TEAMCME®

ACCREDITED TRAINING FOR THE NATIONAL REGISTRY OF CERTIFIED MEDICAL EXAMINERS

CARDIOVASCULAR DISEASES

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HYPERTENSION

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Hypertension 391.41(b)(6) Appendix A: Advisory Criteria

- Most common condition leading to modification of certification interval
- Alone is unlikely to cause sudden collapse
- A potent risk factor for PVD, renal insufficiency and cardiovascular disease

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Hypertension Concerns

MEs should evaluate those with hypertension for CV disease, peripheral artery disease, nephropathy, retinopathy, and other target organ damage.

Counsel the driver regarding modifiable behaviors:

- Smoking
- Obesity
- Lack of exercise

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Hypertension Made Easy!

Problems with blood pressure measurement:

- Placing cuff over clothing
- Using inappropriately sized cuff
- Incorrect arm position-heart height
- Insufficient relaxing time
- Sitting Position, legs uncrossed

Systolic pressure fluctuates in short term from:

- Emotional and physical state
- Transient hypertension (white coat)

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Hypertension Guidelines

An elevated BP should be confirmed by at least two measurements taken at different times during the exam on the same day. Additional measurements are allowed and should be recorded on the report form.

The lowest reading is used to determine stage of HTN.

If the driver is going to be disqualified, it is prudent that the medical examiner personally confirm the BP, rather than a staff member.

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Hypertension Made Easy!

Stage 1 Values: 140/90 to 159/99
- Begins at: 140/90
- Ends at: 1 point below the beginning values for Stage 2

Stage 2 Values: 160/100 to 179/109
- Begins at: Add 20 to systolic & 10 diastolic Stage 1 values.
- Ends at: 1 point below the beginning values for State 3

Stage 3 Values: 180/110 and above
- Begins at: Add 20 to systolic and 10 diastolic Stage 2 values.

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Stage 1 Hypertension (140-159/90-99)		
Certification	**DQ'd**	**Recertification**
For 1 year if: • Has no history of HTN • It is the first exam at which the driver has BP in stage 1 • Does not use medication to control BP *One-time 3-month certificate if:* • History of HTN	History of stage 3 HTN	*For 1 year if any of the following:* • BP ≤ 140/90 *On-time 3-month certificate if:* • BP is stage 1 or stage 2 *6-month certificate if:* • History of stage 3 HTN • BP ≤140/90
Stage 2 Hypertension (160-179/100-109)		
One-time 3-month certificate	History of stage 3 HTN	*For 1 year if:* • BP ≤ 140/90 *6-month certificate if:* • History of stage 3 HTN • BP ≤140/90

Stage 3 Hypertension (≥180/110)		
Certification	**Disqualified**	**Recertification**
Disqualified	Disqualified until BP ≤ 140/90	*6-month certificate if:* • BP ≤140/90

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Hypertensive Medications

Diuretics
- **Furosemide (Lasix)**
  - **Be conscious of potassium (K+) depletion**
- Hydrochlorothiazide (HCTZ)

Calcium Channel Blockers
- Nifedipine
- Amlodipine
- Verapamil
- Diltiazem

Angiotensin-2 Receptor Blockers (ARBs):
- Losartan
- Valsartan

Beta-Blockers
- Metoprolol
- Propranolol
- Atenolol

ACE Inhibitors
- Enalapril
- Lisinopril

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PRACTICE SCENARIO

42-year-old female with High blood pressure, taking HCTZ (Oretic) 25mg and Enalapril (Vasotec) 20mg which she tolerates meds well with no side effects. She also admits to smoking 1 ½ packs of cigarettes per day (for 20 years). She does short hauls for work and is home every night.
- Forgot to take meds before leaving home
- Came to exam after 10 hours driving without sleep
- Had several cups of coffee within past 2 hours
- Exam:
  - BP = 151/94
  - Pulse = 92 bpm and regular

Should this driver be disqualified or certified? Why?

If the driver is certified, for what time interval?

What other requirements would there be?

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PRACTICE SCENARIO ANSWER

Provide a 1-time certificate for 3 months

- Upon return for recertification, they must complete a new physical and have a BP ≤140/90 to be certified for a year

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CARDIOVASCULAR DISEASE

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"An ME's fundamental task during the cardiovascular assessment is to establish whether a driver has a cardiovascular disease or disorder that is accompanied by or likely to cause *syncope, dyspnea, or collapse*, thus endangering driver and public safety and health."

The ME should consider the nature and severity of the disease when determining the duration of medical certification.

The examination is based on:
- The driver's history
- Physical examination
- Additional testing or consultation if necessary

Medical certification depends on a comprehensive medical assessment of overall health and informed medical judgment about the impact of single or multiple conditions.

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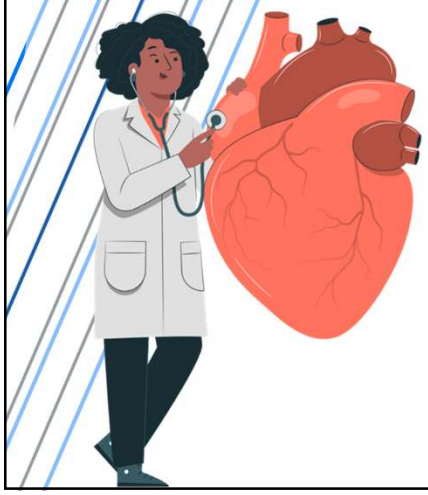

Cardiovascular Medication

Anticoagulants & Blood Thinners:
- *Coumadin (Warfarin): monthly monitoring required (INR 2-3)*

Other anticoagulant monitoring parameters depend on ***Kidney Funtion:*** Creatinine Clearance (CRCL)
- Xarelto (Rivaroxaban)
- Pradaxa (Dabigatran)
- Eliquis (Apixaban)
  - If CRCL > 50, check creatinine every 6-12 months
  - If CRCL < 50, check creatinine every 3 months

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Evaluation/Documentation

If a driver reports symptoms consistent with undiagnosed CVD, you should refer the driver to a specialist for further evaluation prior to certification.

If a driver gives a "Yes" answer to the question regarding heart surgery or a heart procedure, obtain documentation from the cardiologist before certifying.

Consider obtaining pertinent reports such as exercise tolerance test (stress test) and other documentation to adequately assess fitness for duty.

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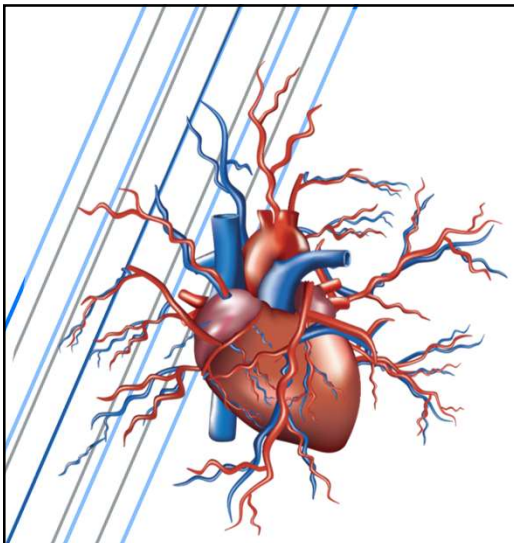

Heart Transplantation

- Concerns are transplant rejection, post-surgical atherosclerosis, medication side effects

Considerations:

- Does the driver have signs of cardiovascular disease?
- Does the driver have signs of rejection?
- Has treatment, including response to medications, been shown to be adequate and effective?
- Does the driver demonstrate compliance with the treatment plan?

Anti-Rejection Medications:

- Tacrolimus (Prograf)
- Cyclosporine
- CellCept

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Syncope

It is an immediate threat to public safety.

- Distinguish between *pre-syncope* (dizziness, lightheadedness) and true *syncope* (loss of consciousness)
- Verify that driver's medications are not predisposing them to decreased BP, electrolyte shifts and imbalances, fatigue
- Qualification determinations are made according to the standards of the underlying condition
  - Cardiac-based syncope
  - Neurologic-based syncope (migraine, seizure)
- Has treatment been shown to be adequate and effective?

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PERIPHERAL VASCULAR DISEASE & ANEURYSMS

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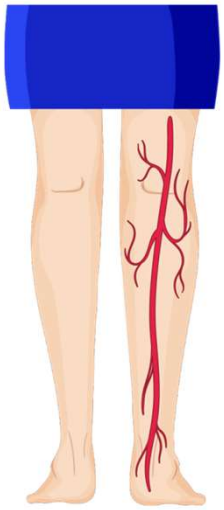
VENOUS THROMBOEMBOLISMS & DISEASE

Superficial Phlebitis

- A benign and self-limited disease. **Coexisting DVT needs to be excluded during the examination.**

Do Not Certify if:

- Coexisting DVT without meeting the DVT guidelines



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Acute Deep Vein Thrombosis (DVT)

- Drivers have an increased risk for developing acute deep vein thrombosis due to long hours of sitting
- DVT can be the source of a pulmonary embolus
- Adequate treatment with anticoagulants decreases the likelihood of recurrent thrombosis by approximately 80%
- Certify drivers who meet the cardiovascular standards

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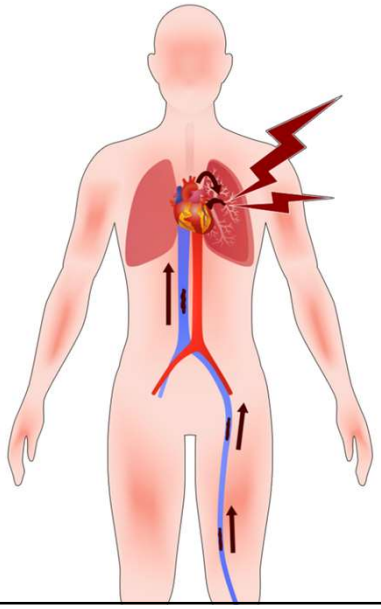

Pulmonary Emboli

- Likely to cause syncope, dyspnea, or collapse
- DVT is a common source

Considerations:

- Asymptomatic
- Appropriate long-term treatment with an anticoagulant

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Intermittent Claudication & Rest Pain

Intermittent claudication and rest pain are due to arterial insufficiency.

7-9% of individuals with peripheral vascular disease of the lower extremities develop intermittent claudication, leading to neuropathy, atrophy, and necrosis.

Intermittent Claudication: Pain in feet and/or legs that is reproducible by walking a specific distance which goes away with rest

Considerations:

- No rest symptoms
- Etiology has been confirmed
- Treatment is adequate, effective, safe, and stable

Rest Pain: Pain at rest (no activity involved), worse with elevation above level of hips. ***Consider disqualification*** *due to reduced function of the affected limb.*

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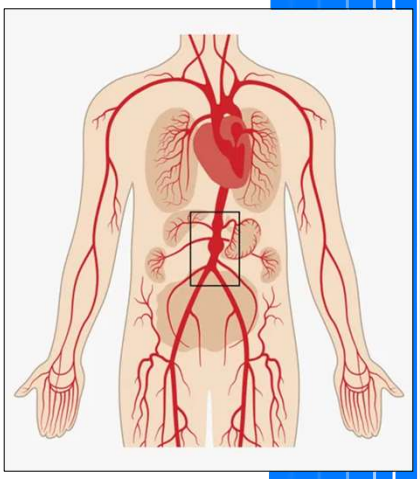
Abdominal Aortic Aneurysm (AAA)

- Most are asymptomatic
- Rupture is related to the size of the aneurysm (< 4cm diameter rarely rupture)
- Aneurysms > 6cm diameter are detected on exam 90% of the time
- Auscultation of a bruit may indicate the presence of an aneurysm
- Ultrasound has nearly 100% sensitivity and specificity for detecting an AAA



Risk Factors:

- Smoking is the strongest risk factor
  - Consider testing smokers
- 3:1 ratio of males to females
- Caucasian
- Family history

The ME may consult with specialists and request additional evaluation to assist in deciding whether a certificate can be issued. Consider the medical history, the driver's response to treatment, current medication regimen, current clinical best practices, and knowledge of the duties and responsibilities of commercial driving.

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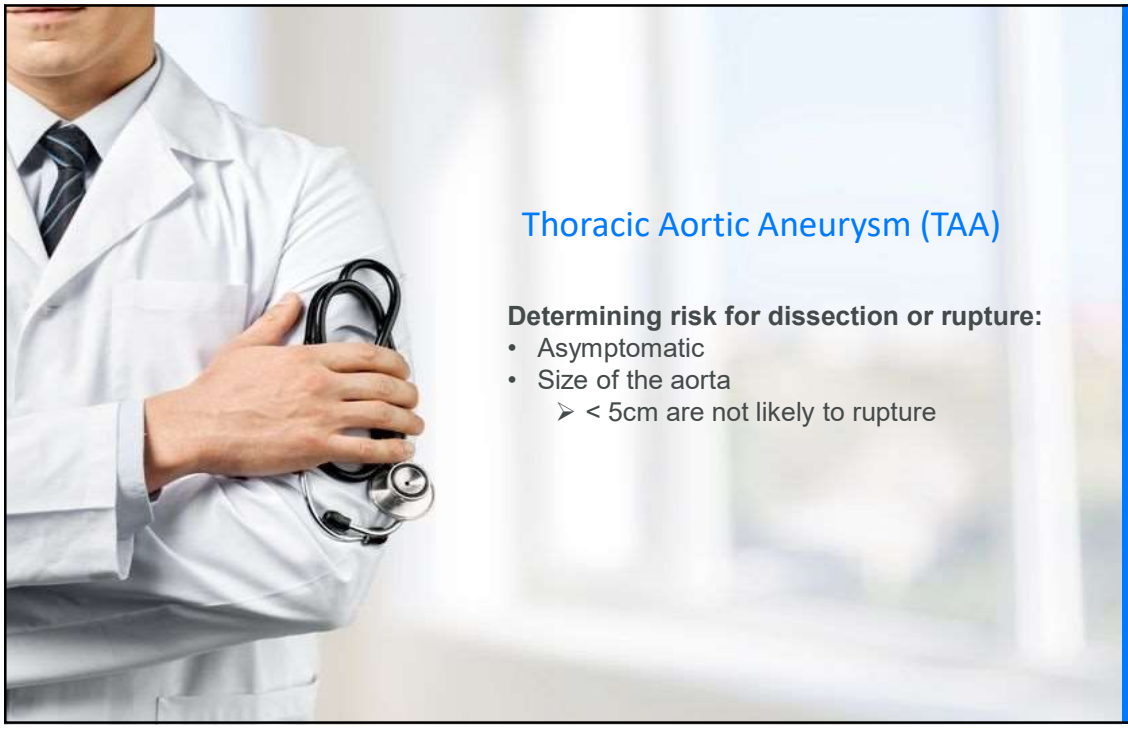

Thoracic Aortic Aneurysm (TAA)

Determining risk for dissection or rupture:

- Asymptomatic
- Size of the aorta
  - ➢ < 5cm are not likely to rupture

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Which of the following medical conditions is most likely to result in incapacitation?

A. Pulse of 118bpm
B. Auscultation of a bruit over the abdomen
C. A recent HbA1c of 11%
D. End-stage renal disease on dialysis

The correct answer is **B**. Auscultation of a bruit over the abdomen is indicative of an abdominal aortic aneurysm. 90% of aneurysms detected on exam are greater than 6cm in diameter and are at high risk of rupturing. There are many factors that may cause a pulse of 118bpm, and it is not likely to be the cause of incapacitation. A HbA1c of 11% indicates that the driver's diabetes is not well controlled, but it is extremely unlikely for this level of hyperglycemia to cause incapacitation.

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Pacemakers

Used to treat bradycardia. Consider the underlying disease when making a certification determination.

- Sinus node dysfunction and atrioventricular (AV) block have variable long-term prognoses, depending on the underlying disease

Considerations:

- Are there signs that the pacemaker is not working properly?
  - Bradycardia
  - Alternating bradycardia and tachycardia
  - Syncope
  - Weakness or tiredness

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Implantable Cardioverter-Defibrillator (ICD)

- Treats ventricular fibrillation and ventricular tachycardia by delivering shock therapy to the heart
  - Likely to cause syncope or collapse
- Will stop a current arrhythmia but DOES NOT prevent arrhythmias

Do not certify drivers with an implanted defibrillator or a combination defibrillator/pacemaker.

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Supraventricular Arrhythmias

Supraventricular Tachycardia (SVT): a common arrhythmia usually *not consider a risk for sudden death.*

- Occasionally can cause loss of consciousness or compromise cerebral function
- Treatment by catheter ablation is usually curative and allows withdrawal of drug therapy

Atrial Fibrillation:

- Associated with embolus formation which can cause stroke
- Anticoagulant therapy decreases this risk in individuals with risk factors for stroke

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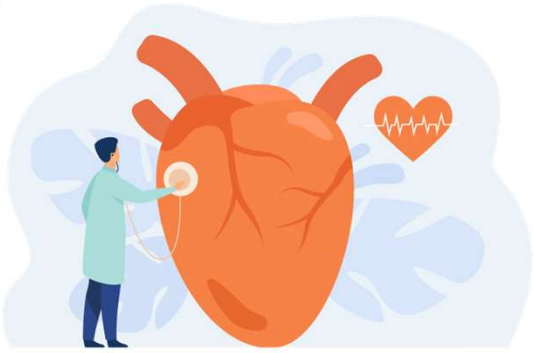

Atrial Fibrillation

Considerations:

- Heart rate is controlled
- Treatment for emboli prevention is effective and tolerated
- Clearance from CV specialist
- Complies with anticoagulant therapy guidelines

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Ventricular Arrhythmias

Ventricular Fibrillation, Ventricular Tachycardia

- Responsible for most of cardiac sudden death

Considerations:

- Is the cause known and does the cause preclude the driver from qualification?
- Is the driver symptomatic?
- Does the driver have sustained ventricular tachycardia?
- Has the driver been evaluated by a CV specialist?

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CARDIOVASCULAR TESTS

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Exercise Tolerance Test (ETT)

The Bruce protocol treadmill test is the most common test used to evaluate workload capacity and detect cardiac abnormalities.

Bruce Treadmill Test Stages, Speeds, and Inclines

Stage	Treadmill Speed	Treadmill Incline
1	1.7 mph	10% grade
2	2.5 mph	12% grade
3	3.4 mph	14% grade
4	4.2 mph	16% grade
5	5.0 mph	18% grade
6	5.5 mph	20% grade
7	6.0 mph	22% grade

- The Bruce protocol involves increasing speed and incline on a treadmill every three minutes per stage
  - Test stops when you've hit 85% of your maximum heart rate, **OR**
  - Heart rate exceeds 115 beats per minute for two stages, **OR**
  - It is deemed that the test should no longer continue

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Exercise Tolerance Test (ETT)

Metabolic equivalent of task (METs) is a unit that estimates the energy used during physical activity, measured in calories

- Can be used to compare activities over a range of body weights and intensities
- 1 MET: The energy cost of sitting quietly
- Under 3 METs: Light-intensity activity
- 3-6 METs: Moderate-intensity activity
- Over 6 METs: Vigorous-intensity activity

A "Normal" ETT:

- Exceed 6 METs through Bruce protocol Stage 2
- No Angina
- <1 mm ST depression in 2 or more leads
- Exceed 85% of age-predicted max heart rate
- 20 mmHg or more rise in systolic BP

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Echocardiogram (ECHO)

- Uses sound waves to create pictures of the heart to detect abnormalities such as leaking heart valves or stenosis
- Has superior sensitivity and specificity compared to the standard ETT
- Indicated in the presence of an abnormal resting electrocardiogram or non-diagnostic ETT
- Assesses left ventricular ejection fraction (LVEF)
  - Ejection fractions of 55-70% are normal
  - 40-55% are slightly below normal
  - 35-39% are moderately below normal
  - < 35% is severely below normal

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CORONARY HEART DISEASES

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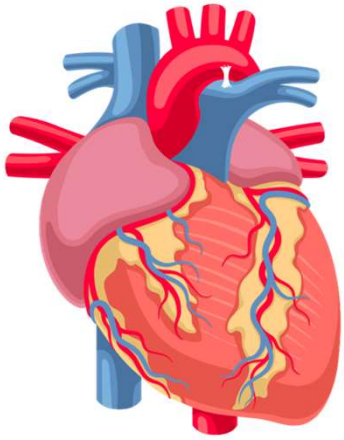

The major clinical manifestations of coronary heart disease (CHD) are acute myocardial infarction, angina pectoris (either stable or unstable), congestive heart failure, and sudden death.

The major independent predictor of CHD survival is **left ventricular function**.

Considerations:

- Has the treatment been shown to be adequate, effective, safe, and stable?
- Is the driver compliant with the treatment plan?
- Is the driver knowledgeable about medications used while driving?

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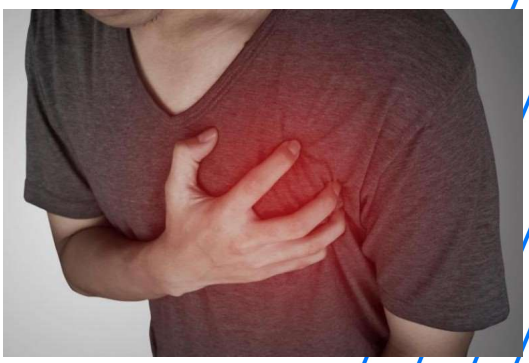
Myocardial Infarction (MI)

- The greatest risk of mortality following an MI is within the first few months

Considerations:

- Asymptomatic
- No left ventricular dysfunction
- No exercise-induced myocardial ischemia on ETT
- Are they compliant with treatment?
- Has treatment been shown to be adequate, effective, safe, and stable?

Cardiologists recommend that an ETT be performed 4 to 6 weeks after an MI and be repeated at least every 2 years.



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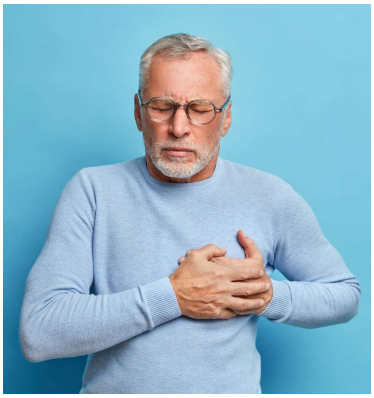
Angina Pectoris



Stable = Predictable: Pain may be precipitated by exertion, emotion, extremes in weather, sexual activity

Unstable = Unpredictable:
- Pain at rest
- Change in pattern (increased frequency and longer duration)
- Decreased response to medication

Considerations:
- Is the driver asymptomatic?
- How long has the angina been stable?
- How long has the driver had changes in the angina pattern?
- Is the driver compliant with the treatment plan?
- Has treatment been shown to be adequate, effective, safe, and stable?

Commonly prescribed medications for angina are nitroglycerin and nifedipine.

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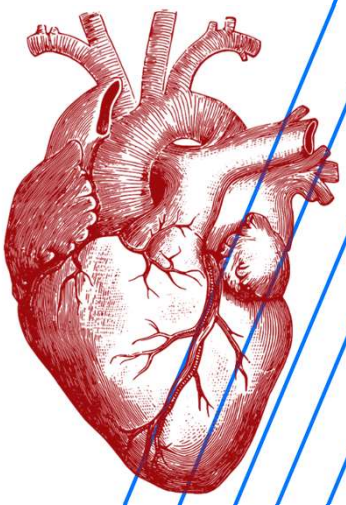
Coronary Artery Bypass Grafting (CABG)

Greatest risk for complications occur in the first 3 months after surgery.
Also, the sternum generally takes 3 months to heal.

There is a high long-term re-occlusion rate of the bypass graft
- Typically, occurring after 5 years
- May indicate the necessity of a stress test (ETT)

Considerations:
- Has the sternum healed completely?
- Is the driver asymptomatic?
- Has treatment been shown to be adequate and effective?
- Any orthostatic symptoms relating to cardiovascular medications?
- Does the driver demonstrate compliance with the treatment plan?



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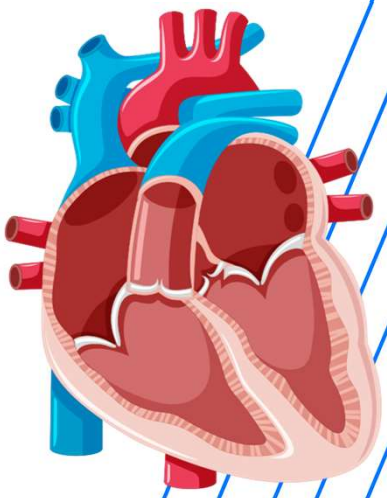
Congestive Heart Failure

A progressive disease that results from damaged muscles of the heart, affecting the ability to pump blood.

- Leading to fatigue, shortness of breath, reduced physical activity, and swelling of the ankles or legs
- Heart failure is measured by LVEF

Considerations:

- Is the driver symptomatic?
- Has treatment been shown to be adequate and effective?
- Any orthostatic symptoms relating to cardiovascular medications?
- Does the driver have a stable LVEF?
- Does the driver demonstrate compliance with the ongoing treatment plan?



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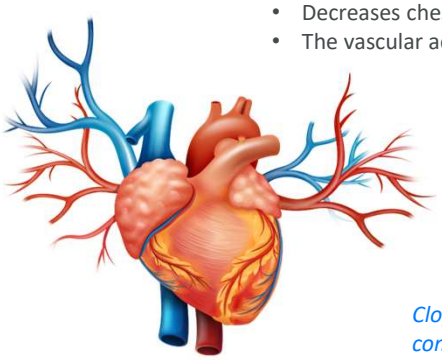
Percutaneous Coronary Intervention (PCI) [Angioplasty/Stent Placement]

- Nonsurgical procedure formally known as angioplasty with stent placement
- Decreases chest pain by improving blood flow
- The vascular access site usually heals within 1 week



Considerations:

- Is there evidence of injury at the vascular access site?
- Does the driver demonstrate compliancy with the ongoing treatment plan?

Clopidogrel (Plavix) is an antiplatelet agent commonly prescribed after stent placement.

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A 62-year-old male who had CABG five weeks ago states “I feel 10 years younger!”. The only medication he takes is a daily aspirin and he denies any post-surgery episodes of angina.

- Cardiologist report dated 3 ½ weeks post-CABG surgery is provided with clearance for driving
  - LVEF is not included in medical records
- A median sternotomy scar from surgery is noted
- The rest of the exam is unremarkable

Should this driver be disqualified or qualified and why?

Is there a need for any additional testing?

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- It is recommended that the driver complete a 3-month waiting period post CABG as this is when there is the greatest risk of complications. It is also to allow for the sternum to heal.
- The determination pending status cannot be used because the remaining portion of the waiting period is longer than 45 days

The driver should be disqualified from driving

- At the completion of the waiting period, the driver should have a new exam. If he meets all requirements, he may be certified

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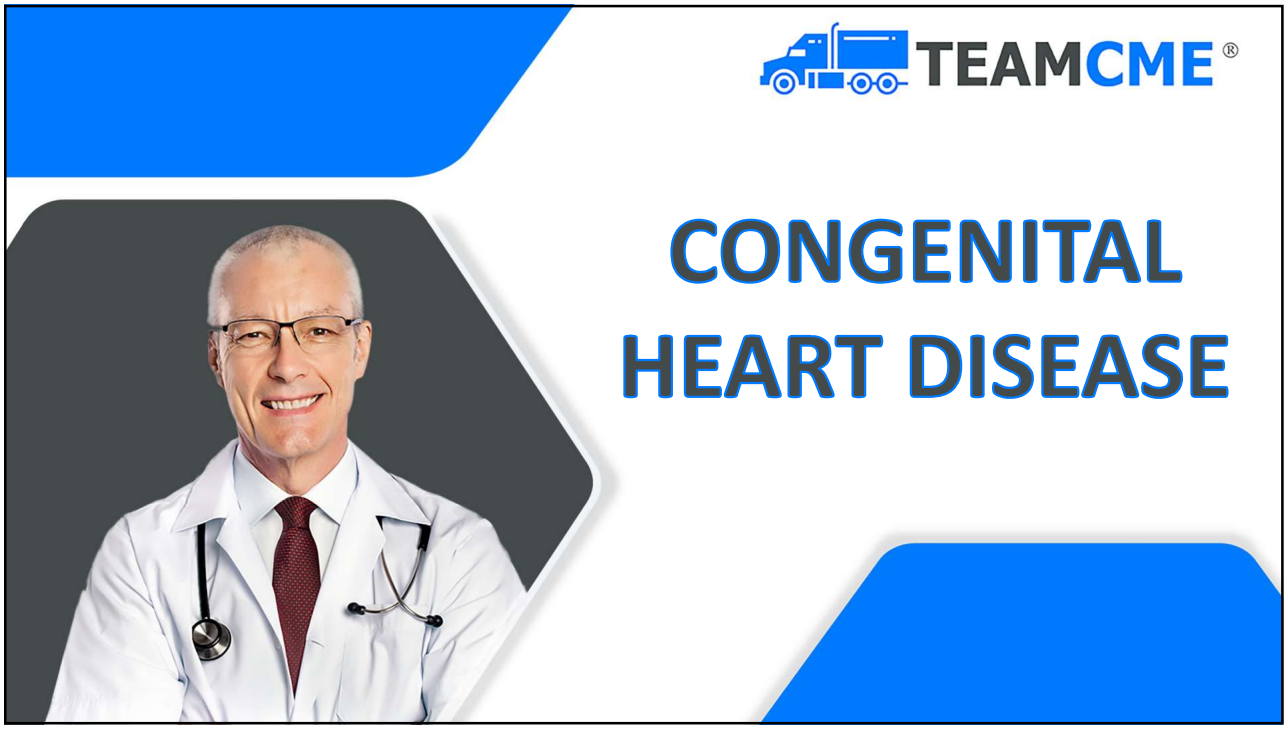

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Congenital Heart Disease/Congenital Heart Defect

- One or more defects with the heart's structure that has existed since birth
- Can change the way blood flows through the heart
- Some congenital heart defects might not cause any problems while others can be life-threatening

Congenital heart diseases:

- Patent ductus arteriosus (PDA)
- Ebstein anomaly
- Tetralogy of Fallot
- Coarctation of the aorta
- Pulmonary valve stenosis
- Transposition of the great vessels
- Ventricular septal defect
- Atrial septal defect
- Marfan syndrome

Considerations:

- What is the anatomic diagnosis?
- What is the severity of the defect?
- How likely is syncope, dyspnea, collapse, or congestive cardiac failure?
- Did the driver undergo successful repair of the congenital defect?
- Does the driver have cardiac enlargement?

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CARDIOMYOPATHY

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Hypertrophic Cardiomyopathy

- Most have no symptoms and a near-normal life expectancy
- When symptomatic, individuals have progressive symptoms
  - Can be benign
  - For some, sudden death is the first manifestation

Signs and symptoms (especially during exercise or exertion):

- chest pain
- syncope
- heart murmur
- sensation of rapid, fluttering, or pounding palpitations
- shortness of breath

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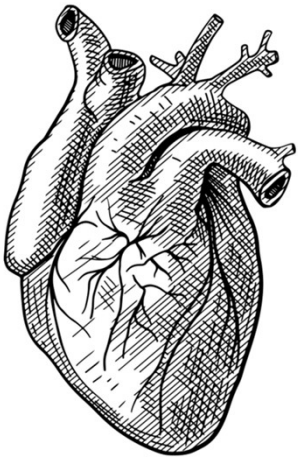

Restrictive Cardiomyopathy

- Least common form of heart disease
- Increased myocardial stiffness leading to impaired ventricular filling

Signs or symptoms:

- Fatigue
- Shortness of breath
- Pedal edema
- Weakness
- Arrhythmias and conduction disturbances

MEs should evaluate whether the driver meets the physical qualification standards and may consider obtaining an evaluation by a cardiologist.

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VALVULAR HEART DISEASES

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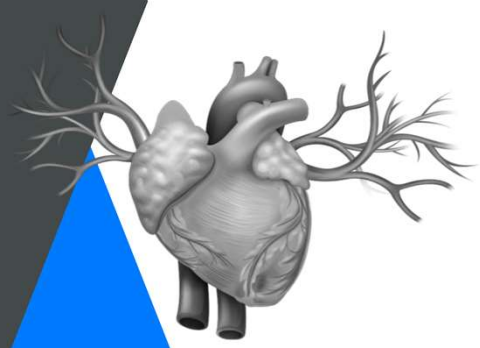

Heart Murmurs

Murmurs are a common sign of valvular heart conditions

- May be associated with other cardiovascular conditions

Types of murmurs:

Systolic murmurs occur during a heart muscle contraction
- Ejection murmurs
  - Due to blood flow through a narrowed vessel or irregular valve
- Regurgitant murmurs

Diastolic murmurs occur during heart muscle relaxation between beats
- Due to a narrowing (stenosis) of the mitral or tricuspid valves
- Or regurgitation of the aortic or pulmonary valves

Continuous murmurs occur throughout the cardiac cycle

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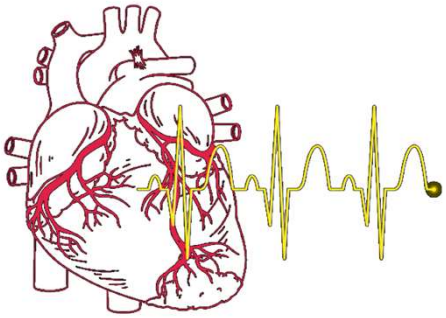
Heart Murmur Loudness



Graded according to their intensity

Grade 1: Must strain to hear murmur

Grade 2: Can hear a faint murmur without straining

Grade 3: Can easily hear a moderately loud murmur

Grade 4: Can easily hear a moderately loud murmur with a thrill

Grade 5: Can hear the murmur when only part of stethoscope is in contact with the skin

Grade 6: Can hear the murmur with the stethoscope close to the skin (not in contact)

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Characteristics of a Pathological Murmur Associated with Cardiac Disease

- Holosystolic
- Harsh murmur
- Abnormal heart sound
- Early Systolic and Mid-Systolic click
- Grade III or higher
- Late Systolic
- Murmur heard over the left sternal border

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Aortic Regurgitation

- Chronic condition
- Gradual left ventricular dilation
- Normal left ventricular systolic function
- Prolonged periods of time when it is asymptomatic
- Conditions such as infective endocarditis and aortic dissection can result in acute severe aortic regurgitation

- **Mild or moderate** = little to no enlargement of the left ventricle
- **Severe** = significant enlargement of the left ventricle

Considerations:

- Severity of the diagnosis
- Size and function of the left ventricle
- Any symptoms that may cause syncope, dyspnea, or collapse

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Aortic Stenosis

Aortic stenosis is characterized by the aortic valve being difficult or stiff to open or does not open fully.

Symptoms:
- Chest pain
- Tiredness after exertion
- Shortness of breath after exertion
- Heart palpitations

Treatment:
- Mild cases may not need treatment, but severe cases would need surgery to repair the valve.
  - Balloon valvuloplasty
  - Surgical commissurotomy

Considerations:
- The severity of the diagnosis
- The presence of signs or symptoms that are likely to cause syncope, dyspnea, or collapse

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Aortic Valve Repair

Mechanical valves:
- No risk of rejection
- Do not wear out as quickly
- Require anticoagulation

Biological valves:
- Harvested from a pig or a cow
- Have a risk of rejection by the body
- Last 7 to 10 years
- Usually do not require long-term anticoagulation therapy

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Mitral Regurgitation

- The valve between the left heart chambers does not completely close
- The most common type of heart disease
- In severe cases, the heart does not deliver sufficient blood to the body, resulting in:
  - Fatigue
  - Dyspnea
  - Orthopnea

MEs should assess the severity of the diagnosis and the presence of signs or symptoms.

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Mitral Stenosis

- Narrowing of the valve between the left heart chambers
- Symptoms indicate a poor prognosis:
  - Angina
  - Syncope
  - Fatigue
  - Dyspnea

Treatment options include enlarging the mitral valve or cutting the band of mitral fibers.

MEs should assess the severity of the diagnosis and the presence of signs or symptoms.

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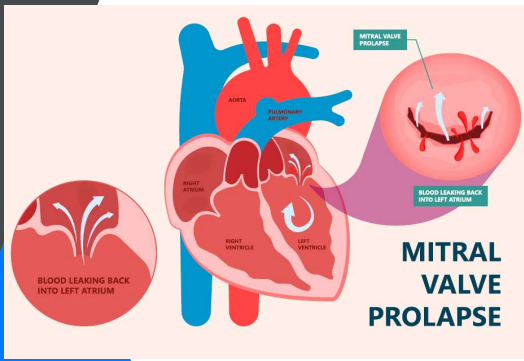
Mitral Valve Prolapse



Mitral valve prolapse is a common cause of mitral regurgitation.

- Mostly benign
- May manifest with dizziness or lightheadedness, fatigue, arrhythmia, heart murmur, difficulty breathing, or chest pain
- Progression can cause atrial fibrillation, left sided heart enlargement, and congestive heart failure

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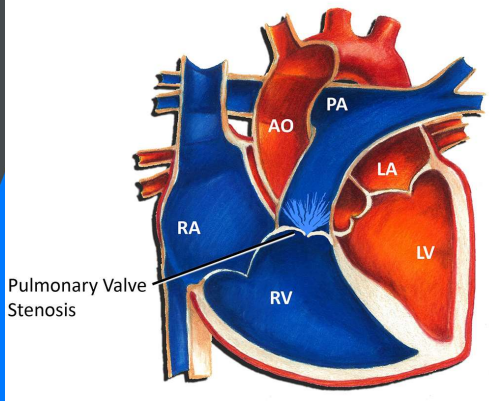
Pulmonary Valve Stenosis



- Usually a well-tolerated condition with gradual progression
- Incapacitation and/or sudden death can occur if the stenosis is severe

MEs should assess the nature and severity of the medical condition to determine whether the driver meets the cardiovascular standard.

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