



**Brigham and Women's Hospital**  
Founding Member, Mass General Brigham

# Board Review in Cardiology

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Center for Advanced Heart Disease  
Division of Cardiovascular Medicine  
Brigham and Women's Hospital  
Assistant Professor of Medicine  
Harvard Medical School



# Garrick Stewart, MD MPH



John Hopkins School of Medicine  
Internal Medicine Residency then Cardiovascular Medicine  
and Advanced Heart Failure/Transplant Fellowships at  
BWH

Assistant Professor of Medicine, Harvard Medical School

- Clinical focus: Advanced HF, mechanical circulatory support, inflammatory heart disease
- Research focus: Patient selection for device therapy in HF

# Disclosures

I have the following financial disclosures:

Advisory/Consulting Role: Procyron, Inc.



# Question #1

A 75-year-old man is admitted with heart failure. He has noted orthopnea and progressive fatigue over the past 6 months. He has a history of osteoarthritis in knees and carpal tunnel. Coronary artery calcium score was 0 last year. On exam, he appears chronically ill. His blood pressure is 90/75 mm Hg; heart rate is 100 bpm.

Numerous ecchymoses are scattered over his extremities. Jugular venous pressure 14cm. Carotid upstrokes are low volume. Both lung bases are dull. There is a soft holosystolic murmur and a summation gallop. Ascites and hepatomegaly are present. 2+ edema and cold extremities are noted.

ECG shows diffusely low QRS voltages. Echocardiogram shows left ventricular ejection fraction (LVEF) 50% and septal and posterior walls measure 2 cm. N-terminal pro-B-type natriuretic peptide is 5000.



## Question #1

Which of the following is the most likely cause of his heart failure?

- A. Coronary artery disease
- B. Cardiac amyloidosis
- C. Thiamine deficiency
- D. Constrictive pericarditis
- E. Aortic stenosis



## Answer #1

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A. Coronary artery disease

**B. Cardiac amyloidosis**

C. Thiamine deficiency

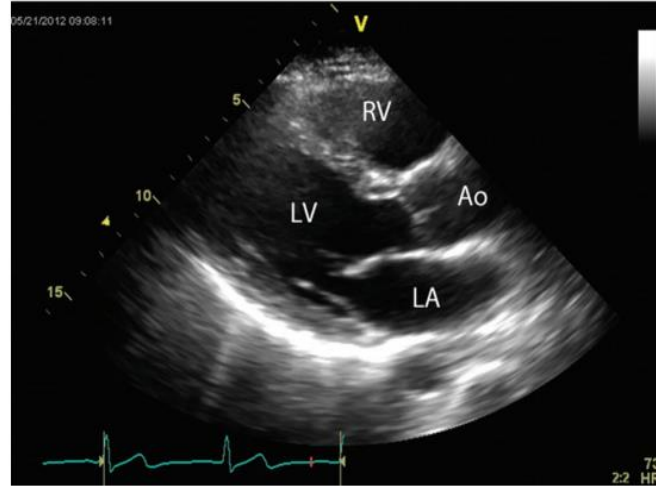
D. Constrictive pericarditis

E. Aortic stenosis

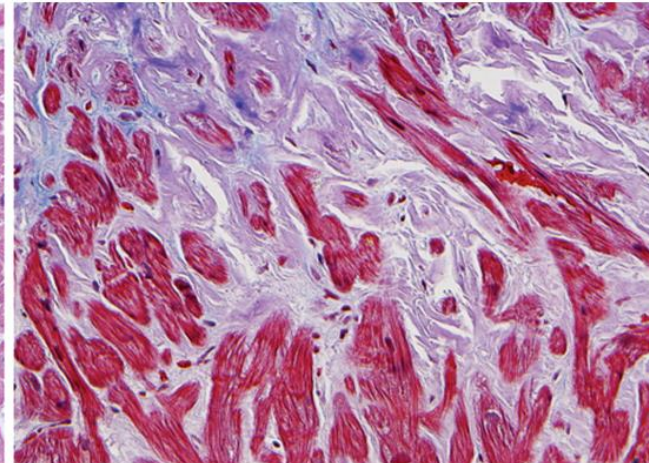
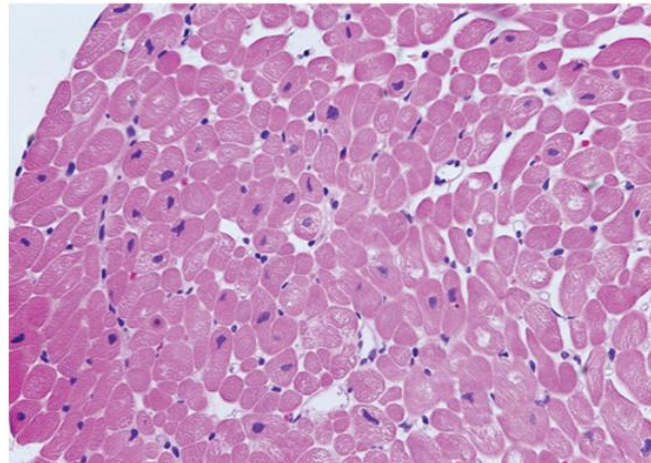
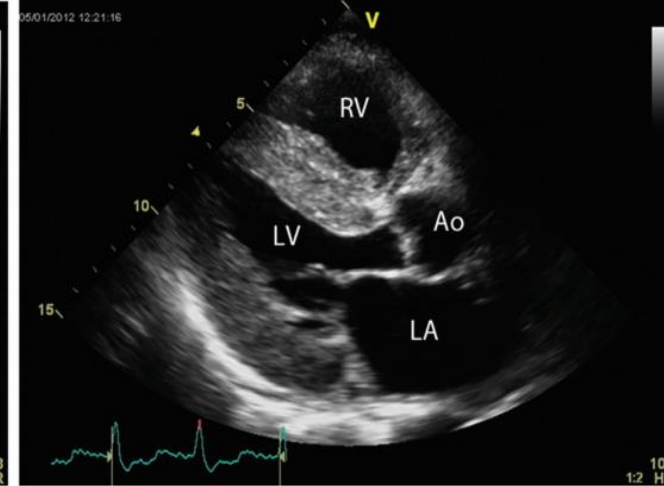


# Cardiac Amyloidosis

Normal

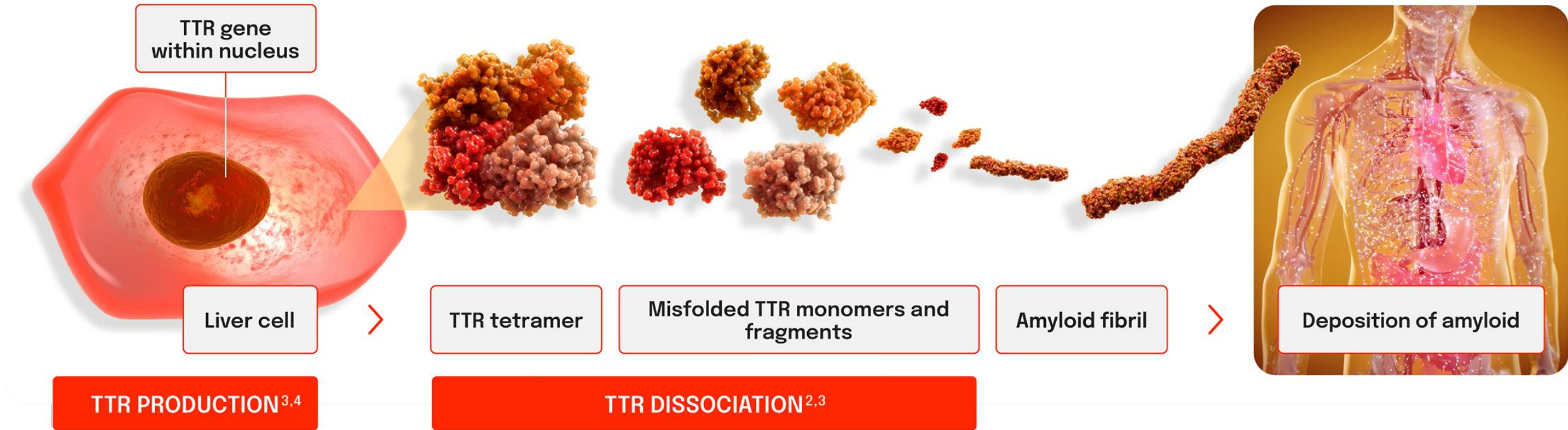


Amyloid





# ATTR Cardiac Amyloidosis Treatments



## TTR silencing:

- Antisense oligonucleotides
- RNAi therapeutics

***Vutrisiran***

## TTR stabilizing:

- TTR tetramer stabilizers

***Tafamidis, Acoramidis***





## Question #2

A 78-year-old man with bioprosthetic mitral valve replacement and 10-year history of diabetes mellitus presents with new onset atrial fibrillation with heart rate of 82 beats/minute and blood pressure of 156/96 mm Hg. Echocardiogram reveals LVEF 56%. Which of the following is a true statement?

- A. Restoration of sinus rhythm reduces risk of stroke compared with rate control and anticoagulation
- B. Warfarin has a lower risk of intracranial bleeding than apixaban
- C. Apixaban should be started to reduce risk of stroke
- D. The combination of aspirin and clopidogrel is equivalent to warfarin
- E. Patient can be cardioverted now and complete 4 weeks of dabigatran



## Answer #2

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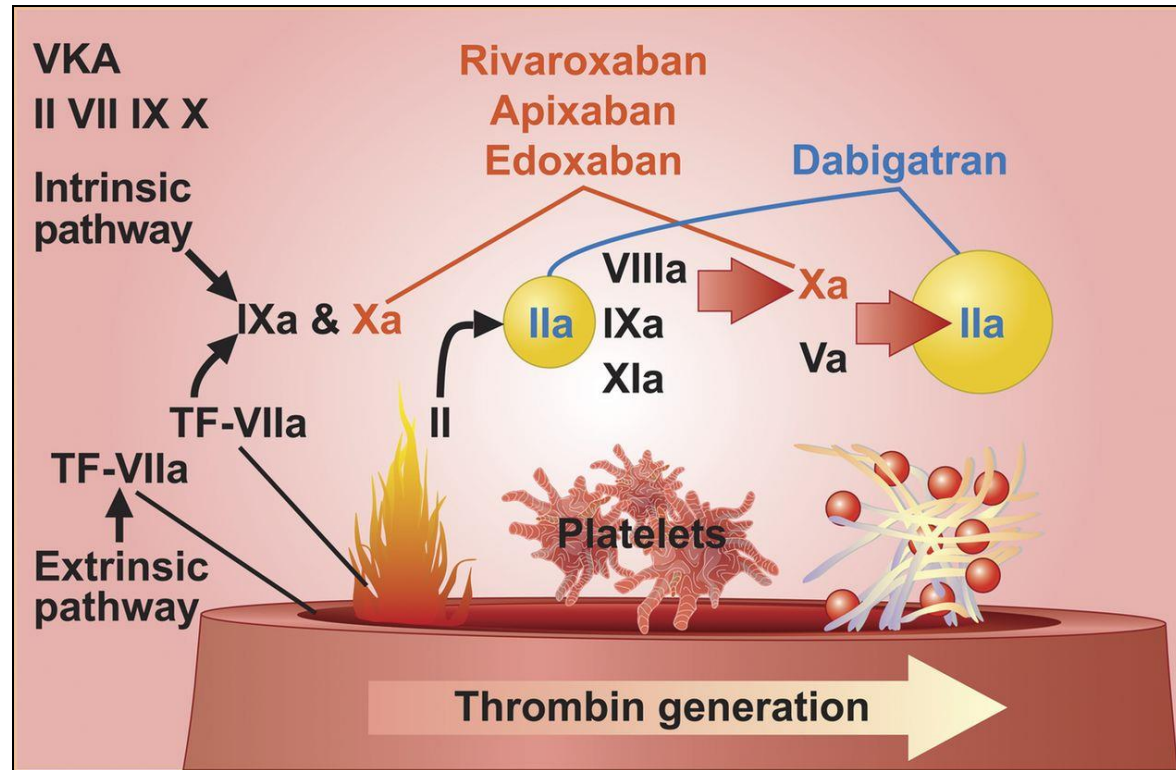
## CHA<sub>2</sub>DS<sub>2</sub>-VASc Calculator for Guiding Antithrombotic Treatment in Atrial Fibrillation

| Criteria                                                                                                                            |                                                          | Poss. Point |
|-------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-------------|
| <b>C</b> ongestive heart failure<br>Signs/symptoms of heart failure confirmed with objective evidence of cardiac dysfunction        | <input type="checkbox"/> Yes <input type="checkbox"/> No | +1          |
| <b>H</b> ypertension<br>Resting BP > 140/90 mmHg on at least 2 occasions <u>or</u> current antihypertensive pharmacologic treatment | <input type="checkbox"/> Yes <input type="checkbox"/> No | +1          |
| <b>A</b> ge 75 years or older                                                                                                       | <input type="checkbox"/> Yes <input type="checkbox"/> No | +2          |
| <b>D</b> iabetes mellitus<br>Fasting glucose > 125 mg/dL or treatment with oral hypoglycemic agent and/or insulin                   | <input type="checkbox"/> Yes <input type="checkbox"/> No | +1          |
| <b>S</b> troke, TIA, or TE<br>Includes any history of cerebral ischemia                                                             | <input type="checkbox"/> Yes <input type="checkbox"/> No | +2          |
| <b>V</b> ascular disease<br>Prior MI, peripheral arterial disease, or aortic plaque                                                 | <input type="checkbox"/> Yes <input type="checkbox"/> No | +1          |
| <b>A</b> ge 65 to 74 years                                                                                                          | <input type="checkbox"/> Yes <input type="checkbox"/> No | +1          |
| <b>S</b> ex Category (female)<br>Female gender confers higher risk                                                                  | <input type="checkbox"/> Yes <input type="checkbox"/> No | +1          |

Anticoagulation Indicated if Score  $\geq 2$   
(Consider Anticoagulation if Score 1 in men, 2 in women)



# Direct Oral Anticoagulants

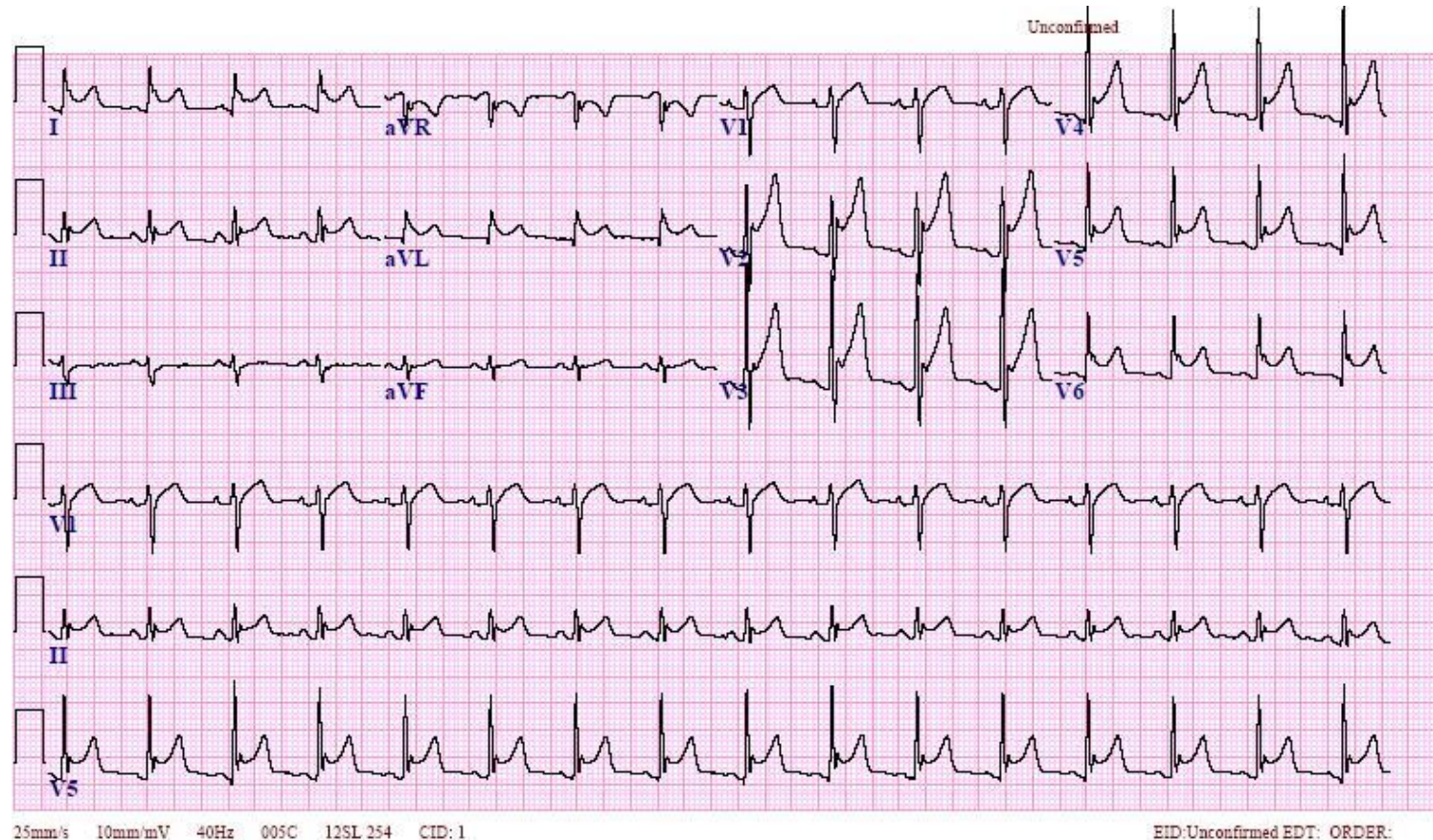


**Nonvalvular Atrial Fibrillation:** AF in the absence of moderate to severe mitral stenosis or mechanical heart valves.

Direct Oral Anticoagulants should not be used in “valvular” atrial fibrillation, in such cases vitamin K antagonists (e.g. warfarin) should be used

## Question #3

A 42 year old man presents with several days of sharp substernal chest pain that is relieved by sitting forward. He had a similar presentation two years ago. Physical exam reveals flat neck veins, regular rhythm, friction rub and clear lung fields. A 12-lead ECG is obtained:





## Question #3

Randomized, placebo-controlled trials have shown which of the following agents to be beneficial in the treatment of this condition when added to NSAIDs?

- A. Infliximab
- B. Colchicine
- C. Corticosteroids
- D. Cyclophosphamide
- E. Metoprolol



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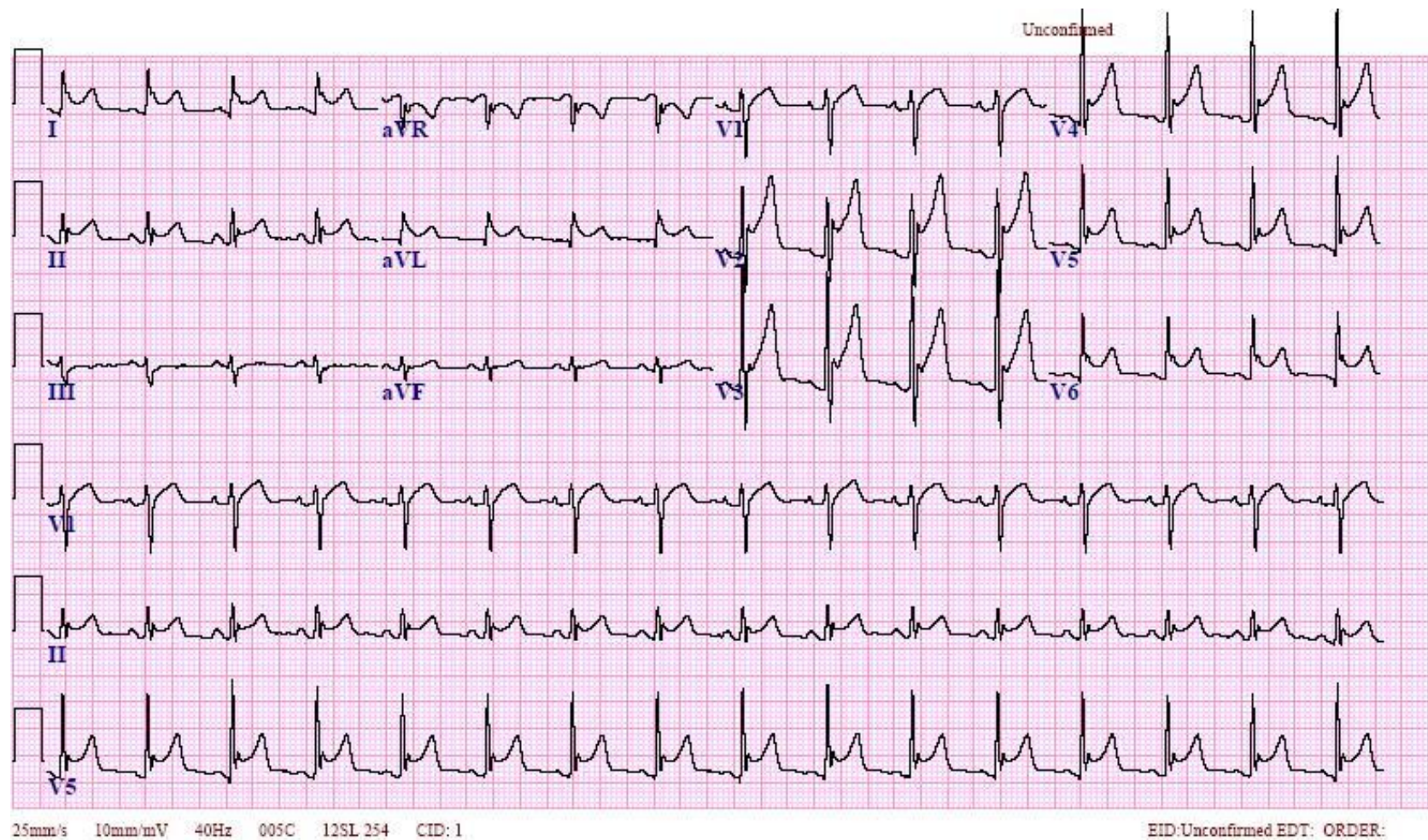
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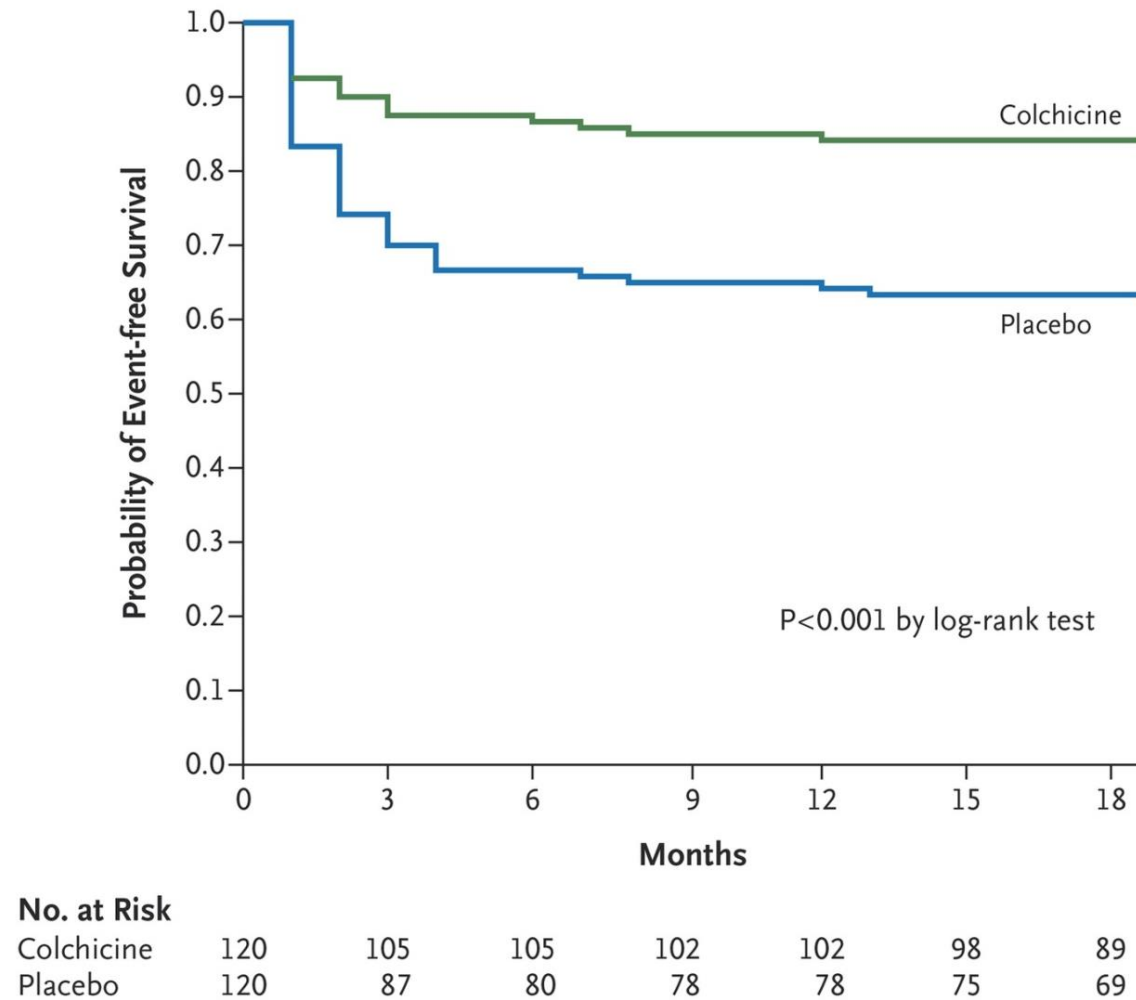
E. Metoprolol



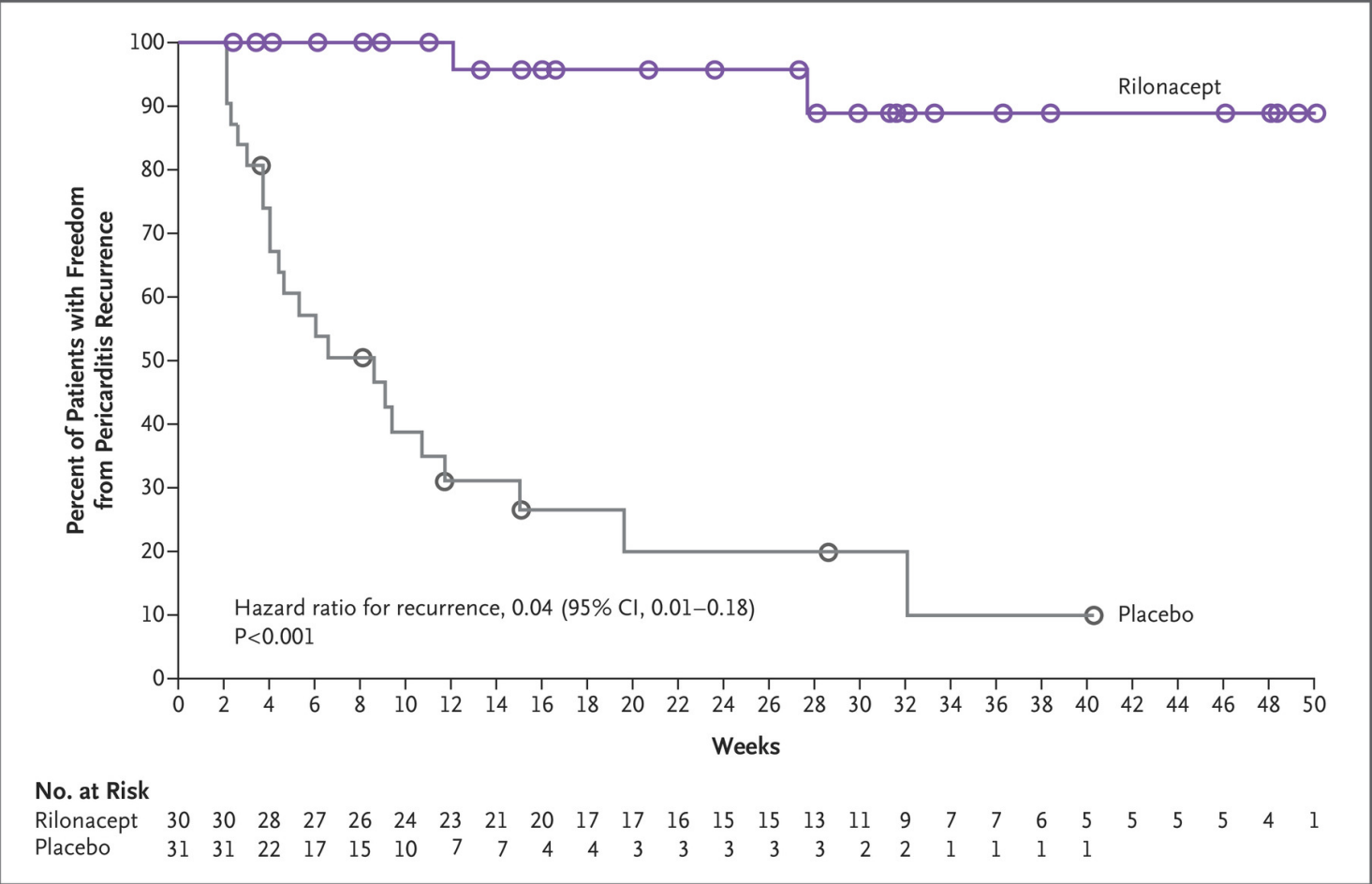




# Survival Free of Incessant or Recurrent Pericarditis



# Novel Therapies for Recurrent Pericarditis: Interleukin-1 trap (Rilonacept)



## Question #4

A 64 year old woman with chronic systolic heart failure, EF 25%, in NYHA Class 2, and 3 prior HF hospitalizations presents for a routine visit. She is euvolemic with heart rate 66bpm in sinus rhythm, BP 102/62. She is on carvedilol 25mg bid, sacubitril-valsartan 49-51mg bid, and spironolactone 25mg daily. Creatinine is 1.2mg/dL, potassium 4.1. What is the most appropriate next step to reduce cardiovascular death and HF hospitalization?

- A. Transition from spironolactone to finerenone
- B. Start semaglutide 0.25mg qweek
- C. Start ivabridine 5mg bid
- D. Start dapagliflozin 10mg daily
- E. Refer to cardiac rehabilitation



## Answer #4

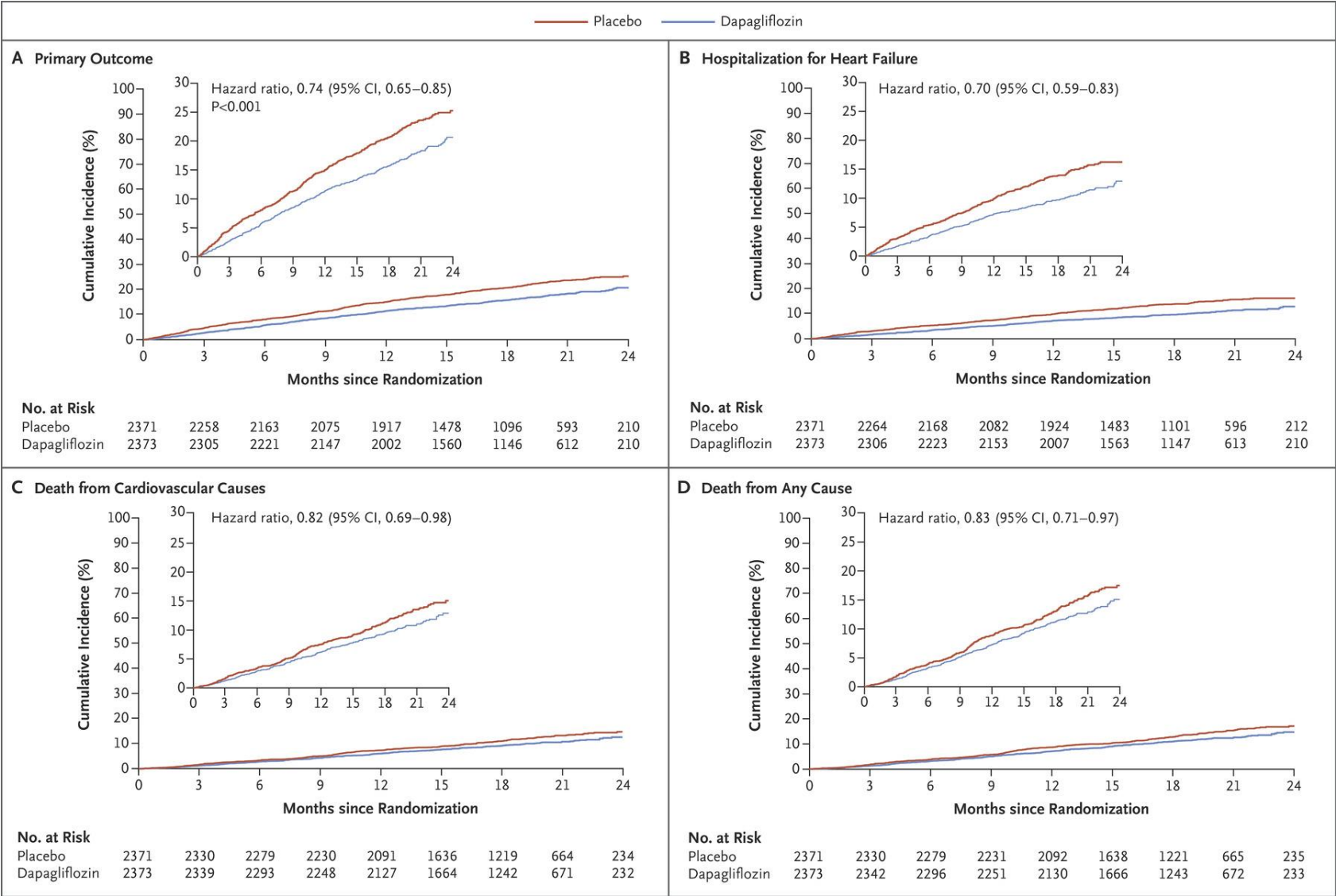
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- D. **Start dapagliflozin 10mg daily**
- E. Refer to cardiac rehabilitation





# DAPA-HF Trial





# 2022 HF Guideline Update

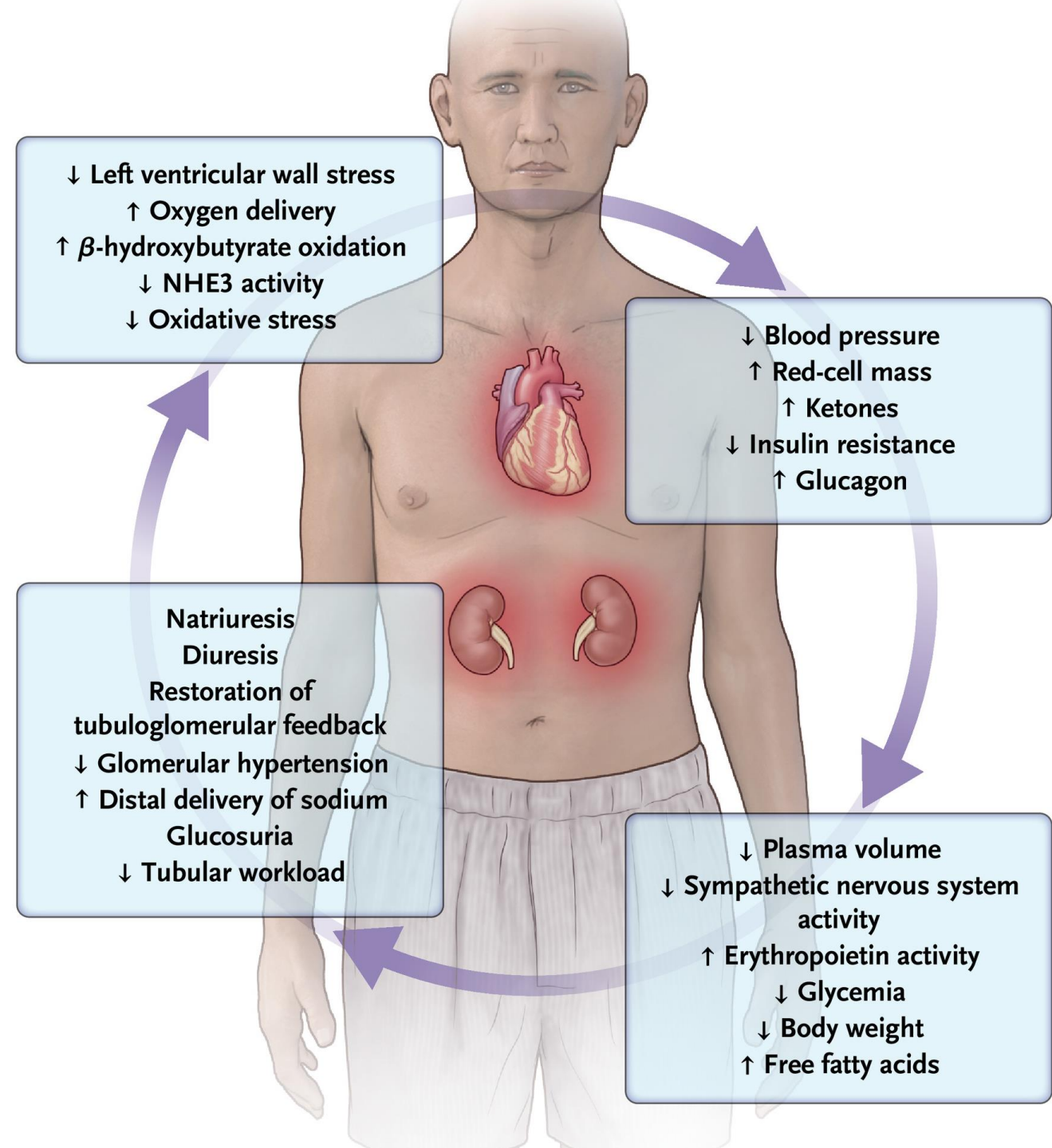
| COR                                                    | LOE | Recommendation                                                                                                                                                                                       |
|--------------------------------------------------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                                                      | A   | 1. In patients with symptomatic chronic HFrEF, SGLT2i are recommended to reduce hospitalization for HF and cardiovascular mortality, irrespective of the presence of type 2 diabetes. <sup>1,2</sup> |
| <b>Value Statement:<br/>Intermediate Value<br/>(A)</b> |     | 2. In patients with symptomatic chronic HFrEF, SGLT2i therapy provides intermediate economic value. <sup>3,4</sup>                                                                                   |



# SGLT2 Inhibitors: Proposed Mechanism

Benefits regardless  
of EF!

Braunwald, E. N Engl J Med 2022; 386:2024-2034



## Question #5

A 55 year-old woman presents for a new patient visit to establish primary care. She reports a history of osteoarthritis of the knees, but takes no prescription medications. She has a normal exam, except for a resting blood pressure of 158/98mmHg in both arms after a period of repose. Repeat BP a week later is 154/96mmHg.

Fill in the blanks: A **normal** blood pressure is \_\_\_\_\_, and this patient has Stage \_\_\_\_\_ hypertension.

- A. <140/90 - Stage 1
- B. <130/80 - Stage 1
- C. <130/80 - Stage 2
- D. <120/80 - Stage 1
- E. <120/80 - Stage 2



## Answer #5

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A. <140/90 - Stage 1

B. <130/80 - Stage 1

C. <130/80 - Stage 2

D. <120/80 - Stage 1

**E. <120/80 - Stage 2**



# AHA/ACC Categories of Blood Pressure in Adults\*

| BP Category  | SBP           |     | DBP         |
|--------------|---------------|-----|-------------|
| Normal       | <120 mm Hg    | and | <80 mm Hg   |
| Elevated     | 120-129 mm Hg | and | <80 mm Hg   |
| Hypertension |               |     |             |
| Stage 1      | 130-139 mm Hg | or  | 80-89 mm Hg |
| Stage 2      | ≥140 mm Hg    | or  | ≥90 mm Hg   |

\*individuals with SBP and DBP in two categories should be classified in higher category  
For example 138/95 = Stage 2

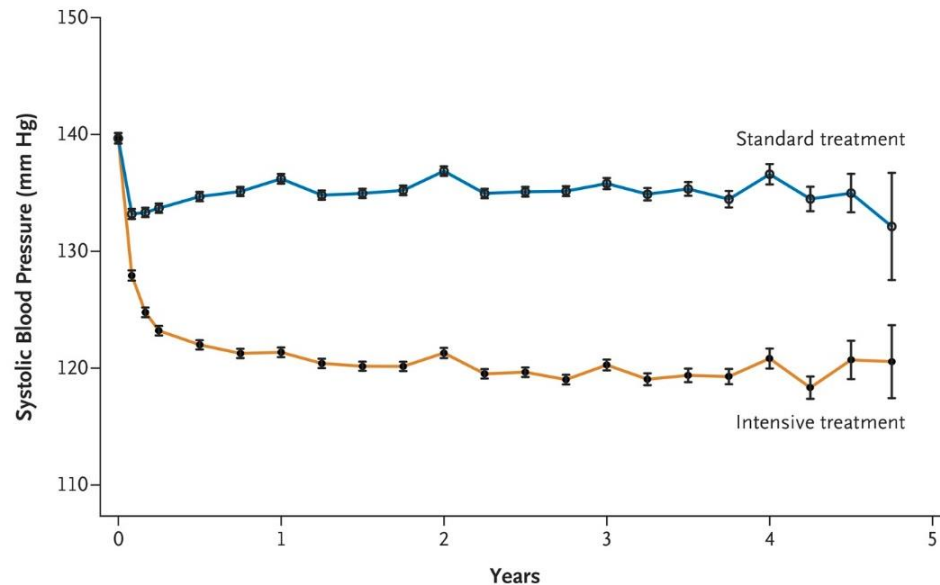


# SPRINT

## Target SBP <140mmHg vs. <120mmHg

n=9361, >50 yo, BP >130/80

Non-diabetic but at risk for CVD



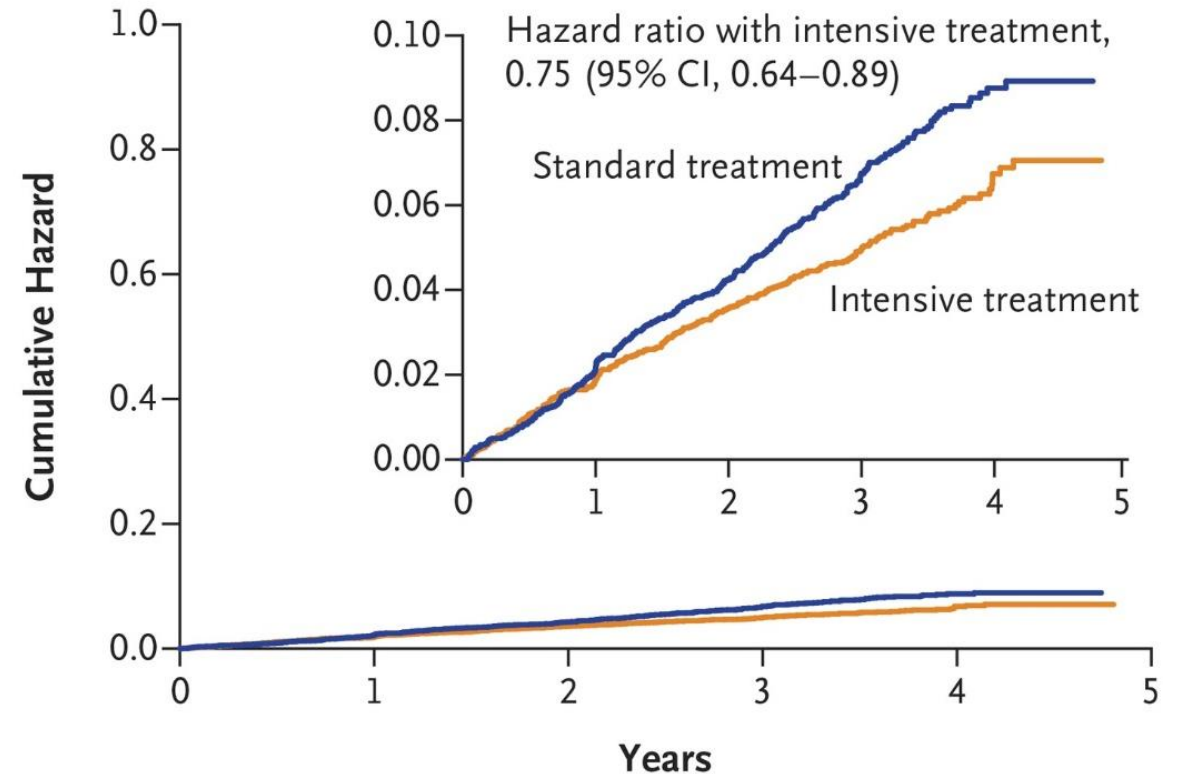
### No. with Data

|                     |      |      |      |      |      |      |      |      |      |     |
|---------------------|------|------|------|------|------|------|------|------|------|-----|
| Standard treatment  | 4683 | 4345 | 4222 | 4092 | 3997 | 3904 | 3115 | 1974 | 1000 | 274 |
| Intensive treatment | 4678 | 4375 | 4231 | 4091 | 4029 | 3920 | 3204 | 2035 | 1048 | 286 |

### Mean No. of Medications

|                     |     |     |     |     |     |     |     |     |     |     |
|---------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Standard treatment  | 1.9 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.9 |
| Intensive treatment | 2.3 | 2.7 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 3.0 |

7





# BP Thresholds for and Goals of Pharmacologic Therapy

| Clinical Condition (s)                                                                              | BP Threshold mm Hg | BP Goal mm Hg |
|-----------------------------------------------------------------------------------------------------|--------------------|---------------|
| <b>General</b>                                                                                      |                    |               |
| Clinical CVD or 10 year ASCVD risk $\geq 10\%$                                                      | $\geq 130/80$      | $<130/80$     |
| No clinical CVD and 10 year ASCVD risk $<10\%$                                                      | $\geq 140/90$      | $<130/80$     |
| Older persons ( $\geq 65$ years of age; non-institutionalized, ambulatory, community-living adults) | $\geq 130$ (SBP)   | $<130$ (SBP)  |
| <b>Specific Comorbidities</b>                                                                       |                    |               |
| Diabetes mellitus                                                                                   | $\geq 130/80$      | $<130/80$     |
| Chronic kidney disease                                                                              | $\geq 130/80$      | $<130/80$     |
| Chronic kidney disease post-renal transplantation                                                   | $\geq 130/80$      | $<130/80$     |
| Heart failure                                                                                       | $\geq 130/80$      | $<130/80$     |
| Stable ischemic heart disease                                                                       | $\geq 130/80$      | $<130/80$     |
| Secondary stroke prevention                                                                         | $\geq 140/90$      | $<130/80$     |
| Peripheral arterial disease                                                                         | $\geq 130/80$      | $<130/80$     |



## Question #6

A 62 year old man with a history of hypertension, migraine headaches and prostate cancer s/p prostatectomy 2 years ago presents to PCP for routine follow up shortly after returning from a summer vacation to Portugal. He is noted on exam to have swelling of his right leg below the knee without tenderness, palpable cord or skin changes. Laboratories reveal Cr 1.2mg/dL and D-dimer 800ng/mL. Ultrasound exam reveals thrombus in the posterior tibial and peroneal veins without extension into the popliteal. What is the most appropriate next step in management?

- A. Follow up ultrasound in 2 weeks
- B. Warfarin (INR 2-3) for 3 months
- C. Apixaban 10mg bid x 7d then 5mg bid for 3 months
- D. Inferior vena cava filter
- E. Rivaroxaban 20mg daily x 6mos



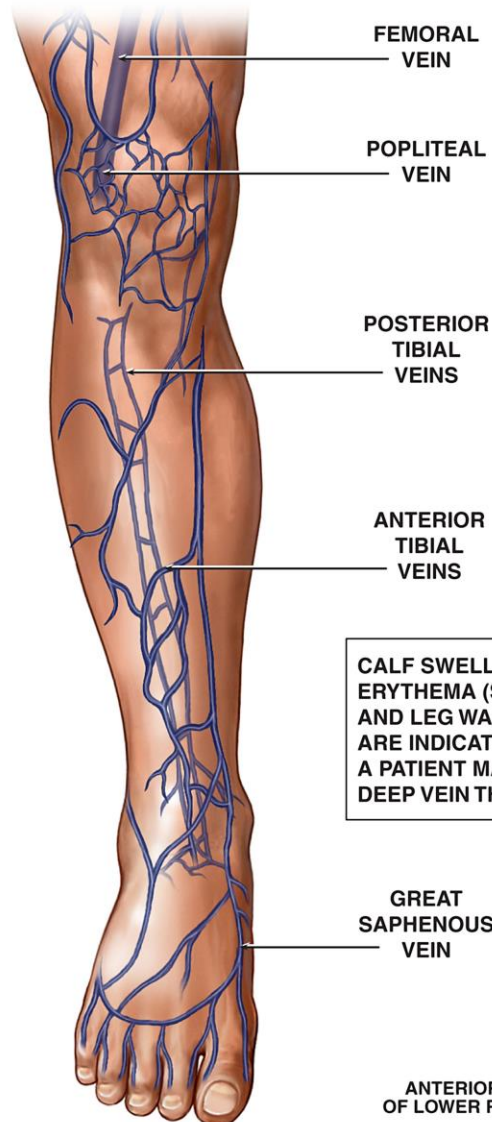
## Answer #6

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## NORMAL ANATOMY

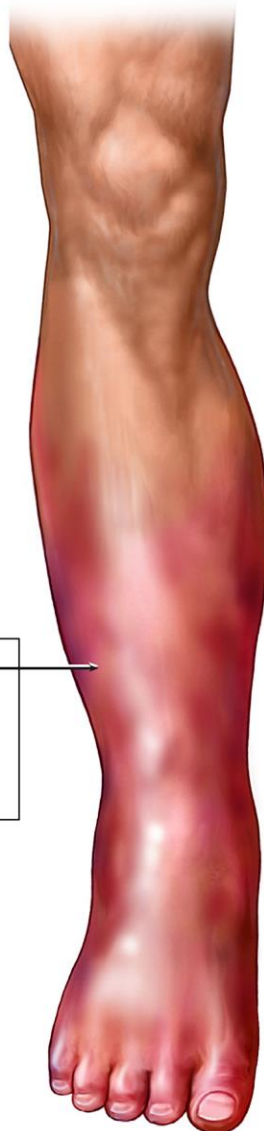


## DEEP VEIN THROMBOSIS

CALF SWELLING,  
ERYTHEMA (SWELLING)  
AND LEG WARMTH  
ARE INDICATIONS THAT  
A PATIENT MAY HAVE  
DEEP VEIN THROMBOSIS.

GREAT  
SAPHENOUS  
VEIN

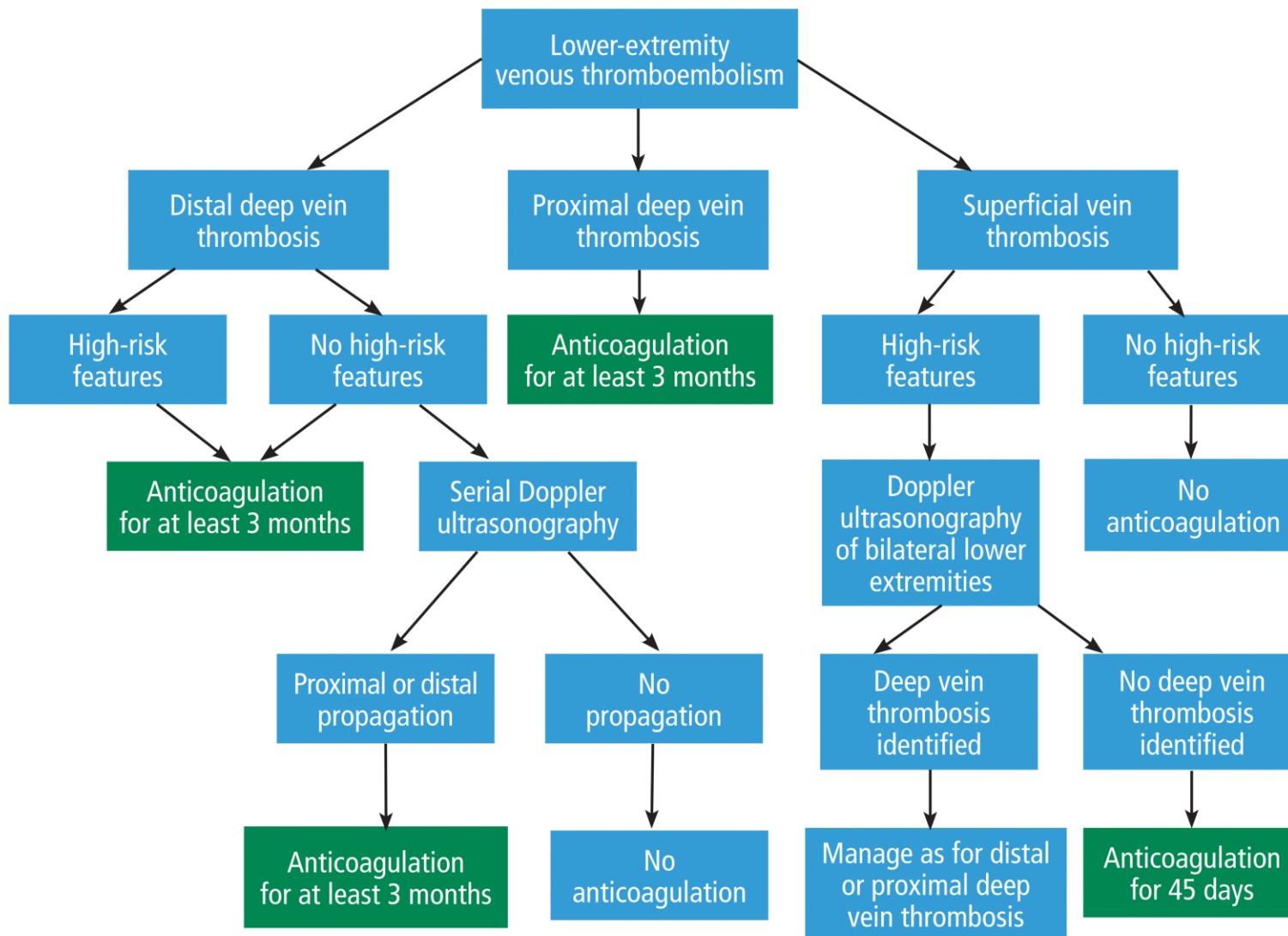
ANTERIOR VIEWS  
OF LOWER RIGHT LEG



## Considerations:

Proximal or Distal?

High Risk or Low Risk?



## High Risk Features for Proximal Extension

- Thrombus extension into or close to (eg, within 1 to 2 cm) the proximal popliteal vein
- Unprovoked DVT
- D-dimer 500 ng/mL
- Extensive thrombosis involving multiple veins (eg, >5 cm in length, >7 mm in diameter)
- Persistent/irreversible risk factors such as active cancer or prolonged immobility
- Prior DVT or PE
- Inpatient status
- Coronavirus disease 2019 (COVID-19)

## Question #7

A 33-year old female presents to the emergency room at 27-weeks gestation with progressive dyspnea (now at rest), orthopnea, and fatigue. She has no prior medical problems. Physical exam is notable for opening snap after S2 with a I/IV diastolic murmur heard best in left lateral decubitus position. HR is 108 beats/min and BP is 130/84 mm Hg. She receives oxygen, IV furosemide, and diltiazem. Echocardiogram demonstrates mitral valve area of 0.5 cm<sup>2</sup> and normal left ventricular ejection fraction. Which is the best approach for management?

- A. Refer for mitral valve clip
- B. Start lisinopril
- C. Balloon valvotomy
- D. Immediate Cesarean section
- E. Start digoxin





## Answer #7

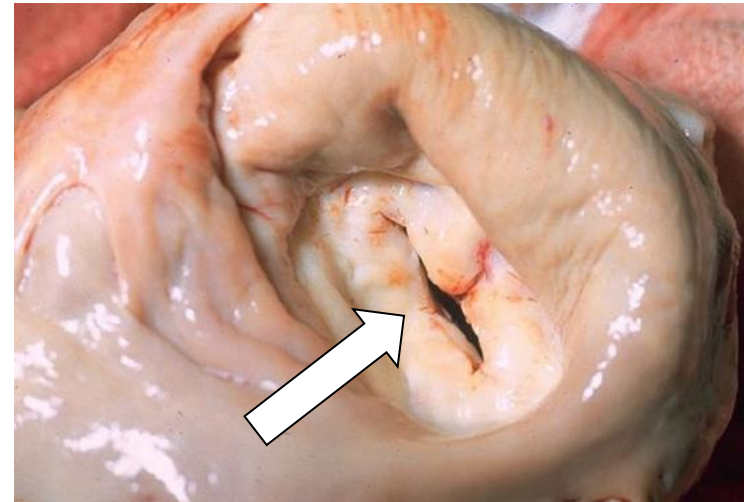
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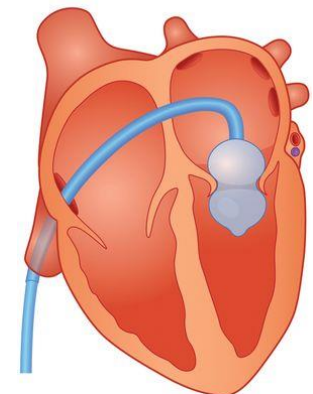
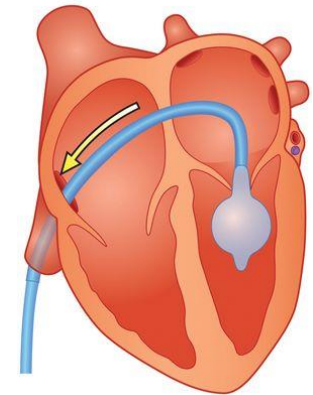
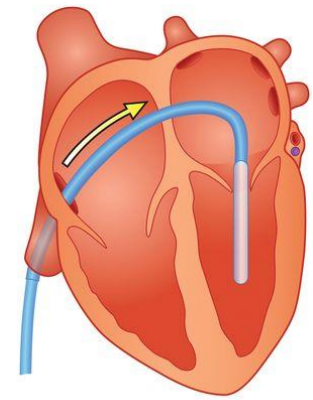
# Mitral stenosis

- Left-sided heart failure symptoms
- Hemoptysis, right-heart failure, hoarseness
- 10-20 years post-rheumatic fever
- Echocardiogram useful to determine therapies
- Exclude atrial myxoma

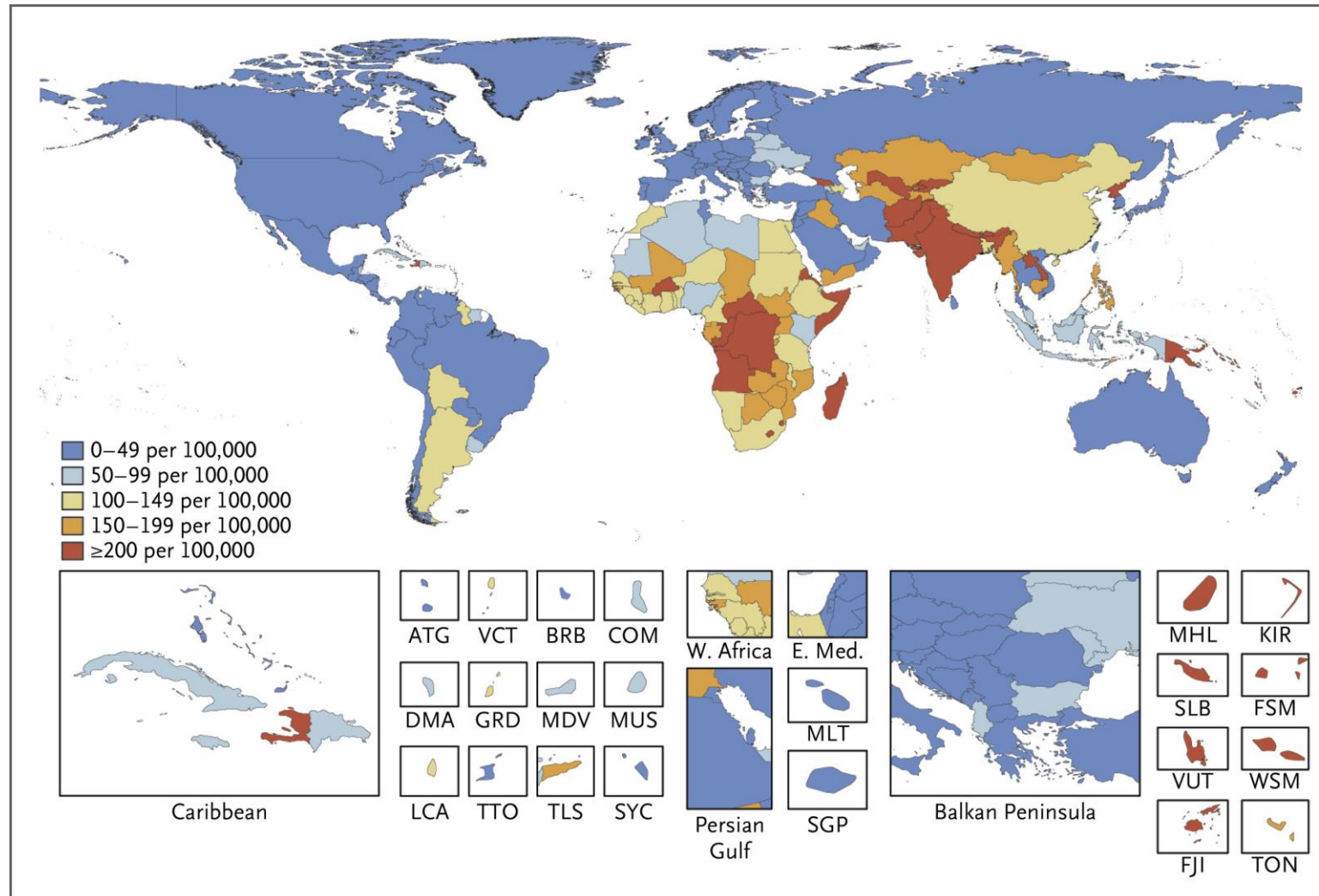


# Mitral stenosis in pregnancy

- NYHA Class III and IV—Treat with percutaneous valvotomy before delivery
- Judicious use of diuretics and beta-blockers for milder forms of mitral stenosis
- Propranolol (classic) vs. cardio-selective (e.g., atenolol, metoprolol) - Beware of bradycardia and hypoglycemia in newborn
- Avoid ACE-inhibitors



# Age-adjusted Life Year Lost due to Rheumatic Heart Disease



## Question #8

A 48-year old man with history of hypertension presents to emergency room with acute chest pain radiating to back with hypotension and a new, large left effusion on chest x-ray. Systolic blood pressure differs in both arms by 22 mm Hg. Appropriate steps in management include:

- A. Treat with sodium nitroprusside alone
- B. Start a loop diuretic alone
- C. Refer for urgent thoracentesis
- D. Refer for urgent surgical repair for proximal dissection
- E. Narcotics for pain relief alone



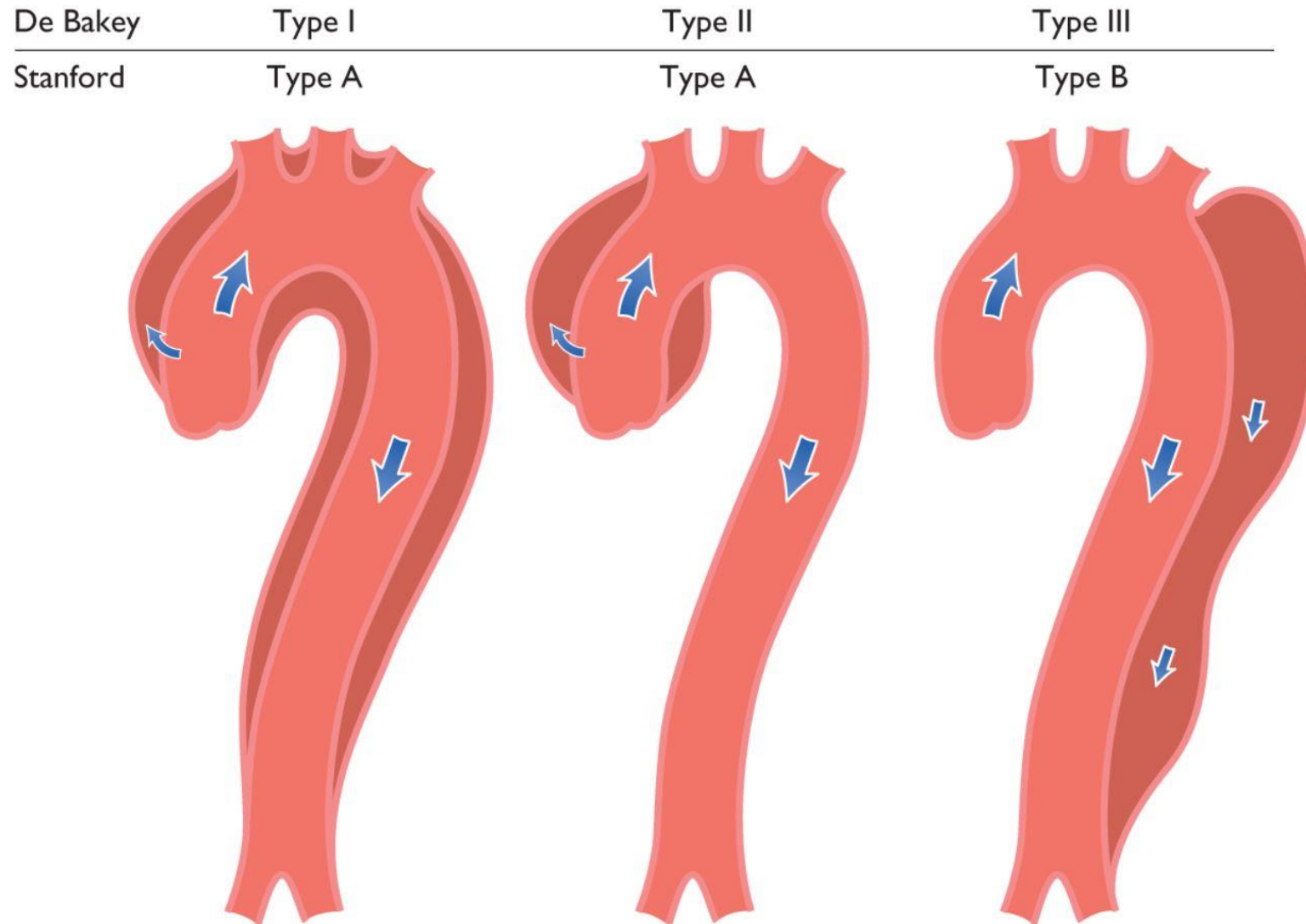
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# Aortic Dissection





# Code Aorta: Acute Management of Aortic Dissection

- Stabilization and pain relief
- Combination of sodium nitroprusside *and* beta-blocker to reduce BP and wall stress
- Immediate surgery for life threatening complications
- Urgent confirmation of dissection (CT, Echo, MRI)
- Distal dissections are often in older patients and associated with CAD



## Question #9

54 year-old man with hypertension on lisinopril presents for a new visit. He does not take an aspirin or a statin. He does not have a regular exercise routine and is a lifelong nonsmoker. No history of diabetes. Father had an MI at age 50. On exam heart rate 75bpm, BP 128/70 mmHg. BMI of 27 kg/m<sup>2</sup>. Total Cholesterol 220, LDL 160, HDL 41. He asks about what he should do to reduce his atherosclerotic vascular risk. In addition to diet and exercise, you recommend the following:

- A. Check lipoprotein (a)
- B. Evolocumab 140mg every two weeks
- C. Fish oil 1000mg twice daily
- D. Calculate PREVENT-ASCVD 10-year risk
- E. Simvastatin 20mg daily



## Answer #9

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# Lipid Lowering to Reduce ASCVD Risk

Screen  
**EARLIER**



- Screen at **age  $\geq 2y$**  if family history of premature ASCVD, severe hypercholesterolemia, or FH
- Screen at **ages 9–11y** to identify FH and other lipid disorders

Check  
**REGULARLY**



- Screen lipids again at age **19y**
- Recheck at least every **5y** and use PREVENT-ASCVD to identify risk

Aim for  
**LOWER LDL-C**



- LDL-C goal:
- **<100 mg/dL** for PREVENT-ASCVD <10%
  - **<70 mg/dL** for PREVENT-ASCVD  $\geq 10\%$ , FH, DM with risk factors, CAC  $\geq 100$  AU
  - **<55 mg/dL** for clinical ASCVD at very high risk\*

Treat  
**LONGER**



- Check lipids **4–12wk** after start or dose change of lipid-lowering therapy, then **every 6–12mo** thereafter
- Benefits increase with longer therapy; tailor duration to individual risk

Promote lifelong healthy lifestyle behaviors



# CPR Framework for Risk Evaluation

<https://professional.heart.org/en/guidelines-and-statements/prevent-calculator>

## Calculate and Classify

Estimate 10-y risk with  
PREVENT-ASCVD

1

Low risk  
0%–<3%

Borderline risk  
3%–<5%

Intermediate risk  
5%–<10%

High risk  
≥10%

## Personalize

Discuss risk estimate  
and therapy options  
with patient

1

Discuss risk estimate  
and therapy options  
with patient

1

AND

Evaluate risk enhancers

2a

Discuss risk estimate  
and therapy options  
with patient

1

Discuss risk estimate  
and therapy options  
with patient

1

## Reclassify and Reassess

If clinical or patient  
uncertainty, consider  
CAC score and revise  
results

1

If clinical or patient  
uncertainty, consider  
CAC score and revise  
results

1

## Decide and Treat

Lifestyle modification

1

Treat with lifestyle  
modification and  
potential lipid-lowering  
therapy

2a

Lifestyle modification  
and lipid-lowering  
therapy

1

### LEGEND

COR 1

COR 2a

COR 2b

COR 3-No Benefit

COR 3-Harm

(Class of Recommendation)



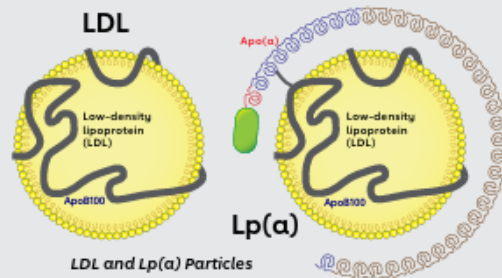
2026 Dyslipidemia

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# Lipoprotein (a)

## What is Lp(a)?

- Lipoprotein(a), or Lp(a), is a cholesterol-carrying lipoprotein in your blood. **Your level is mostly inherited.**



- Lp(a) is similar to low-density lipoprotein (LDL), often called “bad” cholesterol, but it has an extra protein called apo(a). This extra protein makes Lp(a) more likely than LDL to cause plaque buildup in the arteries and reduce blood flow. When your Lp(a) level is high, this buildup and reduced blood flow can increase your risk of heart attack, stroke, peripheral artery disease, and aortic stenosis.
- High Lp(a) levels affect **about 1 in 5 people** worldwide.

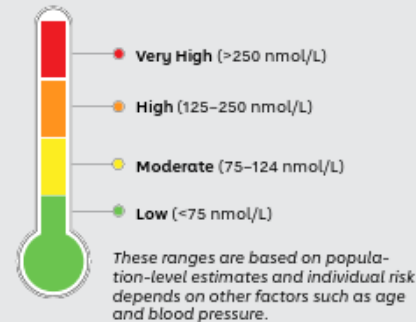
## Are there other factors that put me at risk for high Lp(a)?

- Lp(a) levels can be higher in people of African descent and South Asian populations.
- Levels may also increase with certain life stages such as **pregnancy** and **menopause**.
- Conditions like kidney, liver, and thyroid disease may raise Lp(a) levels.

If your Lp(a) level is high, **cascade screening** is recommended. This means testing your close family members, including parents, siblings, and children, to find others who may be at risk.

## Why should I know my Lp(a) level?

- If your Lp(a) level is **125 nmol/L (50mg/dL) or higher**, your risk of heart disease and stroke may increase, and if your level is **250 nmol/L (100mg/dL) or higher**, your risk may double.



## Many people don't have symptoms.

A simple blood test can show your Lp(a) level. Current guidelines recommend that **every adult be tested at least once in a lifetime**, especially if you have:

- Family or personal history of premature heart disease (meaning under 55 for men and under 65 for women)
- Known family history of high Lp(a)
- Diagnosis of familial hypercholesterolemia (FH) - an inherited condition in which people may be born with very high LDL levels





## Question #10

A 71-year-old man returns for a follow-up visit after anterior myocardial infarction 3 months ago treated with primary PCI but complicated by heart failure with EF 25%. On maximal GDMT, he had dyspnea while going 5 min on a modified Bruce ETT prior to cardiac rehab. A follow-up echocardiogram reveals an improved left ventricular ejection fraction to 32%. ECG is sinus rhythm with QRS duration 129msec. There is no NSVT on ambulatory monitoring. What would you do next?

- A. Refer for primary prevention defibrillator
- B. Refer for cardiac resynchronization pacemaker
- C. Repeat echocardiogram in 3 months to see if LVEF improves prior to implanting ICD
- D. Consider cardiac MRI to assess LVEF
- E. Refer for cardiac resynchronization defibrillator





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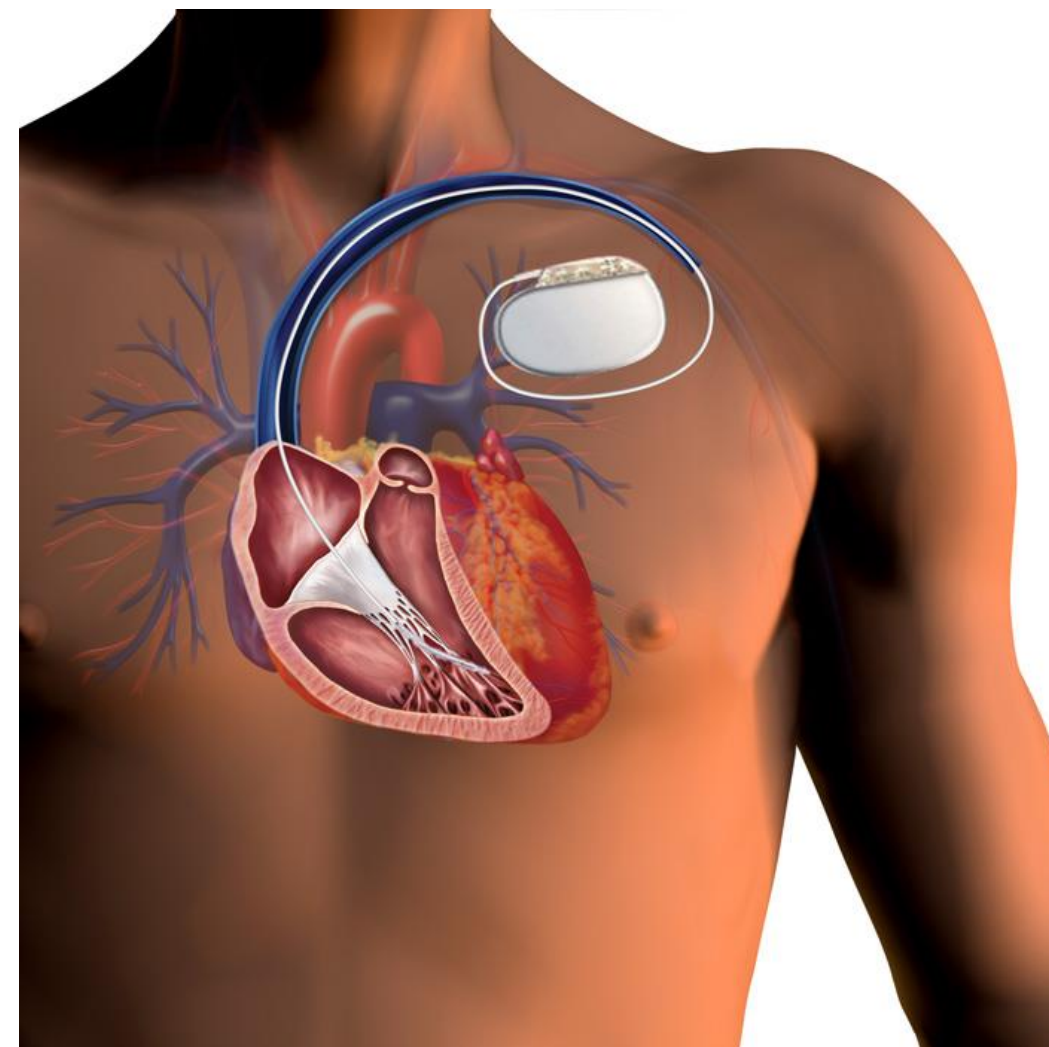
E. Refer for cardiac resynchronization defibrillator



## Recommendations for Primary Prevention of SCD in Patients With Ischemic Heart Disease

References that support the recommendations are summarized in Online Data Supplement 21.

| COR                                    | LOE | Recommendations                                                                                                                                                                                                                                                                                                               |
|----------------------------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| I                                      | A   | 1. In patients with LVEF of 35% or less that is due to ischemic heart disease who are at least 40 days' post-MI and at least 90 days postrevascularization, and with NYHA class II or III HF despite GDMT, an ICD is recommended if meaningful survival of greater than 1 year is expected. <sup>S7.1.2-1,S7.1.2-2</sup>      |
| I                                      | A   | 2. In patients with LVEF of 30% or less that is due to ischemic heart disease who are at least 40 days' post-MI and at least 90 days postrevascularization, and with NYHA class I HF despite GDMT, an ICD is recommended if meaningful survival of greater than 1 year is expected. <sup>S7.1.2-2,S7.1.2-3</sup>              |
| Value Statement: High Value (LOE: B-R) |     | 3. A transvenous ICD provides high value in the primary prevention of SCD particularly when the patient's risk of death due to a VA is deemed high and the risk of nonarrhythmic death (either cardiac or noncardiac) is deemed low based on the patient's burden of comorbidities and functional status. <sup>S7.1.2-4</sup> |
| I                                      | B-R | 4. In patients with NSVT due to prior MI, LVEF of 40% or less and inducible sustained VT or VF at electrophysiological study, an ICD is recommended if meaningful survival of greater than 1 year is expected. <sup>S7.1.2-5</sup>                                                                                            |



Al-Khatib, SM et al. Circulation 2018; 138:e272-391.

## Question #11

A 72-year old man with a history of severe mitral regurgitation from anterior leaflet prolapse with a LVEF of 50% with LVEDD 59 mm presents for a second opinion. Dyspnea occurs when walking up one flight of stairs and he is otherwise healthy and BP in clinic today is 128/78mmHg. Which is the **best** option for management?

- A. Refer for mitral valve surgery
- B. Refer for percutaneous MitraClip
- C. Follow serial echocardiograms and plan surgery when LVEF decreases below 35%
- D. Start ACE-inhibitor to attenuate the progression of LV dilatation
- E. Refer for cardiac resynchronization to reduce mitral regurgitation



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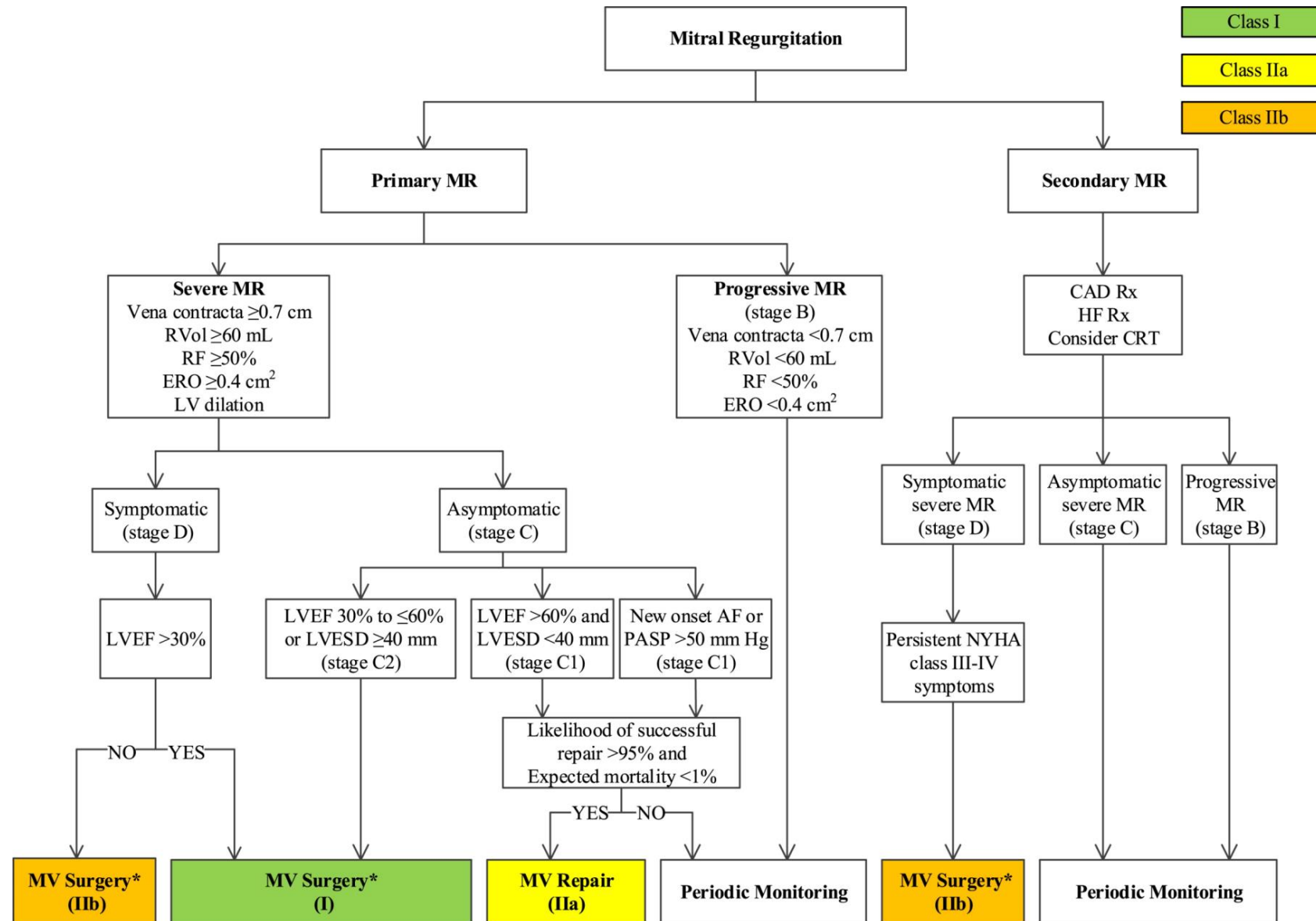
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# Recommendations for Mitral Valve Surgery in Severe Primary Mitral Regurgitation



## Question #12

A 38-year-old female attorney has experienced palpitations over past 2 years. The episodes are not associated with dizziness, syncope, or diaphoresis. She is otherwise healthy, and examination is normal with exception of heart rate 108 beats/minute which increases to 128 beats/minute with standing and when she presents to an audience. An electrocardiogram reveals sinus tachycardia and is otherwise normal. Stress reduction and caffeine reduction did not change symptom burden.

What is the best treatment for these palpitations?

- A. Dofetilide
- B. Propranolol
- C. Radiofrequency Ablation
- D. Amiodarone
- E. Nifedipine



## Answer #12

A 38-year-old female attorney has experienced palpitations over past 2 years. The episodes are not associated with dizziness, syncope, or diaphoresis. She is otherwise healthy and examination is completely normal with an exception of heart rate of 108 beats/minute which increases to 128 beats/minute with standing and when she presents to an audience. An electrocardiogram reveals sinus tachycardia and is otherwise normal. Stress reduction and caffeine reduction did not change symptom burden.

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# Interventions and Indications

|           | <i>Drugs</i>                                                                                       | <i>Actions</i>                                                              |
|-----------|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Class I   | Quinidine<br>Procainamide<br>Disopyramide<br>Lignocaine<br>Mexiletine<br>Flecainide<br>Propafenone | Block fast sodium current (hence slow conduction)                           |
| Class II  | $\beta$ -adrenoceptor blockers                                                                     | Block effects of catecholamines                                             |
| Class III | Amiodarone<br>Sotalol                                                                              | Prolong action potential and hence refractoriness by blocking $K^+$ current |
| Class IV  | Verapamil<br>Diltiazem                                                                             | Block cardiac calcium channel                                               |

## Beta-adrenergic blocker (Class II)

- Sinus tachycardia
- Situational palpitations
- Rate control AF/AFL

## Amiodarone (Class III)

- Paroxysmal atrial fib/flutter
- PSVT
- Sustained VT

## Dofetilide (Class III)

- Blockade of the cardiac ion channel carrying the rapid component of the delayed rectifier potassium currents
- Atrial fib/flutter

## Radiofrequency Ablation

- Treatment for atrial fib/flutter
- Pulmonary vein isolation
- Atrial tachycardia



## Question #13

A 69-year old woman with history of mitral valve prolapse with mild-moderate mitral regurgitation. She is asymptomatic and has a past medical history of controlled hypertension and dyslipidemia without history of endocarditis. She is scheduled for a dental extraction next week. *What is the best recommendation for endocarditis prophylaxis?*

- A. Amoxicillin 2 grams orally 1 hour before procedure
- B. Clindamycin 600 mg orally 1 hour before procedure
- C. Ampicillin 2 grams IV 30 minutes before procedure
- D. All are acceptable options
- E. None of the above



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# Endocarditis Prophylaxis

## Endocarditis Prophylaxis Class IIa

- Prosthetic cardiac valves
- Previous bacterial endocarditis
- Unrepaired cyanotic congenital heart disease (CHD)
- Completely repaired cyanotic CHD using prosthetic material or within 6 months of catheter intervention
- Repaired CHD with residual defect or adjacent to site of a prosthetic patch
- Cardiac transplantation with valve regurgitation due to structurally abnormal valve

## No longer recommended:

- Acquired valvular dysfunction (RHD)
- Hypertrophic cardiomyopathy
- MVP with valvular regurgitation/thickened leaflets

### **For Penicillin/Amoxicillin Allergic patients:**

Clindamycin no longer recommended for dental prophylaxis

Now cephalexin, doxycycline, azithromycin



## Question #14

A 45-year-old woman presents to the emergency room following a motor vehicle accident in which she was wearing a seatbelt. She noted mild dizziness while driving and awakens finding herself on the side of the road. Past medical history is notable for asthma and cutaneous sarcoidosis. She takes hydroxychloroquine 200mg daily and albuterol inhalers. Physical exam is remarkable for mild facial lacerations.

What is the most likely cause of this event?

- A. Hypoxemia
- B. Epilepsy
- C. Hysterical fainting
- D. Neurocardiogenic syncope
- E. Ventricular tachycardia



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# History Essential to Delineate Syncope Etiology

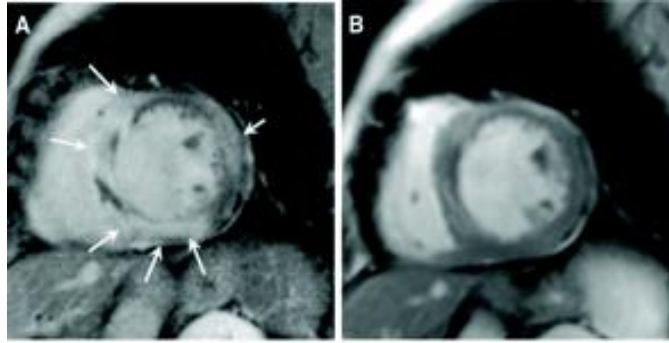
| Event                       | Classic scenario                                                                                                                                                                                               |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Cardiac syncope</b>      | <ul style="list-style-type: none"><li>- Rapid onset without aura; clear sensorium</li><li>- History of CAD, LV dysfunction</li></ul>                                                                           |
| <b>Bradyarrhythmias</b>     | <ul style="list-style-type: none"><li>- History of conduction disease, heart transplant</li></ul>                                                                                                              |
| <b>Neurological syncope</b> | <ul style="list-style-type: none"><li>- Preceded by aura; clouded sensorium</li><li>- Incontinence, tongue biting, seizure activity</li></ul>                                                                  |
| <b>Hysterical fainting</b>  | <ul style="list-style-type: none"><li>- Not accompanied by change in pulse, blood pressure, or skin color</li><li>- Paresthesias of hands/face, hyperventilation</li><li>- Dyspnea, signs of anxiety</li></ul> |



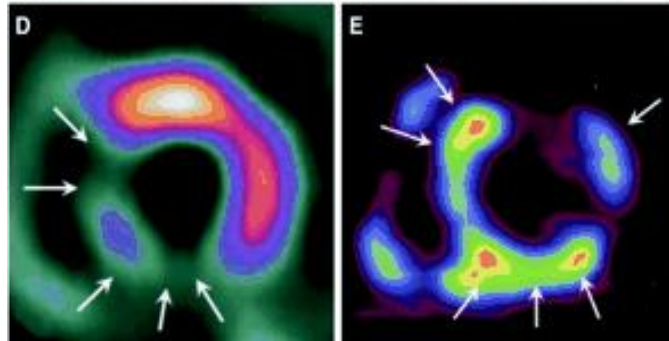


# Cardiac Sarcoidosis and Arrhythmia

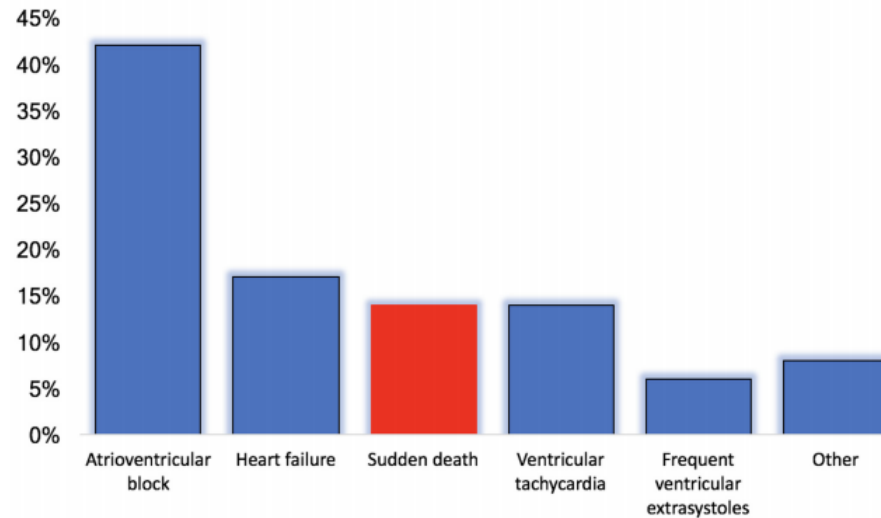
Cardiac  
MRI



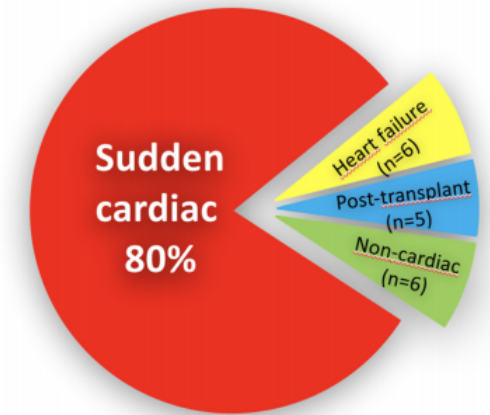
Cardiac  
PET/CT



**Main presenting manifestations**



**Mode of deaths (n=84)**



Tadamura F et al. Circulation 2006; 113:e771-3.

Ekstrom, et al. Eur Heart J 2019; 40: 3121-3128

## Question #15

A 52-year old male presents to clinic for perioperative evaluation prior to elective cholecystectomy. He works full time in construction while also exercising by walking ~40 minutes several times per week in his hilly neighborhood. Past medical history is notable for hypertension, hypercholesterolemia, and a myocardial infarction 3 years ago. What is the best management?

- A. Coronary angiography prior to surgery
- B. Perform cholecystectomy only if emergency
- C. Stress test with MIBI or echocardiogram
- D. Proceed with surgery and ensure beta-blocker use
- E. Stress test without imaging



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# AHA/ACC Guidelines 2014

## Major predictors requiring intensive management and may lead to delay/cancellation of surgery

- **Unstable coronary syndromes** including unstable or severe angina or recent MI
- **Decompensated HF** including NYHA functional class IV or worsening or new-onset HF
- **Significant arrhythmias** including high grade AV block, symptomatic ventricular arrhythmias, supraventricular arrhythmias with ventricular rate >100 bpm at rest, symptomatic bradycardia, and newly recognized ventricular tachycardia
- **Severe heart valve disease** including severe aortic stenosis or symptomatic mitral stenosis

### Other clinical predictors that warrant careful assessment of current status

- History of ischemic heart disease
- History of cerebrovascular disease
- History of compensated heart failure or prior heart failure
- Diabetes mellitus
- Renal insufficiency



# Functional Capacity Can Risk Stratify

Metabolic Equivalent (MET) = amount of oxygen consumed at rest, 3.5 mg/kg/min<sup>2</sup>

## Estimates of Metabolic equivalents (METs)

Can take care of self, such as eat, dress, or use the toilet (1-2 MET).

Can walk up a flight of steps or a hill (4 METs).

Can do heavy work around the house such as scrubbing floors or lifting or moving heavy furniture (between 4 and 10 METs).

Can participate in strenuous sports such as swimming, singles tennis, football, basketball, and skiing (>10 METs).

≥4 METs Very  
Reassuring for  
Low Perioperative  
CAD Risk



## Question #16

A 45-year old man presents to the emergency room with dyspnea. His blood pressure was 228/110 mm Hg and the remainder of the physical examination was only notable for faint crackles. Which of the following findings are characteristics of a hypertensive crisis?

- A. Retinal hemorrhages
- B. Microangiopathic hemolytic anemia
- C. Azotemia and proteinuria
- D. Pulmonary edema and jugular venous distension
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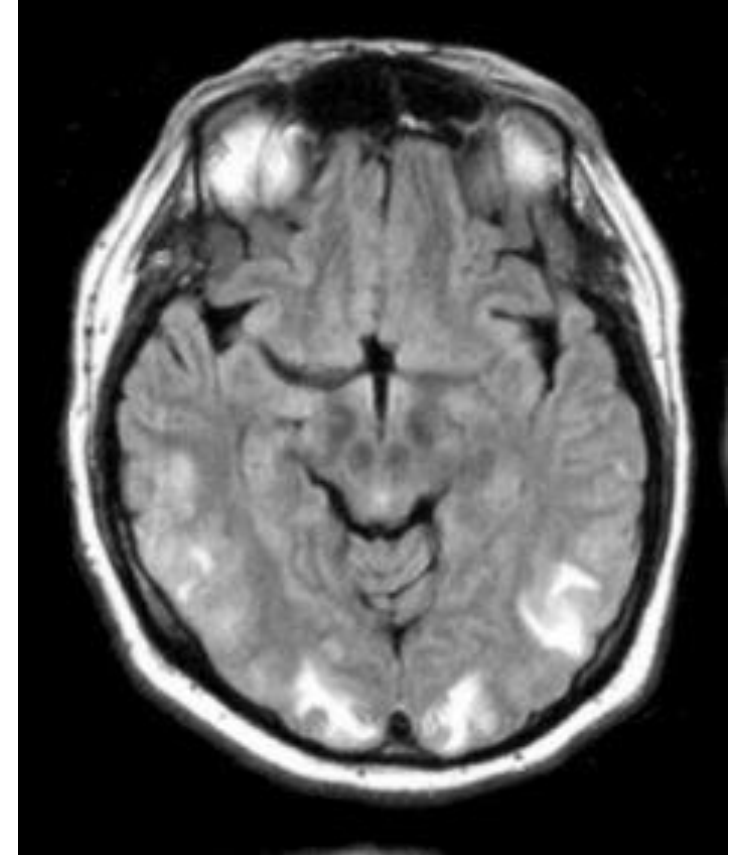
# Features of Hypertensive Crisis

- Renal insufficiency with proteinuria
- Hematuria
- Azotemia
- Microangiopathic hemolytic anemia
- Heart failure
- Nausea and vomiting



# Hypertensive encephalopathy

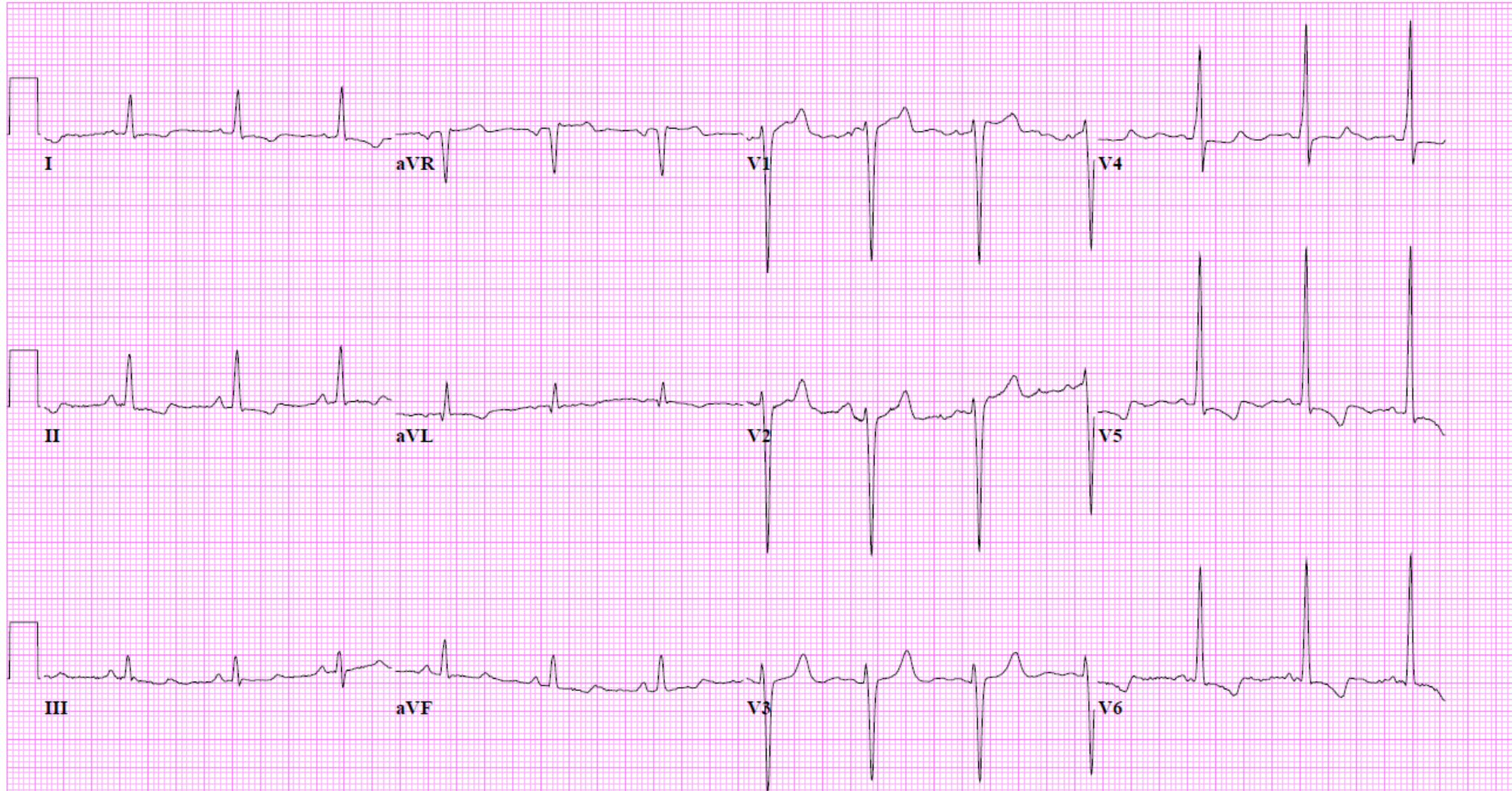
- Confusion, irritability, headaches, stupor, neurologic deficits, seizures, coma
- Sudden rise in BP causes acute damage to blood vessels
- Not always present with malignant hypertension
- Failure of cerebral autoregulation causing excess cerebral blood flow and damage to the wall leading to increased vascular permeability



Reversible Posterior  
Leukoencephalopathy

# Question #17

Please review the following ECG:



## Question #17

Each of the following statements about this ECG finding is true EXCEPT:

- A. Exercise stress testing should include imaging
- B. This can represent end-organ damage from systemic hypertension
- C. Repolarization will normalize with exercise
- D. Can be seen with both eccentric and concentric ventricular remodeling
- E. This ECG is diagnostic for left ventricular hypertrophy



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# Thank You

