Study Guide for Final Exam

Abdominal aortic aneurysm

1. **Know the causes of an abdominal aortic aneurysm. P493**

proposed causes of AAA include atherosclerosis, inflammation, mycotic infection, inheritable connective tissue disorders (Marfan syndrome, type IV Ehlers-Danlos syndrome), and trauma.

atherosclerosis has been considered the most common cause of AAA and the known cause in 25% of all AAA.

2. **Understand risk factors for abdominal aortic aneurysm. P494**

Development of AAA: Atherosclerotic vascular disease, white race, male gender, advanced age, HTN, smoking, COPD, history of hernias, family history of AAA, and presence of other aneurysms. Hypercholesterolemia

AAA expansion: Advanced age, Severe cardiac disease, Previous stroke, Tobacco use, Cardiac or renal transplant.

AAA rupture: Female gender, Low FEV1, Larger initial AAA diameter, Higher mean blood pressure, Current tobacco use, Cardiac or renal transplant, Critical wall stress–wall strength relationship

AAA is an important clinical diagnosis because it is associated with considerable risk of rupture and death as the aneurysm enlarges to a diameter of more than 5.0cm (1.96 inches).

Evidence suggests that the high prevalence of AAA in patients with COPD may be related to medications (oral steroids) and coexisting diseases rather than to a common pathway of pathogenesis involving plasma elastase or α1-antitrypsin deficiency

AAA and elevated homocysteine plasma levels.

AAA represent 75% of aortic aneurysms

3. **Know the symptoms of an abdominal aortic aneurysm.**

AAA may cause symptoms as a result of the pressure on surrounding structures, about 75% are asymptomatic at initial diagnosis.

Symptoms:

Symptomatic aneurysms increase in number after the age of 70years.

In thin patients, a supine abdominal examination may readily show a pulsatile abdominal mass,

Inflammatory AAAs may be manifested with chronic abdominal pain or back pain and, sometimes, ureteral obstruction

Microembolic infarcts in the lower extremity of a patient with easily palpable pedal pulses may suggest either abdominal or popliteal aneurysm. Embolization of mural thrombus from an abdominal aneurysm may be seen with acute limb ischemia caused by femoral or popliteal occlusion.

Symptom and sign of a ruptured AAA

classic diagnostic triad of ruptured AAA is hypotension (42%), pulsatile abdominal mass (91%), and abdominal pain (58%) or back pain (70%). The triad is encountered in only 50% of patients with a ruptured AAA. Ruptured AAAs should be suspected in any patient who comes in with complaints of hypotension and atypical abdominal or back pain symptoms

4. **What is a Saccular Abdominal Aneurysm?**

Saccular aneurysm is an asymmetric weakness or bleb on the side of the aorta; these defects result from trauma or an internal wall defect caused by an ulcer.

Fusiform aneurysm is a symmetric weakness of the entire circumference of the aorta that produces a bulge.

5. **What are the risks for abdominal aortic aneurysm?**

AAA is an important clinical diagnosis because it is associated with considerable risk of rupture and death as the aneurysm enlarges to a diameter of more than 5.0cm (1.96 inches)

Diagnostic Testing for CAD

6. **Why is CT imaging limited in women? P492**

Single-photon emission CT imaging is technically limited in women because breast tissue and smaller coronary artery size

7. **Can ischemic changes on an ECG during or after an ETT correlate to the effected artery or arteries?**

Ischemia that is confined to only the posterior and or lateral segments of the left ventricle is difficult to detect by ETT, but that does not mean that ETT cannot detect ischemia limited to these functional areas of the heart.

8. What diagnostic test is used for CAD? P488

Exercise Tolerance Test- standard first-line approach to initial testing for CAD is the ETT, during which the patient (attached to a 12-lead electrocardiogram) is continuously monitored during graded exercise. The bicycle and treadmill are the two most often used.

The primary goal of the ETT is to increase workload incrementally to induce ischemia or until a predetermined workload is reached.

Myocardial Perfusion Imaging- MPI offers a method of visualizing blood flow to the heart by injection of a radioactive cardiac-specific tracer. This improves the diagnostic accuracy of a stress test because it gives another method of detecting perfusion defects aside from measuring ST depression on the electrocardiogram.

thallium chloride Tl 201 and technetium Tc 99m sestamibi are the radiopharmaceutical agents used for the detection of CAD in MPI.

MPI such be used when baseline ECG abnormality that would interfere with measurement of stress-induced ST-segment changes, such as left ventricular hypertrophy, bundle branch blocks, and digoxin use. MPI is also a useful tool for use with high-risk diabetic patients

Cardiac Magnetic Resonance Imaging (MRI): Cardiac MRI is, with further technologic refinement, anticipated to provide accurate data to distinguish between stable and unstable plaque and to assist with quantifying CAD, replacing the diagnostic cardiac catheterization

Exercise Echocardiography- echocardiographic imaging enhances the sensitivity and specificity of CAD detection to an extent comparable to that provided by nuclear techniques.1 The 2DE evidence for ischemia includes an abnormal left ventricular ejection fraction (LVEF) response to exercise or the development of regional wall motion abnormalities. The exercise is performed with a bicycle or treadmill, and dobutamine is the most common pharmacologic agent used simultaneously with the echocardiography imaging. The image quality may be enhanced by the injection of echogenic microbubbles.

9. Understand the coronary flow related to CAD.

CAD exists when coronary arteries are narrowed by atherosclerotic plaque formation, plaque rupture, or spasm. This narrowing impedes coronary blood flow, resulting in hypoperfusion of the myocardium.

The hypoperfusion produces first diastolic, and then systolic dysfunction, with characteristic signs and symptoms, including chest pain.

Typical ECG changes of ischemia result, although the ST-segment and T-wave changes that are central to demonstration of ischemia occur relatively late in the ischemic cascade.

10. What is the best reason to add a Doppler flow studies during an echocardiogram study?

The Doppler portion of the examination is able to provide an assessment of the outflow gradient that closely approximates that obtained by cardiac catheterization. By combining Doppler ultrasonography and echocardiography, the examiner may make a reasonable calculation of the aortic valve area. Thickened, calcified, and immobile leaflets are readily noted by transthoracic two-dimensional echocardiography**.**

Detect and evaluate blood shunting from a septal defect (Your best response for this specific case, however, would be that Doppler Flow studies would detect and evaluate blood shunting from a septal defect.)

11. What defines a positive exercise echocardiogram?

A positive exercise echocardiogram is defined by stress- induced decrease in regional wall motion, decreased wall thickening, or regional compensatory hyperkinesis

Induced decrease in regional wall motion (Induced decrease in regional wall motion would be included in defining a positive exercise echocardiogram. Wall thickening would not traditionally occur in a positive test and hyperkinesis, **not hypokinesis, generally occurs in a positive test**.)

12. What changes would you see during an ETT that are highly predictive of CAD? P489

On the other hand, if there is evidence of ischemia (typical angina, ischemic ST changes) before the patient's target heart rate is reached, the test is considered strongly predictive of significant CAD.

A second important predictor of more advanced CAD is exercise-induced hypotension (i.e., a fall in systolic blood pressure of at least 20mm Hg at any point during exercise).

13. What is an Isometric ST-segment during exercise caused by? P488

result in positive chronotropic (rate) and inotropic (strength of contraction) response of the cardiovascular system, increasing myocardial oxygen demand. The normal hemodynamic response to these stimuli is an increase in absolute coronary blood flow.

ECG response of normal hearts is maintenance of an “isoelectric” ST segment during exercise and recovery

14. Where would you measure the J point located on an ECG in relation to the QRS and ST-segment depression after an exercise stress test? P488

Junction between QRS and ST segment (The J point is located at the junction between QRS and ST-segment.)

J point of the QRS complex (the junction between the QRS complex and the ST segment).

15. Why would you order an ETT in a symptomatic woman with a normal ECG?

Diagnostic testing is not always accurate in women and need more specialized test to detect CAD.

16. What predictive value does a significant ST-segment elevation have for CAD? p488

ECG changes such as upsloping ST segment (elevation) or isolated T-wave downsloping (depression) have not demonstrated significant predictive value.

These changes have minimal predictive value for CAD (Significant elevation of the ST-segment has minimal predictive value for CAD.)

17. **What physiological changes occur during effort in the routine ETT?**

In a stress test or ETT, patients are asked to perform incremental exercises that result in positive chronotropic (rate) and inotropic (strength of contraction) stimulation of the cardiovascular system, which in turn increases myocardial oxygen demand. Increases in oxygen demand obligate an increase in myocardial blood flow**.**

The healthy coronary circulation can increase flow approximately five times above the baseline level.

The fundamental pathophysiologic change in CAD is a limitation of the ability of the coronary arterial circulation to vasodilate appropriately. As a result, the ability to increase coronary blood flow in the face of increased myocardial oxygen demand is limited, leading to an imbalance between oxygen supply and demand and resulting in myocardial ischemia.

18. What does an abnormal left ventricular ejection fraction on an echocardiogram mean for a patient during an ETT? P490

The 2DE evidence for ischemia includes an abnormal left ventricular ejection fraction (LVEF) response to exercise or the development of regional wall motion abnormalities**.**

19. Know the reasons for using the risk stratification according to the Farmingham risk score to justify a ETT in an asymptomatic patient.

High Farmingham risk score has a high accuracy of predicting a patient risk for CAD within the next 10 years.

All patients, even if asymptomatic, require risk stratification according to the Framingham risk score (low, intermediate, or high) to identify CAD risk equivalents

he ACC/AHA guidelines do not recommend stress tests for asymptomatic patients, unless the patient (men 45years or older, women 55years or older) is sedentary and wishes to begin exercising aggressively

exception is asymptomatic women with diabetes and peripheral arterial disease. These women are classified as high risk; diabetes and peripheral arterial disease are CAD risk equivalents.

The recommendation for asymptomatic women with diabetes, peripheral vascular disease, and possible kidney disease is for secondary prevention strategies to prevent future cardiac events.

Heart Failure

20. Where could you find supporting data for guidelines for prevention of future heart disease? P456

The American College of Cardiology (ACC) and the American Heart Association (AHA) have devised a classification system that grades heart failure by stage (Box 120-3) to include patients at risk for the development of heart failure (stage A) and those with end-stage, advanced disease (stage D). And guidelines to prevent heart failure and treatment

New York Heart Association Functional Classification

Prevention of heart failure is linked to prevention of ischemic heart disease as well as to control of hypertension in the primary care setting.

all patients should be screened for heart disease risk and encouraged to reduce their risk by adopting a healthy lifestyle, including normalization of weight, low-fat diet, smoke exposure avoidance, and exercise**.**

Interventions to screen for heart disease risk include a family history, blood pressure measurement, lipid screen, and blood glucose concentration or hemoglobin A1c level to screen for diabetes.

RISK FACTORS: Most individuals with heart failure have antecedent hypertension or myocardial infarction. Other risk factors include coronary artery disease, diabetes, renal disease, and increasing age. African Americans have a higher prevalence of heart failure than other ethnicities and with a greater 5-year fatality than for whites.

Causes: Coronary artery disease is the most common cause of systolic heart failure

Hypertension, atrial fibrillation, and diabetes are common antecedents of diastolic dysfunction

Hypertension and valvular heart disease were considered the most common causes of heart failure 30 to 50 years ago.

21. What are the signs of heart failure? p541

Symptoms:

Shortness of breath (dyspnea)- Pressure is increased in the pulmonary veins because the heart), which leads to left ventricular overload and worsening symptoms of failure cannot keep up with the supply. This can cause pulmonary congestion or pulmonary edema (interstitial and alveolar congestion

Patients Describe: Breathlessness during activity, at rest, or while sleeping (called paroxysmal nocturnal dyspnea); these symptoms worsen with severity of heart failure

Difficulty breathing while lying flat (orthopnea) or complaints of waking up tired or feeling anxious and restless

Persistent coughing, bronchospasm, or wheezing- Persistent pulmonary interstitial or alveolar edema (sometimes called cardiac asthma), worse when recumbent

Patients Describe: edema (sometimes called cardiac asthma), worse when recumbent. Coughing that produces white or pink blood-tinged mucus may not always be present.

Edema- As blood flow out of the heart is impeded, blood returning to the heart through the veins backs up, causing fluid to build up in the tissues. The kidneys are less able to dispose of sodium and water, also causing fluid retention. This is evidence of right-sided heart failure.

Patient Describe: Swelling in the feet, ankles, legs, or abdomen or weight gain Patients may find that their pants or shoes feel tight.

Signs

Jugular venous distention: An index of right atrial pressure; when elevated, it is an indicator of volume overload. (Tricuspid regurgitation may alter the examination findings.) With normal pressure, the upper level of visible jugular vein is approximately 4cm above the sternal notch.

Physical Examination: With the patient at a 45-degree angle, note the upper limit of visible pulse in the internal jugular. In some patients, this pressure may be normal at rest, but it rises to abnormal levels with compression of the right upper quadrant. This sign is known as the hepatojugular or abdominal jugular reflex.

The internal or external jugular vein is compressed in the supraclavicular fossa, and as the examiner's finger strips the vein cephalad, blood rises in the more proximal portion of the vein; the height of this blood volume above the patient's clavicles reflects the central venous pressure. The height of the venous column normally falls during inspiration as a result of the accompanying decrease in intrathoracic pressure.

Crackles, frothy or pink sputum, pleural effusions- Pulmonary fluids transudate to interstitial spaces and alveoli, usually in lung bases because of gravity. Pulmonary edema. Occur with volume overload—transudative

Physical exam: Lung examination, Dull or absent breath sounds

Third heart sound: Early diastolic rapid ventricular filling associated with left ventricular systolic dysfunction

Physical Exam: S3 is best heard with patient in left lateral position

Fourth heart sound: Overdistention of ventricles during late diastole as the stiff ventricles expand further to accommodate final diastolic filling by atrial contraction (atrial “kick”)

Physical Exam: Best heard with patient in left lateral position; absence of S3 suggests early failure or the presence of diastolic dysfunction

Aortic stenosis: Small volume, high velocity

Physical Exam: Harsh murmur, usually loud

Mitral regurgitation: Large volume, low turbulent flow

Physical Exam: Soft holosystolic murmur

Tricuspid regurgitation: Large volume in right ventricle

Physical Exam: Hepatic congestion, edema, ascites

Hepatomegaly, right upper quadrant tenderness: Liver enlargement or stretching of the hepatic capsule

Physical Exam: Right upper quadrant tenderness indicates enlarged or tender liver

Ascites, anasarca, or edema: Due to volume overload

Physical Exam: Edema of subcutaneous tissue may be found in abdomen, chest, buttocks. Ascites may be suggested by protuberant abdomen, but the examination is not reliable. Pitting or firm edema of lower extremities is common in heart failure.

Altered hemodynamics: Changes in cardiac output by stroke volume and heart rate

Physical Exam: May appear with symptoms and signs of low output, such as lightheadedness, impaired cognition, tachycardia, cool extremities, hypotension

Tachycardia: Changes in heart rate due to arrhythmia or activation of baroreceptors, which in turn activate sympathetic nervous system

These compensatory mechanisms along with the renin-angiotensin-aldosterone and vasopressin release help modulate heart rate early on with a drop in pressure. Ultimately, a tachycardia will ensue, unless it is masked by medication (such as beta blockers, digoxin, calcium channel blockers).

Physical Exam: Heart rate measurement; evaluation of rhythm is important

Displaced point of maximal impulse: Displacement of the palpable apical impulse away from the midclavicular line toward the anterior axillary line indicates left ventricular enlargement.

The palpable apical impulse should be a quick tap, narrow in distribution, not more than 1 to 2cm (0.4 to 0.8 inch) in diameter. An impulse that is palpable with the palm of the hand, lasts longer, or is forceful indicates increased cardiac output or ventricular hypertrophy.

Physical Exam: Palpable impulse may be elicited with the palm placed on the sternum. This finding is a right ventricular tap or heave, indicating right ventricular enlargement and volume overload.

Hypotension, cool extremities: Due to low cardiac output; sometimes medication related

Physical Exam: Blood pressure measurement