Question 52
The correct answer is A
Educational Objectives
Recognize the embolic potential of aortic atheroma.

Critique
The patient has evidence of peripheral embolization with blue toe syndrome. The most likely sources of embolization are the heart and aorta. Acute anticoagulation is indicated, and long-term anticoagulation is appropriate to reduce the risk of recurrence. Transesophageal echocardiography has a high rate of sensitivity for detecting cardiac sources of emboli, including patent foramen ovale, left atrial thrombus, intracardiac tumors, and atheromatous debris of the thoracic aorta. This patient had a mobile plaque identified in the descending thoracic aorta and was receiving long-term anticoagulation therapy. In a patient who has evidence of vascular disease, it is reasonable to test for diabetes and to initiate treatment with an angiotensin-converting enzyme inhibitor. However, the reason for this patient’s blue toe must be identified, and anticoagulation is indicated. Because the distal pulses are normal, the blue toe is not likely to be caused by aortoiliac occlusive disease. Aortography is unlikely to show mobile thrombi, but is indicated if a transesophageal echocardiogram does not provide adequate diagnostic information. A limitation of transesophageal echocardiography is that the abdominal aorta is poorly visualized. Carefully directed surface ultrasound of the abdominal aorta may show mobile thrombi. Most hypercoagulable syndromes cause venous rather than arterial thrombosis. Therefore, because long-term anticoagulation is indicated, it is not necessary to obtain levels of antiphospholipid antibodies, lupus anticoagulant, homocysteine, and protein C. Because warfarin will not provide effective anticoagulation for approximately 1 week, this patient requires immediate anticoagulation with heparin.

Cardiovascular Medicine: Question 53
The correct answer is D
Educational Objectives
Understand the role of anticoagulation in patients with heart failure and paroxysmal atrial fibrillation.

Critique
Patients with heart failure and paroxysmal atrial fibrillation are at increased risk for systemic embolization and anticoagulation is recommended long term. Even though clinically normal sinus rhythm has been established, these patients remain at
increased risk for recurrent atrial fibrillation and systemic embolization. Amiodarone is a class III antiarrhythmic agent but differs from other drugs in this class in having a sympatholytic effect on the heart. This agent has been reasonably well tolerated in heart failure and reduces the recurrence rate of atrial fibrillation. Type I antiarrhythmic agents like procainamide has been shown to increase sudden death in patients with heart failure. The strategy of converting heart failure patients to sinus rhythm (rhythm control) has not been demonstrated to be superior to anticoagulation and rate control, but patients with heart failure and atrial fibrillation have not been adequately studied. The Atrial Fibrillation Follow-up Investigation of Rhythm Management (AFFIRM) was designed to compare these two strategies: rhythm control versus rate control. There was no survival benefit to the rhythm control strategy. In patients converted to sinus rhythm with antiarrhythmics in whom anticoagulation was discontinued, a significant rate of systemic embolization was observed. In this patient who was symptomatic during episodes of atrial fibrillation, it is not unreasonable to continue amiodarone along with long-term anticoagulation. Atrial fibrillation ablation is rapidly evolving but since the patient has had no recent atrial fibrillation recurrences on amiodarone, ablation would not be recommended at this point in time.

**Cardiovascular Medicine:Question 54**
**The correct answer is A**

**Educational Objectives**
Recognize the role of primary angioplasty in the management of cardiogenic shock.

**Critique**
This patient is admitted with cardiogenic shock due to ST-segment elevation acute myocardial infarction. Patients with cardiogenic shock have an in-hospital mortality rate of roughly 50%. The single most important intervention involves establishing patency of the infarct-related artery. In such patients, immediate reperfusion therapy with primary angioplasty is superior to fibrinolysis. It is believed that there is insufficient blood flow to deliver the fibrinolytic agent to the coronary occlusion. In a randomized trial of patients with cardiogenic shock due to acute myocardial infarction, those assigned to an immediate angioplasty strategy had better outcomes than those assigned to medical therapy, which included thrombolysis and intra-aortic balloon counterpulsation (IABP).

IABP is a useful adjunctive measure in patients with cardiogenic shock. The IABP may be placed at the time of coronary angiography and angioplasty. However, IABP should be as an adjunctive therapy in addition to immediate reperfusion therapy of the culprit vessel. Nitroglycerin, β-blockers, and ACE inhibitors should be withheld for patients with cardiogenic shock.

**Cardiovascular Medicine:Question 55**
**The correct answer is A**

**Educational Objectives**
Recognize the role of revascularization therapy for claudication in patients who have peripheral arterial disease.

**Critique**
Angioplasty, with or without stenting, has been evaluated in the iliac and femoral popliteal arteries. Although the initial rate of technical success is high (>90%), the durability of angioplasty, with or without stenting, is far greater in the iliac arteries. The best success rates (5-year patency rates of ≤80%) are achieved with short lesions. Stents appear to have the greatest utility in the management of technical problems that occur during angioplasty, such as dissections in the external iliac arteries. However, stents do not show improved global patency with routine use.
Angioplasty has a mortality rate of less than 0.5%. Surgery for claudication usually involves two operations, aortofemoral bypass and femoral above-knee popliteal bypass. Aortofemoral bypass has the greatest utility in claudication. It is a single procedure that bypasses diffusely diseased iliac arteries and has excellent durability in older patients (80% patent at 10 years). However, these procedures are associated with a mortality rate of 3% to 5%. The incidence of graft infection is 1%. The therapy for graft infection is associated with a mortality rate of ≤40%. Aortic surgery is associated with significant morbidity, and older patients may take months to recover completely. Femoral popliteal bypass is less durable (50% to 60% patent at 5 years) and less applicable. Bilateral bypasses are often required because unilateral infrainguinal disease is unusual. Operative mortality rates of ≤3% are typical when the procedure is used to treat claudication. For prosthetic use, the rate of graft infection is 1% to 2%. In addition, this procedure is more likely to lead to limb threat after graft failure.

**Cardiovascular Medicine:Question 56**

**The correct answer is D**

**Educational Objectives**

Recognize the clinical correlates associated with atrial fibrillation.

**Critique**

Recent data suggest that clinical outcomes are similar in patients who are treated to achieve sinus rhythm compared with those who receive maintenance therapy for rate control and anticoagulation. In many patients, atrial fibrillation is well controlled with anticoagulation and medications that slow atrioventricular node conduction. The prevalence of atrial fibrillation increases with age and affects fewer than 1% of people younger than age 60 and more than 6% of those older than 80 years. The age-adjusted prevalence is higher in men than in women, and blacks appear to be at lower risk than whites. Atrial fibrillation is commonly associated with cardiovascular disease. Atrial fibrillation in the absence of cardiovascular disease or hypertension is relatively uncommon, affecting fewer than 12% of all patients with atrial fibrillation. The incidence of atrial fibrillation is age- and sex-related. It is less than 0.1% per year in people younger than 40 years, greater than 1.5% per year in women older than 80 years, and more than 2% per year in men older than 80 years. The stroke rate in patients who have nonrheumatic atrial fibrillation is approximately 5% per year. This rate is two to seven times the rate in people who do not have atrial fibrillation.

**Cardiovascular Medicine:Question 57**

**The correct answer is C**

**Educational Objectives**

Recognize the increased vascular risk that is associated with mild chronic renal disease.

**Critique**

An elevated serum creatinine level would indicate that this patient is at increased vascular risk. Many recent reports show an increase in coronary artery disease-related morbidity and mortality rates in patients with proteinuria or mild creatinine elevations. The reasons for this association are not clear. The lipid profile is unremarkable, at a NCEP-ATP III target of LDL cholesterol level <130 mg/dL. The glycosylated hemoglobin level is not elevated into the diabetic range. Some studies show an association between elevation of serum uric acid level and significant vascular risk, but no evidence suggests benefit from lowering the uric acid level.
Cardiovascular Medicine: Question 58
The correct answer is C
Educational Objectives
Understand the risk of repeated pregnancies in a patient who has peripartum cardiomyopathy.

Cardiovascular Medicine: Question 59
The correct answer is D
Educational Objectives
Know the management of a patient who has Eisenmenger’s syndrome and secondary erythrocytosis.

Critique
This patient has Eisenmenger’s syndrome as a result of an unrepaired ventricular septal defect and associated secondary erythrocytosis. Although the patient’s symptoms suggest hyperviscosity, they may be caused by iron deficiency rather than by the elevated hematocrit of 54%. The microcytic erythrocytes that are associated with iron deficiency are rigid and not easily deformed. Therefore, viscosity increases paradoxically at a lower hematocrit value. In adults with cyanosis, iron deficiency is associated with stroke. Therefore, the appropriate treatment for this patient is iron replacement at a dose of 325 mg/d for 7 to 10 days until the blood count starts to increase. Further phlebotomy is contraindicated and may lead to rebound erythrocyte production and increased iron deficiency.

Phlebotomy is indicated in a patient who has symptoms of hyperviscosity (headache, fatigue, difficulty concentrating), a hematocrit of > 65%, and no evidence of iron deficiency. Isovolumic saline replacement is indicated at the time of phlebotomy. Oxygen therapy is unlikely to provide significant benefit in most patients who have Eisenmenger’s syndrome. However, supplemental oxygen should be provided during air travel and may be beneficial in patients who live at high altitudes. Sleep apnea may complicate Eisenmenger’s syndrome and is common in patients who have Down syndrome. These patients may benefit from nocturnal oxygen supplementation and continuous positive airway pressure.

Echocardiography provides adequate definition of the patient’s anatomy. In this patient, it shows evidence of right ventricular hypertrophy. This patient cannot undergo surgery because of the severity of pulmonary hypertension. Cardiac catheterization is indicated if the echocardiographic results are ambiguous and if right ventricular outflow tract obstruction cannot be confirmed. If significant right ventricular outflow tract obstruction occurs, the patient may be a surgical candidate. This patient’s hematologic profile is consistent with cyanotic heart disease. Mild thrombocytopenia is common, and further evaluation with bone marrow biopsy is not needed.

Cardiovascular Medicine: Question 60
The correct answer is A
Educational Objectives
Understand the significance of electron-beam computed tomography coronary calcium scores.

Critique
Although a score of 40 may represent the 80th percentile in women who have coronary disease at this age, it does not mean that this patient has an 80% chance of having coronary disease. Scores <100 have a low likelihood of representing occlusive coronary disease. Scores of 100 to 300 indicate intermediate risk, and those >300 indicate higher risk. The positive predictive value of the coronary calcium score for subsequent cardiac events is <15%, and the value of this measurement
beyond a conventional assessment of risk factors is unclear. Exercise electrocardiographic testing would have a relatively high false-positive rate in this patient. Exercise echocardiography is more specific than electrocardiographic exercise testing, but is not indicated in this patient, unless it seems necessary to reassure her. The value of measuring serum homocysteine in a young, asymptomatic woman who has no other risk factors is unknown.

**Cardiovascular Medicine:Question 61**

The correct answer is E

**Educational Objectives**

Understand the role of ACE inhibitors in patients at high risk for cardiovascular morbidity and mortality.

**Critique**

Because some patients are clearly at increased risk for structural heart disease and symptomatic left ventricular dysfunction, preventing the progression of disease is an important goal. In addition to avoiding factors that may increase the risk of heart failure, such as smoking, obesity, and a sedentary lifestyle, important measures include physical conditioning, optimizing body habitus, controlling blood pressure, and treating lipid disorders in accordance with recommended guidelines. However, in this patient, one strategy that offers clear benefit is initiating treatment with an angiotensin-converting enzyme inhibitor. In the HOPE trial, ramipril, 10 mg/d, was given to patients who had controlled blood pressure and did not have heart failure. In this trial, ramipril reduced cardiovascular morbidity and mortality rates in patients who had a history of atherosclerotic disorders (including peripheral vascular disease), diabetes mellitus, or hypertension and associated cardiovascular disease risk factors. Whether or not all angiotensin-converting enzyme inhibitors provide the same benefit is contentious. Furthermore, vitamin E supplementation did not have the same effect. Using other strategies to control this patient’s lipid disorder is wise, but should be done in concert with angiotensin-converting enzyme inhibitors. It was never proven that this patient had myositis, and benign myalgias are common in patients taking simvastatin. It might be reasonable to start this patient on pravastatin, which is less likely than simvastatin to cause myositis, and follow the patient closely for evidence of this complication. Because this patient is not congested and apparently has metabolic syndrome, the thiazolidinedione agent rosiglitazone is an attractive option, but the dose may need to be increased. Perhaps with a modified diet, increased physical activity, and weight loss, insulin can be avoided. The calcium channel blocker amlodipine is an excellent antihypertensive agent, particularly when given with a thiazide diuretic and a β-blocker, but its use is not associated with a reduction in atherosclerotic cardiovascular event rates, as was seen with an angiotensin-converting enzyme inhibitor in the HOPE trial.

**Cardiovascular Medicine:Question 62**

The correct answer is E

**Educational Objectives**

Recognize the appropriate evaluation of premature ventricular contractions following myocardial infarction.

**Critique**

The patient’s electrocardiogram (ECG) showed that she had a silent myocardial infarction. In patients who have a depressed ejection fraction after myocardial infarction, frequent premature ventricular contractions (PVCs) are associated with increased mortality rates. Nevertheless, PVC suppression does not improve outcome. More appropriate therapy in these patients is directed toward the underlying heart
condition. Because of the implications of frequent PVCs in patients with a depressed ejection fraction after myocardial infarction, the status of the myocardium as well as the presence of residual ischemia should be evaluated. The ejection fraction is the single most important determinant of prognosis, and echocardiography or another test to evaluate ejection fraction should be performed in this patient. If the ejection fraction is less than 30%, it is likely that she will benefit from implantation of a cardiodefibrillator regardless of the presence of PVCs. Because the resting ECG showed baseline abnormalities, an exercise electrocardiographic stress test would not be useful. Because this patients symptoms are sporadic, a 24-hour monitor will not likely identify the cause of her presyncope. An event monitor would likely prove more useful for defining the relationship between ectopy and symptoms. Moreover, ambulatory ECG monitoring is not indicated in asymptomatic patients after myocardial infarction (Class IIb indication). Late potentials detected by signal-averaged ECG are common after myocardial infarction in the absence of reperfusion. Although it has a high negative predictive value for arrhythmic death, the positive predictive value of this finding is low. With the recent results of MADIT II its application has fallen out of favor. According to the European Society of Cardiology recommendation for risk stratification after myocardial infarction, signal-averaged ECG is not indicated (Class IIb). The role of electrophysiologic testing has been brought into question by the MADIT II study. In this study, neither electrophysiologic testing nor inducible ventricular arrhythmias were eligibility criteria. In this study of patients who had a depressed ejection fraction after myocardial infarction, during 20 months of follow-up, there was a 31% reduction in the relative risk of mortality among patients in the implantable cardioverter defibrillator group compared with those without an implantable cardioverter defibrillator.

Cardiovascular Medicine: Question 63
The correct answer is B

Educational Objectives
Understand the assessment for risk of sudden death in patients with hypertrophic cardiomyopathy.

Critique
In population-based studies of patients with hypertrophic cardiomyopathy, overall survival rates are similar to those in age-matched control subjects. However, clearly, some patients have a personal or family history of early sudden cardiac death. Patients who have been resuscitated after sudden cardiac death and patients who have sustained ventricular arrhythmias are at increased risk. Likewise, risk is believed to be increased in patients with two or more immediate family members who have had sudden cardiac death. Another prominent risk factor is abnormal blood pressure response to exercise (failure to increase blood pressure by 20 mm Hg with exercise). The risk of sudden cardiac death also appears to be increased in the few patients who have severe ventricular hypertrophy (>30 mm), but it is not clear whether massive hypertrophy is an independent risk factor or a marker for other risk factors.

Cardioverter defibrillators appear to offer the best protection against sudden cardiac death. No direct evidence shows that the therapies used to treat the obstruction that is seen in some patients with hypertrophic cardiomyopathy (pharmacologic agents or septal debulking) reduce the risk of subsequent cardiac death. Defibrillator therapy is indicated in this patient, who had an abnormal blood pressure response to exercise, prominent septal hypertrophy, and a significant family history of sudden cardiac death.
Question 64

The correct answer is E

Educational Objectives

Recognize the clinical presentation of aortic dissection.

Critique

This patient presents with one of the four causes of chest pain which can quickly lead to death: acute myocardial infarction, aortic dissection, tension pneumothorax, and pulmonary embolus. The history of the sudden onset of severe chest pain, rather than a crescendo pattern (which would suggest acute coronary syndrome), is typical for aortic dissection. In patients with a history of severe hypertension, new chest pain that radiates to the back should raise the suspicion of aortic dissection. Rapid diagnostic evaluation for suspected aortic dissection is critical. Transesophageal echocardiography has a high sensitivity and specificity for aortic dissection, and can be performed rapidly at the patient's bedside. Computed tomography and magnetic resonance imaging of the aorta also have high diagnostic accuracy. Therapy with an intravenous β-blocker to decrease blood pressure and heart rate should be initiated immediately. If an ascending aortic dissection is present on cardiac imaging, prompt surgical intervention is indicated. An aortic intimal flap may involve one of the coronary ostia, thereby leading to acute coronary syndrome and an elevation of cardiac troponins. However, it is inappropriate to delay the diagnostic evaluation, medical treatment, and surgical consultation to wait for troponin values. Both thrombolytic therapy and heparin are contraindicated to prevent further bleeding or rupture if a dissection is present. If emergent cardiac catheterization is performed, aortic root angiography should be performed prior to coronary angiography.

Question 65

The correct answer is C

Educational Objectives

Understand the indications for treatment with a permanent pacemaker.

Critique

Sinus node dysfunction is often the primary diagnosis for implantation of a permanent pacemaker. A persistently slow heart rate and the inability to accelerate the heart rate appropriately are common findings. Pacing is also indicated in patients who have sinus node dysfunction and symptomatic chronotropic incompetence. In patients who have symptomatic iatrogenic bradycardia, pacing should be implemented only when the implicating drug cannot be discontinued. Permanent pacemakers have a lesser role in the management of neurocardiogenic syncope and are considered in patients who do not respond to therapy. In the 20-year-old student, an asymptomatic resting heart rate of 45/min is not an abnormal finding. Heart block that occurs early after inferior myocardial infarction is common and usually reversible without affecting outcome.

Question 66

The correct answer is B

Educational Objectives

Recognize the appropriate therapy for acute severe aortic regurgitation.

Critique

The patient has acute severe aortic regurgitation and hypotension, presumably caused by bacterial endocarditis. A β-blocker would slow the heart rate and prolong diastole, worsening aortic regurgitation and potentially leading to further hemodynamic compromise. Afterload-reducing therapy, with or without an inotropic
agent, is indicated to optimize forward cardiac output. Although intra-aortic balloon counterpulsation also decreases afterload, it is contraindicated in a patient who has aortic regurgitation. Depending on the hemodynamic response to intensive medical intervention, the patient may require urgent surgical treatment. However, if surgery can be deferred to allow a period of therapy with intravenous antibiotics, early postoperative infection after aortic valve replacement is less likely. Because of the patient's age, coronary arteriography is not required preoperatively and could lead to embolization of the aortic valve vegetations.

**Cardiovascular Medicine: Question 67**
The correct answer is **E**

**Educational Objectives**
Understand the role of cardiac glycosides in the treatment of patients who have symptomatic (stage C) congestive heart failure.

**Critique**
During long-term follow-up, discontinuing digoxin and spironolactone probably contributed to worsening of this patient's congestive heart failure. In the PROVED and RADIANCE trials worsening heart failure occurred more often in patients with sinus rhythm and symptomatic congestive heart failure due to left ventricular systolic dysfunction who were withdrawn in blinded fashion from digoxin to placebo. The DIG trial was a placebo-controlled study in which digoxin was added to the standard heart failure regimen. In this study, digoxin did not decrease or increase the mortality rate, but was associated with a significant reduction in the rate of hospitalization because of decompensated congestive heart failure. Subsequent analysis of the PROVED/RADIANCE cohort suggested that low doses of digoxin were as effective as higher doses.

In older patients who have symptomatic New York Heart Association class III/IV heart failure, spironolactone is a useful adjunct to baseline medications. Although hyperkalemia is cause for concern, if the patient is stable, this degree of electrolyte abnormality might be tolerable. Other options include discontinuing potassium supplementation and decreasing the dose of spironolactone to 12.5 mg/d, as in the RALES trial. Chronic renal insufficiency is cause for concern in this patient. However, he appears to be stable and probably will do well on this intense, complex congestive heart failure protocol. The final prescription on discharge should include digoxin, 125 jg/d, and spironolactone, 12.5 mg/d, but not potassium supplementation. This patient’s electrolyte levels and renal function should be followed closely in the outpatient department. It is appropriate to check digoxin blood levels and regulate the dose to maintain a level of 0.7 to 1.2 ng/mL. It is not necessary to increase his diuretic dose at this time as the recent decompensation was probably related to discontinuation of digoxin and spironolactone. Discontinuing the β-blocker is not desirable as this is a drug that improves outcomes in this patient population. Increasing the dosage of atorvastatin would only be indicated if his serum LDL cholesterol level were above the target level of 100 mg/dL. Aspirin is indicated for secondary prevention and is unlikely to have contributed to his decompensation.

**Cardiovascular Medicine: Question 68**
The correct answer is **D**

**Educational Objectives**
Identify the best management of a patient at delivery.

**Critique**
The patient has an atrial septal defect and is asymptomatic. The best treatment option is to monitor the patient during pregnancy and encourage ambulation as soon as possible after delivery. If the atrial septal defect is large enough to require
intervention this should be performed after delivery. Antibiotic prophylaxis is not required for patients who have isolated secundum atrial septal defects. Cesarean delivery is rarely recommended for patients who have cardiovascular disorders. This mode of delivery requires prolonged recuperation and delays the return to normal prepregnancy hemodynamics. For this reason, vaginal delivery is preferable because it allows prompt postpartum mobilization, thereby reducing the risk of paradoxical embolus.

**Cardiovascular Medicine: Question 69**

**The correct answer is B**

**Educational Objectives**

Identify the optimal therapeutic approach for a patient who has a low HDL cholesterol level in the absence of elevated total and LDL cholesterol levels.

**Critique**

The treatment goal is to bring this patient's lipid profile as close to normal as feasible; the low HDL cholesterol and high triglyceride levels are both targets for optimizing therapy. The patient's LDL cholesterol level is at the ATP III goal of ≤130 mg/dL. Both niacin and fibrates elevate the HDL cholesterol and lower the triglyceride level. Thus, combination lipid-modifying therapy is required. Niacin-statin combination therapy is safer than a fibrate-statin combination. Slow up-titration of the niacin dosage is required, with a target goal of 1500 to 2000 mg/d as tolerated. Increasing the statin dosage might lower the triglyceride level further, but would likely have little effect on the HDL cholesterol level. On average, statins increase HDL cholesterol by only 5% to 7%. The risk of rhabdomyolysis is greatest with a statin-fibrate combination. Experts suggest that fenofibrate is a safer agent than gemfibrozil for use in conjunction with a statin. In light of the potential for rare but serious rhabdomyolysis, including fatalities, associated with the combination of cerivastatin and gemfibrozil, great caution must be taken when combining these two drug classes. If niacin is not tolerated, a low dose of a statin with fenofibrate can be substituted; gemfibrozil should not be used. Pravastatin and fluvastatin may be safer than other statins when used in combination with a fibrate. Patients should be cautioned about the occurrence of myalgias and warned to stop the drug and contact a physician if muscle symptoms occur.

**Cardiovascular Medicine: Question 70**

**The correct answer is A**

**Educational Objectives**

Know the indications for closure of an atrial septal defect.

**Critique**

The most likely diagnosis in this patient is an atrial septal defect. The wide and fixed split of the ECG is pathognomonic. However, partial anomalous pulmonary venous drainage is an alternative diagnosis and is suspected when transthoracic echocardiography does not show an atrial septal defect. Nevertheless, in an adult, the anatomy is rarely completely defined on surface echocardiogram. The right ventricular enlargement is consistent with a hemodynamically significant shunt that has a pulmonary-systemic flow ratio ≥1.8:1.0. Mild elevation of pulmonary artery pressure is not a contraindication to closure and may be caused by the high pulmonary flow. Transthoracic echocardiogram, even when performed with saline contrast, cannot accurately localize the defect. Therefore, transesophageal echocardiogram is indicated to define the anatomy and exclude anomalous pulmonary venous drainage. The defect may be closed percutaneously or surgically. The method of closure is based on the availability of interventional versus surgical expertise as well as the size
and location of the defect. Most ostium secundum atrial septal defects can be closed percutaneously. Atrial septal defects in other locations (sinus venosus, ostium primum) require surgical closure. It is unlikely that the patient would require diagnostic catheterization before referral for treatment. The findings on physical examination, chest radiograph, and echocardiogram all point to a hemodynamically significant atrial septal defect with a pulmonary-systemic flow ratio ≥2:1. Endocarditis is rare in an uncomplicated atrial septal defect. Referral for closure is indicated. Antibiotic prophylaxis is indicated only when associated valvular lesions are present. After surgical or percutaneous closure, antibiotic prophylaxis is indicated for 6 months. This patient would probably tolerate pregnancy well because she does not have evidence of shunt reversal and the mildly elevated pulmonary pressure is probably related to the high flow. However, congestive failure sometimes complicates pregnancy, and there is a risk of paradoxical embolization. Thus, the recommendation for surgical or percutaneous closure, if feasible, before the patient contemplates pregnancy, is reasonable.

**Cardiovascular Medicine: Question 71**

The correct answer is D  
**Educational Objectives**  
Understand the use of cardiac stress testing after coronary bypass graft surgery.  
**Critique**  
After bypass surgery, this patient has done well while taking aspirin and a statin to decrease her cholesterol level. Data show that ACE inhibitors may decrease the long-term incidence of subsequent cardiac events in patients who have coronary artery disease. However, there is no evidence that short-term use reduces the risk associated with noncardiac surgery. Similarly, no evidence supports the use of angiotensin receptor blockers or calcium channel blockers in this situation. There are also no data to support the use of intravenous nitroglycerin during surgery in patients who have heart disease. Perioperative ß-blockers reduce the incidence of cardiac events in patients who have known or likely coronary artery disease.

**Cardiovascular Medicine: Question 72**

The correct answer is C  
**Educational Objectives**  
Understand the indications for endomyocardial biopsy in patients with congestive heart failure.  
**Critique**  
This patient has congestive heart failure with preserved left ventricular systolic function. The visits to the emergency department were likely precipitated by episodes of acute pulmonary edema, or cardiac asthma. At this patients age, new onset of asthma is unlikely, and physical examination shows no evidence of chronic obstructive pulmonary disease. Hypertension can cause severe left ventricular hypertrophy, and coronary artery disease is always a possibility in a patient who has hypertension and diabetes mellitus. However, the collective findings suggest restrictive cardiomyopathy, and the findings of low voltage on the electrocardiogram with increased left ventricular wall thickness on the echocardiogram strongly suggest amyloidosis. Endomyocardial biopsy is the best and quickest way to make this diagnosis. Endomyocardial biopsy is also used for surveillance follow-up of cardiac allograft recipients; to diagnose anthracycline-induced cardiomyopathy; to evaluate other infiltrative cardiomyopathies, such as sarcoidosis and hemochromatosis; and to detect acute myocarditis, especially giant cell myocarditis. This patient will likely require further evaluation with bone marrow aspiration, biopsy, and serum and urine
protein electrophoresis to exclude multiple myeloma. Although exercise scintigraphy and coronary angiography are useful to exclude coronary artery disease, this diagnosis is less likely given this presentation. Right heart catheterization is likely to confirm the results of the echocardiogram with elevated right ventricular pressure and pulmonary artery pressure and demonstrated increased pulmonary capillary wedge pressure. However, the mechanism for the pulmonary hypertension is post-capillary due to elevated pulmonary venous pressures.

**Cardiovascular Medicine: Question 73**

The correct answer is A

**Educational Objectives**

Recognize the appropriate options in treating a patient with a late presentation of ST-segment elevation acute myocardial infarction.

**Critique**

The most recent trials randomizing ST-segment elevation acute myocardial infarction patients to thrombolysis versus angioplasty (with or without stenting) have now demonstrated the superiority of angioplasty. The DANAMI-2 trial randomized patients within 6 hours of the onset of symptoms to front-loaded tPA or primary angioplasty, which frequently required hospital transfer to an institution with 24-hour angioplasty services. Those assigned to the angioplasty treatment group had markedly superior outcomes.

This patient, however, has presented to medical attention more than 12 hours after the onset of symptoms. Women and non-English speakers have been associated with a later presentation for acute myocardial infarction. Studies of thrombolysis show no significant benefit in terms of recanalizing the infarct-related artery in those patients presenting more than 12 hours after the onset of symptoms. Because this patient still has chest pain, there is potentially residual viable myocardium and referral for emergent coronary angiography and possible revascularization is still indicated. In some patients who present very late after acute myocardial infarction, the electrocardiogram may show persistent ST-segment elevation. Persistent ST-segment elevation may signify 1) persistent myocardial injury, 2) ventricular aneurysm formation, and/or 3) localized myocardial infarction-related pericarditis. If a patient continues to have ischemic chest pain, referral for cardiac catheterization is indicated, even if the presentation is late.

**Cardiovascular Medicine: Question 74**

The correct answer is D

**Educational Objectives**

Understand and apply an exercise prescription in a high-risk patient who has cardiovascular disease.

**Critique**

This patient has several high-risk features for exercise, but none that precludes exercise training. Because he has symptoms of dyspnea at low levels of exertion and a recent large infarction with left ventricular ejection fraction of < 30%, his American Heart Association risk status is class C. Exercise should not be prescribed using an absolute intensity, such as 5 metabolic equivalents, because this patient may not be able to achieve this level of effort or may have an adverse response. Relative intensity, as derived from the exercise tolerance test, should be prescribed, and would probably be most effective in the moderate range (50% to 70% of peak heart rate). The patient should take cardioactive medications on his usual schedule because they may prevent ischemia and excessive myocardial oxygen demand during exercise. Postexercise hypotension is more likely to occur in patients who
have reduced left ventricular systolic function and are taking cardioactive medications. A long cool-down period of low-intensity exercise is recommended. This patient should be referred to a supervised cardiac rehabilitation program.

**Cardiovascular Medicine: Question 75**

**Educational Objectives**

Understand the prognostic issues associated with uncomplicated mitral valve prolapse.

**Critique**

This patient has mitral valve prolapse with mild mitral regurgitation, normal chamber sizes and systolic function, and symptomatic unifocal premature ventricular complexes. No additional echocardiographic imaging is indicated because the cardiac valves and chambers were well visualized on transthoracic imaging, and mitral repair surgery is not being considered. An antiarrhythmic agent is not indicated because the patient has no symptoms of syncope and no evidence of more complex ectopy. Afterload-reducing therapy with an ACE inhibitor offers no benefit in a patient who has valvular mitral regurgitation.

In one study, the prognosis of asymptomatic patients with mitral valve prolapse was related to primary moderate mitral regurgitation, ejection fraction <50%) and secondary risk factors (mitral regurgitation, left atrial enlargement, flail leaflet, atrial fibrillation, and age greater than 50 years). This patient has a single secondary risk factor (mild mitral regurgitation). Based on criteria validated in Olmsted County, Minnesota, she has a good prognosis (Avierinos et al). She should be evaluated every 1 to 2 years to detect changes in clinical status or in mitral regurgitation. More frequent echocardiographic imaging is not indicated if she has no change in clinical status or physical findings. The patient should receive antibiotic prophylaxis against infective endocarditis, and therapy with β-adrenergic antagonist may be considered.

**Cardiovascular Medicine: Question 76**

**Educational Objectives**

Diagnose congenital complete heart block.

**Critique**

The rhythm strip in this patient shows complete heart block. The physical finding of S1 of varying intensity is common in patients who have complete heart block. This finding is related to the changing relationship between atrial and ventricular contractions. This patient most likely has congenital complete heart block. This condition is most commonly associated with maternal systemic lupus erythematosus. Excess vagal tone is more likely to cause Wenckebach, or first-degree, atrioventricular block. The cardiovascular effects of the drug 3,4-methylenedioxyamphetamine (MDMA), or ecstasy, include large increases in blood pressure, heart rate, and myocardial oxygen consumption and not bradycardia. Sick sinus syndrome can occasionally occur in young people, but it would cause sinus slowing and a reduced heart rate response to exercise. Her sinus rate is increased. The indications for permanent pacing in young patients who have congenital complete atrioventricular block have evolved based on the expanding understanding of the natural history of the disease. Recent studies show that long-term survival may be improved through implantation of a pacemaker and that serious symptoms, such as syncope, may be avoidable in patients who have congenital complete atrioventricular block. In an asymptomatic patient who has congenital complete atrioventricular block, several criteria must be considered before a pacemaker is implanted. Pacing is indicated in patients who have congenital complete heart block.
and a wide QRS escape rhythm or ventricular dysfunction. Pacing is also indicated in patients who are at risk for bradycardia-dependent long QT interval and resultant arrhythmias. Pacing should be considered in an infant with congenital complete heart block who has a ventricular rate <50 to 55/min or <70/min in the setting of congenital heart disease. There is a recently described association with the development of dilated cardiomyopathy.

**Cardiovascular Medicine: Question 77**

The correct answer is B

**Educational Objectives**

Understand how metabolic exercise testing is used to determine disease severity and prognosis for patients with congestive heart failure.

**Critique**

Factors other than cardiac insufficiency appear to be limiting this patient’s exercise tolerance. His peak oxygen consumption is low for his age, but he did not reach the anaerobic threshold, as evidenced by the respiratory exchange ratio that is less than 1.0. At rest, slightly more oxygen is consumed than carbon dioxide produced, and the expiratory exchange ratio (carbon dioxide produced/oxygen consumed) is less than 1.0. At peak exercise, when circulatory failure occurs and oxygen supply cannot meet demand, more carbon dioxide is produced and the expiratory exchange ratio exceeds 1.0 as the anaerobic threshold is reached. The metabolic exercise test is a useful tool to provide more precise risk stratification of patients who have symptoms of heart failure. Usually, a patient who is seriously considered for heart transplantation has a peak VO2 of less than 14 mL/kg per min at a respiratory exchange ratio of greater than 1.10 or a peak VO2 of less than 55% of age- and sex-predicted values in healthy persons. This patient probably is not a candidate for heart transplantation at this time, and factors other than heart failure may be contributing to his breathlessness. There is no evidence of volume overload; therefore, additional diuretics are unlikely to relieve his symptoms. Right heart catheterization would be indicated to tailor therapy if there was evidence of decompensated heart failure. Resting scintigraphy would be useful to assess the presence of viable myocardium if the patient had evidence of ongoing ischemia. The history and physical examination suggest lung disease. Complete pulmonary function tests would be helpful in determining whether chronic obstructive pulmonary disease or restrictive pulmonary disease, perhaps as a result of amiodarone toxicity, is contributing to his exercise intolerance.

**Cardiovascular Medicine: Question 78**

The correct answer is E

**Educational Objectives**

Understand when to order a cardiac imaging stress test.

**Critique**

An exercise stress test is likely to be inconclusive in this obese patient with rheumatoid arthritis. Pharmacologic testing makes more sense, and either echocardiographic or nuclear perfusion imaging would be suitable. However, because of this patient’s obesity, sestamibi imaging will probably provide a higher yield than echocardiography. Cardiac catheterization is not indicated in the current guidelines, and invasive testing is not appropriate in a patient who has stable angina.
**Cardiovascular Medicine:Question 79**
The correct answer is D

**Educational Objectives**
Know the indications for surgery for an abdominal aortic aneurysm.

**Critique**
Initiating treatment with a β-blocker is a reasonable approach, given this patient’s mildly elevated blood pressure and the presence of an aneurysm. β-blocker therapy will also reduce shear stress on the aortic wall. The presence of symptoms without another reasonable cause suggests that the aneurysm may be expanding or that subacute rupture may have occurred. The UK Small Aneurysm study showed a slightly increased risk of rupture in women. Therefore, the patient should be hospitalized and referred to a vascular surgeon.

Confirmation of the diagnosis is warranted, and more immediate intervention may be required. Ultrasound is an effective screening technique, and in this case, it showed an aneurysm with a diameter approaching 5cm. Computed tomography or magnetic resonance angiography would provide more precise information about the size and extent of the aneurysm. High-resolution computed tomography is an inappropriate test. It is used to evaluate pulmonary parenchyma for intestinal fibrosis or pulmonary masses. Helical (spiral) computed tomography angiography is used to evaluate the aorta. Magnetic resonance imaging of the spine is not needed at this time because the most worrisome cause of this patient’s pain is the potentially life-threatening abdominal aortic aneurysm.

The dose of simvastatin should be increased because the patient has a coronary artery disease risk equivalent, as defined by the NCEP-ATP III guidelines. As with known coronary artery disease, in a patient with an abdominal aortic aneurysm, the 10-year risk for cardiovascular events is >20%. According to current guidelines, this profile warrants treatment to lower the low-density lipoprotein cholesterol level to <100 mg/dL.

**Cardiovascular Medicine:Question 80**
The correct answer is C

**Educational Objectives**
Recognize the mechanism of myocardial infarction due to mitral stenosis.

**Critique**
This patient has evidence of mitral stenosis with pulmonary hypertension and right heart failure on her physical examination. She has a typical diastolic rumble murmur of mitral stenosis, as well as evidence of pulmonary hypertension (right ventricular heave, loud P2, and jugular venous distention). The patient is in atrial fibrillation, placing her at risk for thromboembolic complications. She presents with chest pain and ST-segment elevation in her anterior leads. The most likely pathophysiologic explanation of her presentation is thromboembolism from a left atrial appendage thrombus to her left anterior descending coronary artery. Generally, emboli to the brain, kidneys, and peripheral arterial tree are more common than emboli to the coronary circulation. Management is the same as for patients with ST-segment elevation myocardial infarction, and includes aspirin, heparin, β-blockers, nitroglycerin, and immediate reperfusion therapy (with either thrombolysis or primary angioplasty).

It would be very unusual for this young woman to have coronary atherosclerosis. Patients with left ventricular dysfunction may develop left ventricular thrombosis; however, those with mitral stenosis generally do not have left ventricular dysfunction. Coronary arteritis and vasospasm are rare causes of coronary vascular insufficiency, and would be less likely.
Cardiovascular Medicine: Question 81

The correct answer is A

Educational Objectives

Recognize the factors that are associated with cardiac arrest.

Critique

Sudden death is a major health problem in the United States, with an annual incidence of 300,000 to 400,000. Of these, only 2% to 15% survive long enough to reach the hospital, and half of those who are hospitalized die before discharge. The most common underlying cause is ischemic heart disease. In a study of recording tapes of ambulatory patients who died while wearing ambulatory monitors, the causative arrhythmia was ventricular tachycardia in 62%, ventricular fibrillation in 8%, torsades de pointes in 13%, and bradycardia in 17%.

The Canadian Amiodarone Myocardial Infarction Arrhythmia Trial and the European Myocardial Infarct Amiodarone Trial assessed the effect of amiodarone on the risk of sudden death after myocardial infarction in patients with decreased left ventricular function, irrespective of ventricular arrhythmias. Both studies showed a reduction in the incidence of arrhythmic death, but no reduction in overall mortality rate. These studies did not compare this therapy with implantable cardioverter defibrillators. In other studies that compared the efficacy of antiarrhythmics with that of implantable cardioverter defibrillators in primary or secondary prevention of cardiac arrest, most data support the superiority of implantable cardioverter defibrillators. Cardiac arrest in the first 24 hours after myocardial infarction does not predict late sudden death.

Cardiovascular Medicine: Question 82

The correct answer is C

Educational Objectives

Recognize that echocardiography is the most important test in the initial evaluation of a patient with heart failure.

Critique

Echocardiography would provide significant diagnostic information in this case. It differentiates between systolic and diastolic dysfunction, estimates ejection fraction, and assesses regional wall motion, the pericardium, valves, aorta, and aortic route. Electrocardiography, although it shows evidence of previous myocardial infarction, left ventricular hypertrophy, and arrhythmia, is less helpful. However, the finding of low voltage in a patient who does not have emphysema and is not obese suggests that congestive heart failure (CHF) is caused by an infiltrative process, such as amyloid. Chest radiography provides a poor estimate of left ventricular function. Coronary angiography is recommended in patients who have systolic dysfunction and angina because coronary revascularization improves symptoms and survival in these patients. The American College of Cardiology/American Heart Association guidelines for CHF suggest little role for noninvasive coronary artery disease testing in patients with CHF and angina. The role of coronary angiography for patients who have CHF but not angina is controversial. No controlled trials indicate that coronary revascularization reduces the mortality rate in this patient group. Coronary angiography should be considered if noninvasive testing suggests left main coronary artery disease or significant ischemic myocardium. In a patient who has a history of coronary artery disease as well as symptoms of CHF and systolic dysfunction in the absence of angina, some experts recommend coronary angiography. Similarly, some recommend coronary angiography to exclude a congenital coronary artery lesion in young patients who have CHF. Coronary revascularization does not improve outcome in an older patient without angina, but some believe that an invasive effort to identify coronary artery disease should be made whenever possible.

The plasma B-type natriuretic peptide level is elevated in patients with CHF (left
ventricular systolic dysfunction) and in those with diastolic dysfunction. Although this
test appears promising to help distinguish dyspnea caused by lung disease from
dyspnea caused by CHF, current guidelines recommend more research to determine
its role in diagnosis and management.

Cardiovascular Medicine: Question 83
The correct answer is A

Educational Objectives
Recognize when pregnancy is contraindicated in a patient who has Marfan syndrome.

Critique
This patient has aortic root enlargement and a family history of Marfan syndrome.
These characteristics correlate with a diagnosis of Marfan syndrome. In patients who
have Marfan syndrome, pregnancy is contraindicated when the aorta is larger than
40 mm. β-blocker therapy should be instituted, and the patient should be counseled
against having a pregnancy at this time.
In patients with Marfan syndrome, elective surgery for aortic root disease is usually
recommended when the aorta is 5 cm or larger. If surgery is performed, now or in
the future, and the patient has an excellent result, future pregnancy could be
considered. Urgent surgery is considered when the aorta expands rapidly, when it is
larger than 6 cm, and when there is evidence of an acute aortic event.

Cardiovascular Medicine: Question 84
The correct answer is D

Educational Objectives
Recognize the optimal blood pressure in a patient with diabetes.

Critique
In a patient with diabetes, elevated blood pressure requires vigorous
antihypertensive therapy to achieve normal or near-normal blood pressure. At least
50% of patients who have type 2 diabetes mellitus also have hypertension. The goal
for optimal blood pressure in a patient with diabetes is ≤120/80 mm Hg. Data from
the HOT trial showed that diabetics who achieved a target diastolic blood pressure
≤80 mm Hg had a 51% lower risk of cardiovascular mortality than those with a
diastolic pressure of ≤90 mm Hg. Thus, new data since the publication of the JNC VI
guidelines (1997) suggest that a more aggressive approach is indicated. Many
diabetic patients require three-drug therapy. An ACE inhibitor or an angiotensin
receptor blocker is recommended as first-line therapy. However, the recently
published ALLHAT study supports the use of a thiazide diuretic as first-line therapy.

Cardiovascular Medicine: Question 85
The correct answer is A

Educational Objectives
Understand the mechanism of failure of a bioprosthetic valve.

Critique
After 16 years, a bioprosthetic valve is at risk for failure, typically by progressive
cuspal calcification followed by abrupt cuspal fracture and acute regurgitation.
Intuitively, cusp fracture should be associated with a diastolic murmur. However, the
murmur of acute aortic regurgitation may not be prominent, whereas the increase in
stroke volume across the calcified bioprosthesis is more readily audible and may be
the only clue to a change in valve performance. Paraprosthetic regurgitation may
occur early after surgery, which would not explain the patient’s recent change in
status. It may also occur late, as a sequela of endocarditis, for which this patient
does not appear to be at risk. Although thrombotic complications occur in
conjunction with mechanical prosthetic valves, thrombosis is unusual in association
with a bioprosthetic aortic valve that was implanted years earlier. Mitral stenosis is unlikely to cause an abrupt change in symptoms, and the crescendo-decrescendo murmur does not suggest mitral regurgitation.

**Cardiovascular Medicine: Question 86**

The correct answer is D

**Educational Objectives**

Recognize a patient for whom an angiotensin-converting enzyme inhibitor should be prescribed in acute myocardial infarction.

**Critique**

Left ventricular remodeling refers to changes in the size and shape of the left ventricle that occur after acute myocardial infarction (AMI). As the remaining noninfarcted myocardium enlarges and changes shape, compensatory eccentric hypertrophy occurs, ultimately followed by further dilatation and deterioration of left ventricular systolic function. The treatment of choice for the prevention of remodeling is an angiotensin-converting enzyme (ACE) inhibitor, which improves left ventricular function, reduces both short- and long-term mortality, reduces the incidence of heart failure, and reduces recurrent reinfarction in patients with AMI. Patients who are most likely to benefit from ACE inhibitors include those with systolic dysfunction, anterior wall myocardial infarction, or clinical evidence of congestive heart failure. Treatment with an oral ACE inhibitor should begin as soon as possible following admission in patients without systemic hypotension or hyperkalemia. Antiarrhythmic drugs are not used routinely as prophylaxis after AMI. This patient does have asymptomatic nonsustained ventricular tachycardia and a depressed left ventricular ejection fraction, placing her at higher risk for subsequent sudden cardiac death. Asymptomatic episodes of nonsustained ventricular tachycardia in the peri-myocardial infarction period (within 48 hours) are generally followed closely on telemetry. Treatment with β-blockers and ACE inhibitors is indicated. If a patient develops ventricular arrhythmias that are symptomatic or persist beyond 48 hours, then further evaluation (electrophysiology testing) and treatment (antiarrhythmic agents, implantable defibrillators) may be considered. Calcium channel blockers generally have not proved to provide benefit in AMI patients in reducing remodeling, reinfarction, or sudden death.

**Cardiovascular Medicine: Question 87**

The correct answer is C

**Educational Objectives**

Recognize the role of antiarrhythmic agents in secondary prevention of cardiac arrest.

**Critique**

Patients who survive a cardiac arrest, who have recurrent documented episodes of sustained ventricular tachycardia, and who have recurrent syncope of unknown origin are at highest risk for cardiac arrest. The utility of preventing cardiac arrest with drug treatment is limited. Only β-blockers reduced the rate of death from cardiac arrest and the total mortality rate in randomized trials. Class I antiarrhythmic drugs, such as procainamide, increase the mortality rate, particularly in patients with an ischemic substrate. Class III drugs, such as sotalol and amiodarone, show mixed results. Racemic sotalol has both β-blocker and class III actions, and some of its benefits may be the result of its β-blocker properties. D-sotalol, a pure class III drug, increases the mortality rate after myocardial infarction. Amiodarone is superior to class I antiarrhythmic drugs for patients with previous cardiac arrest. In the high-risk patient who has had a myocardial infarction, amiodarone reduces the risk of sudden death, but does not decrease the overall
mortality rate. In patients with heart failure, the effect of amiodarone on the total mortality rate is controversial.

**Cardiovascular Medicine: Question 88**  
The correct answer is E  
**Educational Objectives**  
Understand that β-blockers are indicated in patients who have asymptomatic left ventricular dysfunction.  
**Critique**  
β-Blockers are recommended for the treatment of patients who have a reduced ejection fraction, regardless of whether they have a history of myocardial infarction. Many trials of β-blockers in patients with left ventricular dysfunction show decreased symptoms, prolonged life, and decreased rates of hospitalization. The favorable effects occur when these drugs are added to therapy with ACE inhibitors. Although controlled clinical trials are lacking, the use of β-blockers in asymptomatic patients who have a low ejection fraction is recommended by the American College of Cardiology/American Heart Association.  
Digoxin decreases the incidence of symptoms and does not prolong survival. Therefore, it is not indicated in this case. According to the RALES trial, spironolactone is effective in patients who have New York Heart Association class III/IV heart failure, but not in asymptomatic patients. Diuretics are not indicated in an asymptomatic patient who does not have evidence of volume retention. Angiotensin receptor blockers are recommended as a substitute for angiotensin-converting enzyme inhibitors when patients cannot tolerate these drugs or when they are contraindicated. The use of an ACE inhibitor in conjunction with an angiotensin receptor blocker is being studied, but no data support their use together in the treatment of congestive heart failure.

**Cardiovascular Medicine: Question 89**  
The correct answer is B  
**Educational Objectives**  
Identify a patient who is at risk for aortic coarctation.  
**Critique**  
The most likely diagnosis in this patient is coarctation of the aorta. The findings on physical examination are consistent with a bicuspid aortic valve with an early systolic click and a murmur over the aortic area. She has had documented hypertension for many years. Hyperthyroidism is usually associated with systolic hypertension only. Her heart rate is normal, which is also unusual. Blood pressure in the lower extremities was 100/60 mm Hg, with a gradient of 60 mm Hg. Chest radiograph showed rib notching, and magnetic resonance angiography showed a discrete coarctation after the take-off of the left subclavian artery. Because she was reluctant to undergo surgery, she was referred for balloon dilation and stenting of the coarctation. She was prescribed antibiotic prophylaxis for her bicuspid aortic valve, and an echocardiogram showed mild aortic insufficiency. She should undergo annual echocardiograms and will probably require lifelong antihypertensive therapy, given the delayed treatment of her coarctation. An echocardiogram will show what is likely to be a bicuspid aortic valve, but may not clearly define the area of coarctation, especially if the sonographer is not alerted to the possibility of coarctation. This patient has no evidence of pheochromocytoma. A chest radiograph would be helpful in showing the expected rib notching, but not until after a decrease in blood pressure in the lower extremities is documented.
Cardiovascular Medicine: Question 90
The correct answer is E
Educational Objectives
Manage a vagal reaction in the setting of acute myocardial infarction.
Critique
The combination of acute hypotension and bradycardia suggests a vagal reaction in the setting of acute myocardial infarction. Administration of the anticholinergic agent atropine is the treatment of choice. Atropine will not be helpful if the patient has high-grade atrioventricular block with a sinus rate >60/min. If the bradyarrhythmia and hypotension persist after a total of 2.0 mg of atropine in divided doses, the insertion of a temporary transvenous pacemaker is indicated. Great care should be exercised in this patient who has recently received a fibrinolytic agent. Volume replacement or inotropic support with dopamine may be required if hypotension persists after correction of the bradyarrhythmia, but they are not indicated as initial therapies. Isoproterenol should be avoided in patients with acute myocardial infarctions, because it may greatly increase myocardial oxygen consumption, leading to increased myocardial ischemia.

Cardiovascular Medicine: Question 91
The correct answer is B
Educational Objectives
Recognize primary (severe) pulmonary hypertension in a pregnant patient.
Critique
This patient has features of severe pulmonary hypertension. The loud pulmonary component of S2 and the prominent right ventricular impulse are consistent with this diagnosis, as is the electrocardiogram. Secondary causes of pulmonary hypertension should be excluded. Atrial and ventricular septal defects that cause severe pulmonary hypertension result in cyanosis. Further evaluation for secondary causes of pulmonary hypertension, such as pulmonary thromboembolic disease, is indicated. In pulmonary stenosis, the P2 would be diminished or absent. In mitral stenosis, a diastolic murmur is expected and the ECG would demonstrate left atrial enlargement.

Cardiovascular Medicine: Question 92
The correct answer is A
Educational Objectives
Understand the role of diuresis in a patient with decompensated heart failure.
Critique
Diuretics are necessary to treat fluid retention in patients with congestive heart failure (CHF). Symptomatic benefit occurs more rapidly with their use than with the use of any other class of heart failure medication. However, diuretics should not be used as single-drug therapy to treat CHF. Angiotensin receptor blockers are not equivalent to ACE inhibitors in the treatment of CHF. Angiotensin receptor blockers are as likely as ACE inhibitors to cause hypotension, worsening renal function, and hyperkalemia, and should be used only in patients who cannot tolerate ACE inhibitors. No data support the combined use of an ACE inhibitor with an angiotensin receptor blocker in the patient who has decompensated CHF. β-Blockers are not rescue therapy and are administered only to stable patients with CHF. Many experts recommend a 2- to 4-week period of stability before these drugs are started in patients with heart failure. Symptomatic improvement may take 2 to 3 months. There is no evidence that the serum concentration of digoxin corresponds to the therapeutic effect. Similarly, there is no evidence that higher doses are more effective than lower doses. A recent study showed that higher serum digoxin levels may have a negative effect on outcome.
Dobutamine may be used intermittently to stabilize a decompensated patient, for example, while the patient is awaiting transplantation. Long-term dobutamine infusion with regular intermittent dosing may increase the mortality rate. Before the ACE inhibitor is discontinued because of cough, the increased pulmonary congestion should be treated by increasing the dose of diuretic.

**Cardiovascular Medicine:** Question 93

**The correct answer is A**

**Educational Objectives**

Recognize the clinical presentation of right ventricular myocardial infarction

**Critique**

This patient is admitted with the clinical presentation of a right ventricular (RV) infarction. Typically, RV infarction occurs when there is an occlusion of the right coronary artery proximal to the right ventricular marginal branch (usually a proximal right coronary occlusion). The clinical triad of hypotension, elevated jugular venous pressure, and clear lung fields is consistent with either tamponade or RV infarction. Kussmaul's sign (an increase in jugular venous pressure on inspiration) is a classic feature of both RV infarction and constrictive pericarditis, but is rarely seen in tamponade. Other physical findings seen in RV infarction include a right ventricular gallop, tricuspid regurgitation, and bradycardia (from sinus and/or atrioventricular nodal ischemia). Hemodynamically, patients with RV infarction are often hypotensive and bradycardic. The right atrial pressure is typically elevated >10 mm Hg, and the pulmonary capillary wedge pressure is usually normal if there is no significant left ventricular involvement. On the electrocardiogram, RV extension may be seen in patients with acute inferior myocardial infarction, best diagnosed by elevation of the ST-segment in lead V4R. The electrocardiogram in this particular patient was nondiagnostic because he likely spontaneously reperfused before presentation, although he still has clinical evidence of RV stunning. In tamponade and constrictive pericarditis, there is elevation and equalization of the diastolic pressures in the right atrium, right ventricle, pulmonary capillary wedge, and left ventricle. In addition to the standard treatment for acute myocardial infarction, therapy for RV infarction includes judicious volume loading, the avoidance of venodilators such as nitrates or diuretics, and maintenance of atrioventricular synchrony with pacing.

**Cardiovascular Medicine:** Question 94

**The correct answer is D**

**Educational Objectives**

Manage acute atrial fibrillation associated with hemodynamic compromise.

**Critique**

Although the complexes are wide, the rhythm is irregularly irregular, consistent with atrial fibrillation. The aberration may be rate related, or the patient may have a conduction defect. In general, the rhythm associated with ventricular tachycardia or fascicular tachycardia is regular, as is that of atrioventricular node reentry. Nonetheless, the appropriate treatment in this hypotensive patient with evidence of pulmonary edema is prompt direct-current cardioversion. The risk of embolic events is outweighed by the benefit of rapid cardioversion. Normal saline should not be administered in the presence of pulmonary crackles suggesting heart failure. Diltiazem is likely to worsen the hypotension. Procainamide can be used in a patient with Wolff-Parkinson-White syndrome who has atrial fibrillation. In this patient, the rate may increase and intravenous procainamide will likely worsen the hypotension. Digoxin will not act rapidly enough to slow the heart rhythm as the sole agent administered.
**Cardiovascular Medicine:Question 95**
The correct answer is A

**Educational Objectives**
Manage angiotensin-converting enzyme inhibition in a patient who has renal dysfunction and severe heart failure.

**Critique**
In 15% to 30% of patients who have severe heart failure, the use of ACE inhibitors is associated with a significant increase (10% to 15%) in the serum creatinine level. Renal function usually improves after the diuretic dose is decreased. These patients may be treated by decreasing the diuretic dose. Therefore, there is no indication to discontinue the ACE inhibitor or decrease the dosage. If the increase in creatinine is greater than 30% of the baseline level or if the value does not stabilize within 2 to 4 weeks, a decrease in the ACE inhibitor dosage should be considered. A potassium level >5.0 meq/L is another indication to decrease the dosage of ACE inhibitor. Persistent edema is a contraindication to a fluid bolus in this patient. Dobutamine administration is not indicated because the patient is stable and is responding to therapy.

**Cardiovascular Medicine:Question 96**
The correct answer is B

**Educational Objectives**
Understand when to order exercise electrocardiography.

**Critique**
In a premenopausal woman, coronary artery disease is unusual unless the patient has strong risk factors. This patient’s only risk factor is mild obesity, which by itself, is not a powerful risk factor. However, because this type of pain is typical of angina pectoris, discharge with primary care follow-up is inappropriate. On the other hand, admission is inappropriate for this low-risk patient who has normal electrocardiographic findings and biologic markers. Therefore, performing a diagnostic test within 72 hours is reasonable. Because the patient’s findings on electrocardiogram are normal and she can exercise, an exercise electrocardiogram is a cost-effective first step.

**Cardiovascular Medicine:Question 97**
The correct answer is A

**Educational Objectives**
Identify the absolute contraindications for administration of thrombolytic agents.

**Critique**
The prompt initiation of a thrombolytic agent during ST-segment elevation acute myocardial infarction is associated with limitation of the infarct size, a reduction in congestive heart failure, and improved survival. However, these potent agents should not be given if the patient has a history of hemorrhagic stroke, nonhemorrhagic stroke within the past year, known intracranial neoplasm, active peptic ulcer disease, uncontrolled hypertension (>180/110 mm Hg), or suspected aortic dissection. There are clinical conditions in which the potential benefit from administration of thrombolytic therapy should be weighed against the risk of bleeding in each case. These relative contraindications include blood pressure >180/110 mm Hg initially but then controlled with medication, history of chronic severe hypertension, current use of anticoagulants in therapeutic doses (INR≥2), recent trauma or major surgery within 4 weeks, cardiopulmonary resuscitation for >10 minutes, noncompressible vascular puncture, and pregnancy. Age alone is not a contraindication, although elderly patients have a higher risk for intracranial hemorrhage with thrombolysis.
This patient had a nonhemorrhagic stroke 3 months ago, and was treated with warfarin. This recent stroke represents an absolute contraindication to thrombolytic therapy. The other clinical features listed as alternative answers each represent a relative contraindication that should be weighed on a case-by-case basis.

**Cardiovascular Medicine: Question 98**

**The correct answer is A**

**Educational Objectives**

Recognize the high risk of mortality associated with pulmonary hypertension in a pregnant patient.

**Critique**

This patient has a new diagnosis of severe primary pulmonary hypertension. Severe pulmonary hypertension in pregnancy, whether primary or secondary, carries a 30% to 50% risk of maternal mortality. If pregnancy occurs in a patient who has established severe pulmonary hypertension, she should be counseled against continuing the pregnancy. Termination is recommended.

Prostacyclin and bosentan are pulmonary vasodilators that are used to treat severe symptomatic pulmonary hypertension. They should be considered for use during pregnancy if this patient refuses termination. Warfarin therapy is commonly used in patients who have severe pulmonary hypertension because of the known risk of in situ pulmonary thrombus formation. Anticoagulation should be considered if the patient decides to continue the pregnancy.

Angiotensin-converting enzyme inhibitors and angiotensin receptor blockers are contraindicated in pregnancy because of their teratogenic potential.

**Cardiovascular Medicine: Question 99**

**The correct answer is C**

**Educational Objectives**

Understand the potential for nonsteroidal anti-inflammatory drugs to exacerbate or cause heart failure.

**Critique**

A recent study showed that NSAIDs are unlikely to precipitate new congestive heart failure (CHF). However, in more than 7000 patients, exposure to these drugs was associated with a relative risk of 9.9 for exacerbation of CHF. NSAIDs may cause vasoconstriction, which can decrease cardiac output in patients who have advanced CHF.

Although patients who have hyperthyroidism and hypothyroidism are at risk for CHF, this patient’s thyroid function was normal after she received thyroid hormone suppressive therapy. Newer thiazolidinedione hyperglycemic agents, such as rosiglitazone, may exacerbate CHF, but glipizide is less likely to have this effect. Neither estrogen nor alendronate, which is used to treat osteoporosis, is associated with fluid retention or with exacerbation of CHF. One study suggested that estrogen therapy reduced mortality rates in older women with congestive heart failure. The results of this study do not endorse hormone replacement therapy in women with CHF, but suggest that estrogen is unlikely to lead to fluid retention and dyspnea.
Cardiovascular Medicine: Question 100
The correct answer is A

Educational Objectives
Understand the long-term anticoagulation regimens that are recommended for patients who have mechanical prosthetic valves.

Critique
Mechanical valve prostheses are associated with thromboembolic risk and require long-term anticoagulation. A mitral valve prosthesis is associated with a greater thrombotic risk than the same valve in the aortic position because of the difference in cross-sectional area. For the first 3 months after aortic or mitral valve replacement with a mechanical prosthesis, patients should receive warfarin with a target INR of 2.5 to 3.5. Patients who have a mechanical mitral valve prosthesis should receive this regimen indefinitely, as should patients who have a mechanical aortic valve in addition to other risk factors for thromboembolism (atrial fibrillation, left ventricular systolic dysfunction, hypercoagulable state, or previous thromboembolic event). If no other risk factors are present, patients who have a tilting disk or bileaflet mechanical aortic valve prosthesis should receive warfarin with a target INR of 2.0 to 3.0 after the first 3 months.

Although no controlled trials support the use of aspirin in addition to warfarin, many physicians recommend the use of aspirin, 100 mg/d, in addition to warfarin for all patients during the first 3 months after mechanical valve replacement. This treatment is also used long term for patients who have a mechanical mitral valve replacement and for those who have an embolic event during warfarin therapy. Aspirin alone is not an adequate antithrombotic agent.

Cardiovascular Medicine: Question 101
The correct answer is B

Educational Objectives
Recognize acute ventricular septal defect after myocardial infarction.

Critique
Mechanical complications usually occur 2 to 7 days after acute myocardial infarction (AMI). Ventricular septal defect (VSD) and papillary muscle rupture leading to acute mitral regurgitation are rare mechanical complications that occur in roughly 0.1% of cases of AMI. Both disorders usually lead to abrupt pulmonary edema and/or hypotension. Papillary muscle dysfunction, without rupture, can also cause severe mitral regurgitation after AMI. Early diagnosis is critical because survival 24 hours after a large VSD or papillary muscle rupture is roughly 25% with medical therapy. An emergent echocardiogram is indicated to help with the early diagnosis. Hemodynamic monitoring with a pulmonary artery catheter is usually necessary. An increased oxygen saturation between the right atrium and ventricle is seen with left-to-right shunting through a VSD. Both disorders may be associated with prominent v waves on the pulmonary capillary wedge tracing. Echocardiography is helpful in making the correct diagnosis.

For both disorders, rapid treatment involves nitroprusside and/or intra-aortic balloon pump. Emergent surgical repair is usually considered for definitive therapy; however, the survival is still only 50% following repair. Pericardial tamponade from rupture of the left ventricular free wall usually leads to sudden hypotension and death. After heart failure, free wall rupture represents the second most common cause of death for patients who die in hospitals after myocardial infarction. Predisposing factors include advanced age as well as first myocardial infarction, probably due to lack of coronary collaterals. Ventricular free wall rupture is most commonly seen 1 to 4 days after a myocardial infarction, but can rarely occur up to 3 weeks afterward. The free wall rupture typically occurs in
the junction of the infarction with normal myocardium, and less often within the center of the infarct. Patients usually present with cardiovascular collapse, tamponade, or pulseless electrical activity. Right heart catheterization in tamponade would demonstrate diastolic elevation and equalization of pressures from the right atrium, right ventricle, and pulmonary capillary wedge with reduced cardiac output. Atrial septal defect is not a complication following AMI.

**Cardiovascular Medicine: Question 102**
The correct answer is A

**Educational Objectives**
Recognize the mortality benefits associated with implantable cardioverter defibrillators.

**Critique**
Factors associated with a high risk of sudden death include the following: previous myocardial infarction with reduced ejection fraction and nonsustained ventricular tachycardia; structural heart disease with recurrent unexplained syncope; idiopathic cardiomyopathy with syncope or ventricular tachycardia; hypertrophic cardiomyopathy with syncope or ventricular tachycardia; right ventricular dysplasia; and long QT syndrome.

The 50-year-old man (option B), despite a previous myocardial infarction, has preserved left ventricular function. In this case, the benefit of an implantable cardioverter defibrillator as a prophylactic device is not established. The 30-year-old woman (option C) has preserved left ventricular function, and regardless of the nonsustained ventricular tachycardia, her prognosis is excellent. The 33-year-old woman (option D) has no symptoms that suggest hemodynamically compromising arrhythmia, a negative finding on 24-hour ambulatory monitor, and a negative family history.

**Cardiovascular Medicine: Question 103**
The correct answer is C

**Educational Objectives**
Identify alcohol as a cause of left ventricular systolic heart failure.

**Critique**
Excessive alcohol consumption is the most likely cause of this patient's congestive heart failure. In a recent case-control study, the incidence of heavy alcohol consumption was much higher in patients with dilated cardiomyopathy than in a control population. Early evidence of diastolic dysfunction may precede clinical heart failure. Unlike repair of an atrial septal defect in adulthood, repair of this defect in childhood is almost never associated with late onset of heart failure. Likewise, late dehiscence of an atrial patch is unusual and is unlikely to be associated with left-sided heart failure and systolic dysfunction. This patient has no family history of dilated cardiomyopathy and no risk factors for coronary artery disease.

**Cardiovascular Medicine: Question 104**
The correct answer is D

**Educational Objectives**
Understand the complications associated with anticoagulation therapy during pregnancy.

**Critique**
This patient is at high risk for an anticoagulation-related complication in pregnancy. Multiple treatment options are available. Aspirin and clopidogrel are not effective forms of anticoagulation during pregnancy for a patient who has a mechanical prosthesis. Dipyridamole is contraindicated during pregnancy because it carries a
substantial risk of thromboembolism or valve obstruction as a result of thrombosis. Heparin, 5000 U subcutaneously three times daily, and enoxaparin, 30 mg subcutaneously twice daily, are doses for prophylaxis for deep venous thrombosis and are likely to be ineffective doses for anticoagulation in an adult. The optimal anticoagulation treatment option for patients who have mechanical valve prostheses is controversial, and decisions must be made based on individual needs. Whatever regimen is used, doses need to be appropriately adjusted.

**Cardiovascular Medicine: Question 105**
The correct answer is B

**Educational Objectives**
Manage angina or silent ischemia after successful thrombolysis for acute myocardial infarction.

**Critique**
This patient had successful thrombolysis for acute ST-segment elevation myocardial infarction. He denies any post-infarction angina and has no evidence of heart failure or arrhythmias. However, he does have silent ischemic ST-segment abnormalities on his resting electrocardiogram. Coronary angiography before discharge is indicated for patients with angina or residual ischemia (either at rest or induced by exercise or pharmacologic stress) after successful thrombolysis. For patients without recurrent angina or silent ischemia, noninvasive risk assessment with an exercise or pharmacologic stress test before discharge would be appropriate.
The ACC/AHA guidelines give a class I recommendation to perform coronary angiography in patients who have undergone successful thrombolysis who meet the following criteria: residual myocardial ischemia (post-myocardial infarction angina, provokable ischemia on stress testing), hemodynamic instability, or clinical heart failure with an ejection fraction <40%.

**Cardiovascular Medicine: Question 106**
The correct answer is C

**Educational Objectives**
Recognize the manifestations of congenital long QT syndrome.

**Critique**
This patient's history of syncope treated with a β-blocker and her current electrocardiogram suggest congenital long QT syndrome. This syndrome comprises various electrophysiologic disorders. Typically, this syndrome is a primary electrical disease with no associated structural abnormality. Patients who have long QT syndrome are at risk for malignant ventricular arrhythmias, particularly polymorphic ventricular tachycardia, as seen on this monitor strip. The episode is typical in that it follows the compensatory pause after a premature ventricular contraction and the morphology is typical of torsades de pointes, which is the specific form of polymorphic ventricular tachycardia associated with long QT. The QT interval on the sinus beats is prolonged.

If the arrhythmia is controlled, the long-term prognosis is good. Prevention of arrhythmias is often achieved with long-term β-blocker therapy (which was effective in this patient), permanent pacing, or left cervicothoracic sympathectomy. Patients who have recurrent syncope, have survived a cardiac arrest, or have had sustained ventricular tachycardia despite drug therapy should receive an implantable cardioverter defibrillator (class IIb recommendation). Other patients with long QT syndrome who should be considered for a primary implantable cardioverter defibrillator are those who have aborted sudden death or who have a strong family history of sudden death.

This arrhythmia would be very unusual in patients with Wolff-Parkinson-White
syndrome, who are more likely to have supraventricular tachycardias. Atrial fibrillation in the setting of Wolff-Parkinson-White syndrome may show beat-to-beat variation in QRS width, but it is unlikely to be initiated by a premature ventricular contraction. In hypertrophic cardiomyopathy and dilated cardiomyopathy, monomorphic ventricular tachycardia or ventricular fibrillation would be far more common than polymorphic ventricular tachycardia. The normal physical examination makes either form of cardiomyopathy less likely.

**Cardiovascular Medicine: Question 107**
The correct answer is A

**Educational Objectives**
Recognize the drug interaction between amiodarone and digoxin.

**Critique**
This patient has digoxin toxicity. Amiodarone and digoxin are often prescribed together in patients who have heart failure or atrial fibrillation. Careful attention to the interaction between these drugs is important. Amiodarone is a potent inhibitor of several cytochrome P-450 enzymes. This patient is taking amiodarone, which may lead to a 50% increase in serum digoxin levels. Electrocardiogram shows underlying atrial fibrillation with a junctional escape. This rhythm of complete heart block with an accelerated junctional escape is typical of digoxin toxicity. Management includes measuring the digoxin level, discontinuing the digoxin, and administering digoxin immune Fab (ovine). Amiodarone also has important interactions that lead to decreased metabolism of theophylline and warfarin. When amiodarone therapy is added, doses of digoxin and warfarin should be decreased empirically by one-half. It is unlikely that this patient with adult-onset diabetes mellitus has ketoacidosis. No clinical evidence supports a diagnosis of a severe exacerbation of heart failure. The absence of pulmonary edema is a helpful finding. A soft S3 may be noted in patients who have chronic heart failure. It is also unlikely that this patient has adrenal insufficiency. She is receiving long-term steroid therapy for chronic obstructive pulmonary disease, but has had no major stressor that would lead to adrenal insufficiency. Acute coronary syndrome is also unlikely. She has no anginal symptoms, electrocardiogram shows no ST-T changes, and the troponin level is normal.

**Cardiovascular Medicine: Question 108**
The correct answer is B

**Educational Objectives**
Treat dyslipidemia in patients with diabetes mellitus.

**Critique**
This patient has several lipoprotein abnormalities, including elevated total and LDL cholesterol levels, a depressed HDL cholesterol level, and an elevated fasting serum triglyceride level. According to the American Diabetes Association and ATP III, the LDL cholesterol should be the primary target of treatment in patients with diabetes and dyslipidemia. Thus, the first goal of therapy in this patient is to reduce the LDL cholesterol level to <100 mg/dL because diabetes is now considered a coronary artery disease risk equivalent. A statin is the recommended initial agent. Furthermore, the Heart Protection Study showed that a statin (simvastatin, 40 mg) decreased the incidence of vascular events in patients with diabetes without clinical coronary disease, regardless of the baseline LDL cholesterol level. A fibrate or niacin is likely to improve the patient’s lipid profile but would have only modest effect on her LDL cholesterol. Although a bile acid resin will lower the LDL cholesterol, it is often associated with an increase in triglycerides and is difficult to tolerate, except at low doses. Ezetimibe, a new intestinal brush border cholesterol
absorption inhibitor, would be expected to lower the LDL cholesterol level by 15% to 20%. Thus, alone, it would not achieve the LDL cholesterol goal of <100 mg/dL. If the target goal is not achieved with statin therapy, ezetimide can be safely added. The combination lowers triglycerides and provides incremental lowering of LDL cholesterol.

Cardiovascular Medicine:Question 109
The correct answer is C

Educational Objectives
Manage a low-risk patient hospitalized with unstable angina.

Critique
This patient was hospitalized with unstable angina. She has no evidence of congestive heart failure, and myocardial infarction has been ruled out. This patient has one of the seven following TIMI risk score prognostic variables: age ≥ 65 years, ≥3 traditional risk factors for coronary artery disease, documented coronary artery disease with 50% coronary artery diameter stenosis, ST-segment deviation, ≥2 anginal episodes within the past 24 hours, aspirin use within the last week, and elevated cardiac biomarkers. Patients with less than three such variables are characterized as having low-risk acute coronary syndrome. For such patients, outcomes from recent trials are equivalent between an early invasive strategy involving coronary angiography and a conservative approach involving noninvasive stress testing during the hospitalization. Given the patient’s left ventricular hypertrophy repolarization abnormality, an exercise electrocardiography study may be nondiagnostic. Cardiac imaging with either echocardiography or nuclear medicine scintigraphy is recommended. Coronary angiography with either computed tomography or magnetic resonance imaging is still in development and is not indicated for routine clinical use.

Cardiovascular Medicine:Question 110
The correct answer is C

Educational Objectives
Diagnose tachycardia-mediated cardiomyopathy.

Critique
The most likely cause of this patient’s symptoms is tachycardia-mediated cardiomyopathy, which can occur with persistent tachycardia. Symptoms include atrial fibrillation with rapid ventricular response and may be caused by the depletion of high energy stores. Although this form of cardiomyopathy is usually reversible with control of heart rate, resolution may take several months. This patient’s mitral regurgitation is not severe and is likely a result rather than a cause of cardiomyopathy. The patient has no symptoms that suggest coronary artery disease, and the finding of an isolated Q wave in lead III is insignificant. The echocardiogram suggests a global process, and no segmental wall motion abnormalities are seen. Although the patient had a cough and bronchitis 3 months ago, these symptoms improved with treatment, and the symptoms of congestive heart failure are more recent. His hypertension is not severe and is not likely to have caused hypertension and heart disease. Further, hypertensive heart disease is usually associated with diastolic dysfunction rather than with systolic dysfunction.
Cardiovascular Medicine: Question 111
The correct answer is A
Educational Objectives
Recognize the appropriate evaluation of syncope.

Critique
Approximately 30% of the population experiences syncope at some point. In the absence of structural heart disease, syncope, near-syncope, and transient lightheadedness are usually benign, but the recurrence rate is high (30%). Obtaining a careful history and performing a thorough physical examination are critical components of the evaluation of syncope and can help to distinguish patients who have benign syncope from those who are likely to have a malignant cause. In approximately 50% of cases, history and physical examination alone can identify the probable cause of syncope. In this case, the most likely cause is vasovagal syncope related to enhanced vagal tone as a result of both the back injury and micturition. In this case, the history, the normal physical examination and normal electrocardiogram are consistent with a benign cause and no further evaluation is warranted. Micturition syncope can occur in young men and is a variant of situational syncope. In older individuals, including women, micturition syncope is often associated with orthostatic hypotension due to medications. Patients who have recurrent micturition syncope should be advised to urinate while sitting down. Although β-blockers play a role in the management of some types of neurocardiogenic syncope, such therapy would not be initiated after a single episode. The patient’s minimal elevation in blood pressure and heart rate are likely related to anxiety. This patient has no evidence of a primary neurologic event, and the utility of CT scan of the head in the evaluation of syncope is limited. Because the patient has no evidence of major trauma to the great vessels or back, CT scan of the chest would not be useful. Likewise, the patient has no indication of ischemia, and exercise tolerance testing would not be of use.

Cardiovascular Medicine: Question 112
The correct answer is B

Educational Objectives
Recognize the ATP III guidelines for initiation of cholesterol-lowering drug therapy at a variety of target levels.

Critique
According to ATP III guidelines, the target LDL cholesterol level for this patient is <160 mg/dL. Her major risk factors include age and elevated LDL cholesterol level. She should be encouraged to make therapeutic lifestyle changes, including following a diet low in saturated and trans fatty acids, <70% of total calories obtained from saturated fat and <35% obtained from total fat. If she has one additional risk factor, such as a history of smoking, an HDL cholesterol level <40 mg/dL, or a family history of premature coronary artery disease, her NCEP-ATP III target LDL cholesterol would be <130 mg/dL. In patients with overt vascular disease or diabetes (considered a coronary artery disease risk equivalent), the target LDL cholesterol level is <100 mg/dL.
**Cardiovascular Medicine:Question 113**

**The correct answer is C**

**Educational Objectives**
Understand the role of resynchronization therapy in a patient who has refractory congestive heart failure.

**Critique**
In patients who have cardiomyopathy and significant conduction defects (left bundle branch block and first-degree atrial ventricular block), implantation of biventricular pacemakers is associated with significant symptomatic improvement. This improvement is attributed to normalization of the PR interval, reduced mitral regurgitation, and resynchronization of the left ventricular contraction. Biventricular pacing is accomplished by placement of a standard right ventricular lead. The left ventricle is paced with a lead that is passed through the coronary sinus venous system to the lateral aspect of the left ventricle. It is not clear whether biventricular pacing improves survival but it does improve quality of life and exercise tolerance. By criteria based on the MADIT II study, an implantable cardiodefibrillator would provide survival benefit in this patient. This patient does not require coronary artery bypass graft surgery because he has no evidence of ischemia. He has an akinetic segment, but no true aneurysm. Therefore, aneurysmectomy would not benefit this patient. Although mitral valve repair can be performed in patients who have a decreased ejection fraction, in this patient, mitral regurgitation may be caused by the defect and the stretched annulus rather than by primary mitral valve disease. Transmyocardial laser revascularization is associated with improvement in anginal symptoms, but not with improvement in heart function.

**Cardiovascular Medicine:Question 114**

**The correct answer is B**

**Educational Objectives**
Recognize the appropriate medical management of a patient with subacute stent thrombosis.

**Critique**
This patient developed subacute coronary stent thrombosis. Acute coronary stent thrombosis during stent implantation is very rare, occurring in <0.5% of cases. Subacute stent thrombosis occurs in roughly 1% of cases, typically 5 to 10 days after implantation of the stent. Causes of subacute stent thrombosis include inadequate antiplatelet therapy, inadequate stent deployment, and the presence of a hypercoagulable state. This patient developed a rash after starting clopidogrel. Clopidogrel is prescribed in addition to aspirin after coronary stent implantation to reduce the risk for stent thrombosis. A rash occurs in approximately 3% of patients taking clopidogrel. Studies have shown that antiplatelet agents (aspirin plus clopidogrel, or aspirin plus ticlopidine) are superior to antithrombotic regimens (either warfarin alone or warfarin plus aspirin). Clopidogrel is the first-line agent instead of ticlopidine, which has such side effects as thrombotic thrombocytopenic purpura. Adding ticlopidine to aspirin would be the most appropriate regimen for this patient who developed a rash to clopidogrel. Dipyridamole would be the next most appropriate choice, if the patient is intolerant of ticlopidine. Antithrombotic agents, such as coumadin or low-molecular weight heparin, are less effective compared to antiplatelet agents to prevent stent thrombosis.
Cardiovascular Medicine:Question 115
The correct answer is C

Educational Objectives
Recognize the risk of cardiovascular events in a patient with peripheral arterial disease.

Critique
Patients who have peripheral arterial disease without a history of myocardial infarction or ischemic stroke have approximately the same relative risk of cardiovascular mortality as those who have a history of coronary or cerebrovascular disease. In patients who have peripheral arterial disease, the mortality rate from all causes is approximately equal in men and women, and is increased even in asymptomatic patients. The severity of peripheral arterial disease in the legs is closely associated with the risk of myocardial infarction, ischemic stroke, and vascular death. The combined event rate is 5% per year. The lower the ankle-brachial index, the greater is the risk of cardiovascular events.

Cardiovascular Medicine:Question 116
The correct answer is C

Educational Objectives
Evaluate a patient with aortic stenosis with concomitant cardiomyopathy.

Critique
This patient has symptoms of congestive heart failure and evidence of aortic valve calcification, but low transvalvular gradients. Because gradients are dependent on flow, this patient's gradients may be low as a result of severe left ventricular systolic dysfunction despite severe aortic stenosis.
Left ventricular systolic dysfunction is associated with increased perioperative risk in patients who have aortic stenosis. Some patients have a very poor prognosis after aortic valve replacement. In others, the prognosis is greatly improved after surgery. Dobutamine stress echocardiography is useful in patients who have left ventricular systolic dysfunction, aortic stenosis, and low transvalvular gradients. An increase in aortic gradients in the setting of systolic augmentation of the left ventricle suggests that aortic stenosis is severe and that the low gradients can be attributed to low flow across the valve as a result of cardiomyopathy. Conversely, left ventricular contractile reserve without an increase in gradients suggests that, despite calcification of the valve, stenosis is not severe.
Contractile reserve in the setting of severe aortic stenosis suggests a better prognosis with aortic valve replacement than with medical therapy, whereas absence of contractile reserve suggests a poor prognosis after aortic valve replacement. Although transesophageal echocardiography allows excellent visualization of the valve, it does not allow determination of left ventricular contractile reserve. Exercise testing is usually contraindicated in patients who have severe symptomatic aortic stenosis. Its use as a tool to assess contractile reserve has not been validated in patients with aortic stenosis.
Myocardial perfusion imaging does not allow assessment of left ventricular contractile reserve or the severity of aortic stenosis.
Cardiovascular Medicine: Question 117
The correct answer is A

Educational Objectives
Understand the components of an exercise prescription.

critique
The recommendations provided to these three persons include information on all of the key components of an exercise prescription: intensity, frequency, and modality. Here, intensity is prescribed as absolute intensity, such as brisk walking, and not as relative intensity, such as percentage of maximum heart rate or oxygen uptake. The relative intensity will vary because each individual will exercise at a different percentage of his or her peak capacity or heart rate. The frequency is 5 days per week. Although an exact time to complete the task is not given, the duration of exercise is implied by the recommendation to walk 2 miles at a brisk pace. The time needed to complete the 2-mile walk may vary, but if each person walks briskly, individual times should not differ significantly. The exercise modality is walking. The exercise dose (the approximate amount of energy expended per unit time) is similar among all participants because they are performing the same amount of exercise weekly. Age affects the relative intensity of exercise, but does not substantially affect the amount of energy expended because the pace and duration will be nearly the same in all participants. Brisk walking (3 to 4 miles per hour) is usually considered a moderately intense exercise. When performed 5 days per week, persons of all age groups should achieve health benefits.