

# Cardiology

## Valvular heart disease, SBE prophylaxis, HF and HTN

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# Lecture Modules

- Valvular Heart Disease
- Subacute Bacterial Endocarditis Prophylaxis
- Heart Failure
- Hypertension

# Valvular Heart Disease

# Grading of murmurs

- Grade I/VI Barely discernable
- Grade II/VI Readily discernable
- Grade III/VI Loud and easily heard
- Grade IV/VI Palpable thrill associated with murmur
- Grade V/VI Palpable with edge of stethoscope on precordium
- Grade VI/VI Heard with stethoscope off chest

Question: Which one of the following heart murmurs is best heard over the right precordial area extending into the neck?

- A. Mitral valve insufficiency
- B. Mitral valve prolapse
- C. Aortic stenosis
- D. Aortic insufficiency
- E. Mammary souffle

# Correct answer is C

## Aortic Stenosis

- Bicuspid and other congenitally abnormal aortic valves
- Tricuspid aortic valve stenosis
- Rheumatic valvular heart disease
- Up to 5% of elders > 75 years old have aortic stenosis
- Mammary Souffle is a flow murmur through the internal mammary artery

# Aortic Stenosis

# Aortic Stenosis – Clinical Findings

- II-III/VI mid systolic murmur at upper right sternal border radiating into the carotids
- Carotid pulse – slow upstroke
  - Pulsus parvus et tardus
- PMI prolonged
  - LVH
- PMI laterally displaced
  - Dilated left ventricle



# Diagnostic Testing

- 12 lead ECG – often shows LVH, Left atrial enlargement
- CXR-may show
  - Cardiomegaly
  - Pulmonary congestion
  - Aortic valve calcification
- Echocardiogram – indispensable!

Question: A 73 yo female has stable HTN and T2DM. She has known aortic stenosis on a prior echocardiogram. She has noted several episodes of lightheadedness while walking and recently almost passed out while shopping at Dubai Festival City Mall. She has no h/o CAD nor does she have chest pain or edema. Her exam is notable for a 2-3/6 systolic murmur that radiates up both carotids. Which of the following is the best next step?

- A. Add an ACEI to decrease afterload
- B. Aim for an A1C goal of 7.0 to prevent CAD
- C. Start fludrocortisone (Florinef) to increase preload
- D. Refer to cardiothoracic surgery to consider AV replacement
- E. Add a calcium channel blocker to decrease BP

# Correct answer is D

## Aortic Stenosis

- When the classic symptoms of angina, syncope, and heart failure develop, survival declines precipitously
  - 50% of symptomatic patients die within 2-5 years unless aortic valve is surgically replaced
- Prompt recognition of symptoms and evaluation for possible severe aortic stenosis are crucial in managing the disease

# Treatment

The only proven effective therapy for symptomatic  
aortic stenosis is aortic valve replacement

# Aortic Stenosis - AVR

- Choice of valve prosthesis
- Mechanical valve – best choice for patients < 50 yo
  - Risk of thromboembolism
  - Bleeding from anticoagulation
- Biosynthetic valve
  - Limited durability – 10-15 years
  - Excellent choice in the elderly > 65 yo

# Aortic Stenosis

- TAVR/TAVI – transcatheter aortic valve replacement/implantation
- Balloon valvotomy
  - Palliative technique in poor surgical candidates for AVR
  - Higher incidence of:
    - Residual/recurrent stenosis
    - Death
    - Stroke
    - Aortic rupture
    - Aortic regurgitation

# Aortic Stenosis

## Key points

- AS is the most common murmur in family medicine.
- It is a harsh midsystolic murmur heard at the RUSB and radiating into the carotids.
- When a patient with AS becomes symptomatic, they should be referred for valve replacement surgery if they are fit.

# Aortic Regurgitation



# Aortic Regurgitation

- Risk Factors
  - Hypertension
  - Primary aortic disease
  - Calcific aortic sclerosis
  - Bicuspid valve
  - Marfan's syndrome
  - Syphilitic aortitis
    - Hx lesson
  - Collagen vascular diseases
    - Takayasu's arteritis ,etc...
- Acute AR
  - Aortic dissection
  - Endocarditis
- Treatment
  - Afterload reduction first
  - AVR

# Aortic Regurgitation - Symptoms and Signs

- Most common symptoms are left-sided heart failure
  - Dyspnea on exertion
  - Orthopnea
  - Fatigue
- Wide pulse pressure (Sys BP – Dia BP)
- Diastolic “Blow” heard best at left sternal border
  - Austin Flint murmur during diastole
- Corrigan’s pulse
  - Water hammer carotid pulse with rapid run off
- Quincke’s pulse
  - Gentle pressure on nail bed then shows pulsation of nail bed pressure head

# Diagnostic Testing

- 12 lead ECG shows LVH
- Chest x-ray shows
  - Enlarged heart
  - Uncoiling and enlargement of the aortic root
- Echocardiogram for assessing the severity of aortic insufficiency

# Aortic Regurgitation - Treatment

- Afterload reduction improves hemodynamics in the short term
  - Calcium channel blockers, e.g. nifedipine
  - Angiotensin-converting enzyme inhibitors
  - Angiotensin-receptor blockers
  - Hydralazine
- For highly symptomatic patients, valve replacement is the recommended option

# Aortic regurgitation

## Key points

- Mild AR can be treated with afterload reduction: ACEI, ARB, CCB, etc...
- There are classic physical exam findings with AR: wide pulse pressure, Quincke's pulse.
- The classic murmur is the Austin-Flint soft early diastolic blow.

Question: A 32-year-old male presents to clinic with a two-day history of pain between his shoulder blades. It feels like a ripping sensation. He denies the use of alcohol. The pain is not worse with breathing, but always there. No history of hypertension. He had a bad sore throat as a child. What is the most likely diagnosis?

- A. Partial tear of the levator scapulae and rhomboid muscles
- B. Pancreatitis
- C. Pulmonary embolus
- D. Aortic dissection

# Correct answer is D

- This is a classic case of aortic dissection wherein the pain is described as an acute ripping sensation located between the shoulder blades posteriorly. The aorta is a retropleural/-peritoneal structure.
- A muscle strain/tear is due to use/overuse/injury to the affected muscle group. Spontaneous tearing without an antecedent history can usually be ruled out.
- The pain of pancreatitis can also radiate posteriorly, but to the mid back.
- Acute pulmonary embolus can give pleuric chest pain – sharp, localized pain from irritation of the pleural rubbing against the chest pain. It can often be localized with the pointing of a finger.

# Mitral Regurgitation and Mitral Valve Prolapse



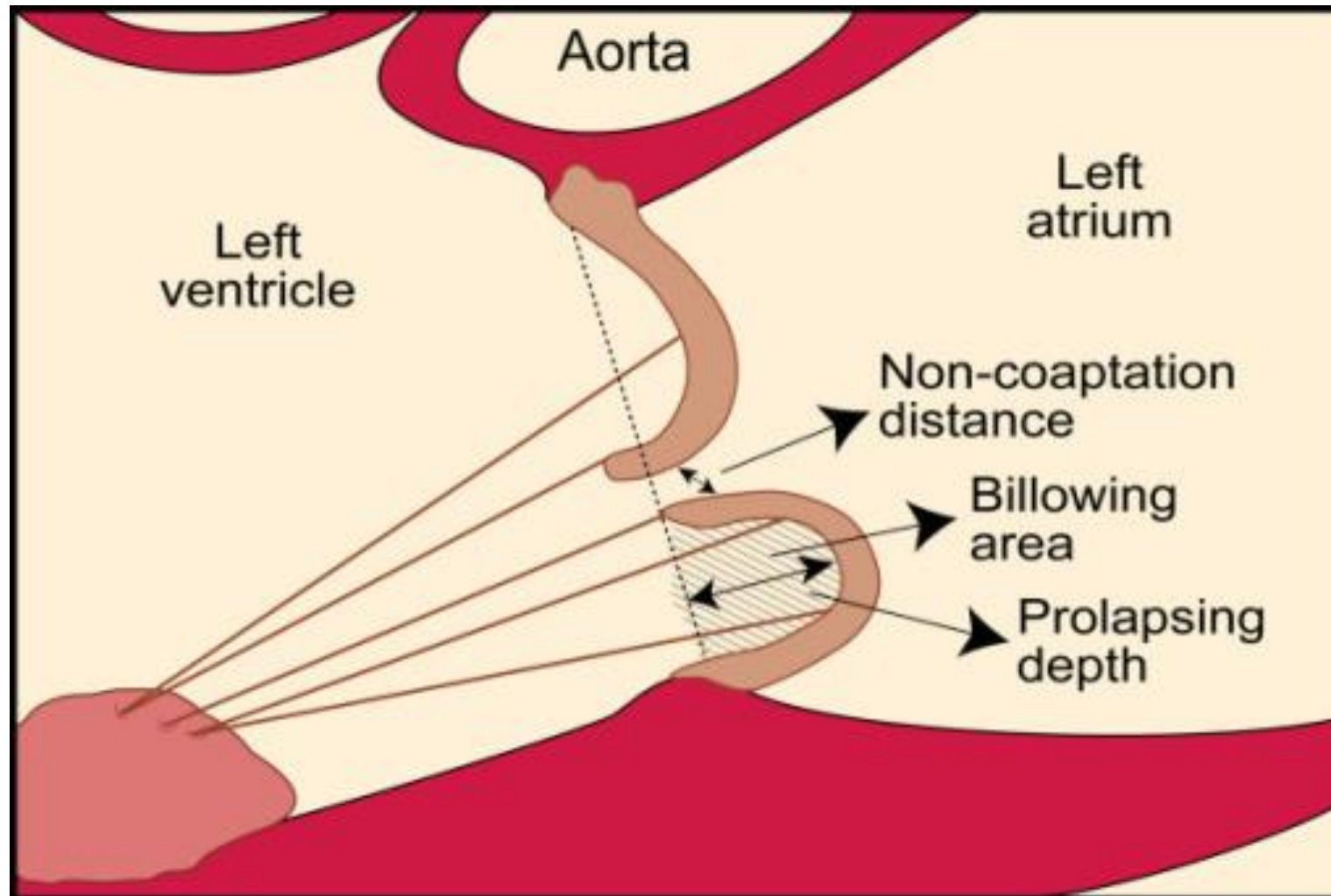
# Mitral Regurgitation

- The mitral valve is composed of the mitral annulus, the leaflets, the chordae tendineae, and the papillary muscles
- Abnormalities in any of these structures may lead to mitral regurgitation

# Mitral Regurgitation

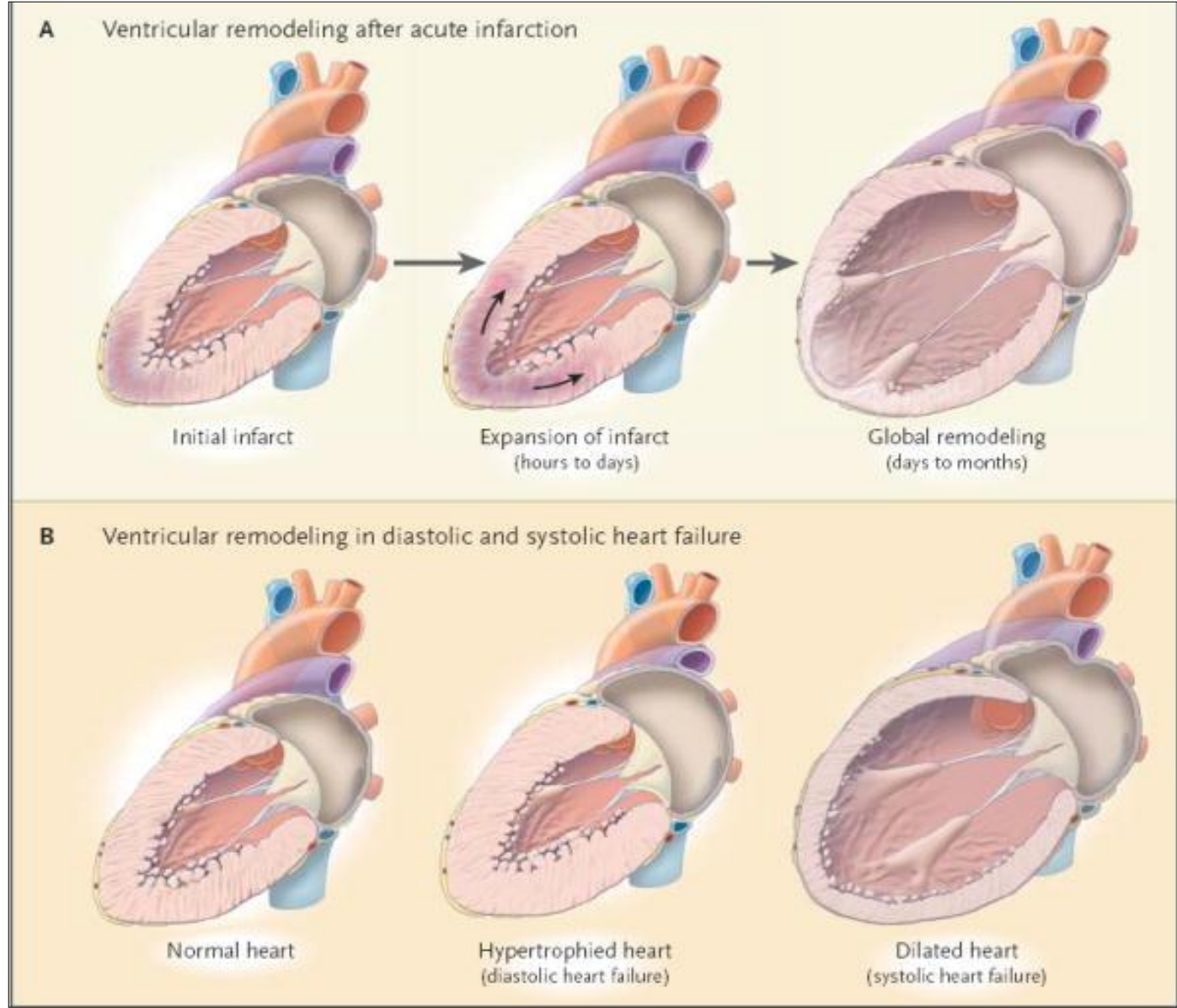
- Causes
  - **Mitral valve prolapse**
  - Myocardial ischemia leading to papillary muscle dysfunction or infarction
  - Annular calcification
  - Endocarditis
  - Collagen vascular disease
  - Rheumatic heart disease

# Mitral Valve Prolapse



Slide from NIH in public domain at:

[https://openi.nlm.nih.gov/detailedresult.php?img=PMC3296553\\_1476-7120-10-3-1&query=mitral+valve+prolapse&it=xg&req=4&npos=44](https://openi.nlm.nih.gov/detailedresult.php?img=PMC3296553_1476-7120-10-3-1&query=mitral+valve+prolapse&it=xg&req=4&npos=44)



Jessup M, Brozena S, Heart Failure, N Engl J Med 2003;  
348:2007-2018, May 15, 2003

Question: A 28 yo female G2P2002 presents for a routine physical. You note a mid systolic click consistent with mitral valve prolapse. In this instance, you should order an echocardiogram to help clarify if significant mitral regurgitation exists and SBE prophylaxis should be prescribed.

- A. True
- B. False

# Correct answer B

- SBE prophylaxis is not indicated for MVP whether or not MR exists.
- May clinicians order an echo to confirm their finding of MVP.  
However, clinical acumen alone can make this diagnosis in a classic mid systolic click.

# Physical Exam

- MR has a mid to late systolic murmur best heard over apex
- Radiates to left axilla
- Intensity varies from soft to loud
- Pitch is medium to high
- Quality is blowing
- A midsystolic click may be present with MVP

# Diagnostic Testing

- 12 lead ECG usually shows LVH or LAE
- Chest x-ray typically shows cardiomegaly
- Echocardiography shows the extent of left atrial and LV enlargement
  - Left atrium > 4 cm



# Treatment

- In symptomatic mitral regurgitation, use ACEI initially to reduce LV volume and improve symptoms
- Mitral valve surgery next step
  - Mitral valve repair or prosthetic valve are the two typical options

# Mitral regurgitation and MVP

## Key Points

- MR is the second most common murmur in family medicine
- MR most commonly results from MVP
- MVP does not need SBE prophylaxis
- Use the echocardiogram to assess degree of regurgitation, size of left atrium, and time valve surgery.

# Right-Sided Heart Murmurs

# Tricuspid and Pulmonic Valves

- Right-sided heart murmurs will vary with inspiration as blood flow ebbs and flows
- TR and PS are systolic murmurs
- TS and PR are diastolic murmurs
- Tricuspid murmurs best heard at lower left sternal border
- Pulmonic murmurs best heard at upper left sternal border

# Pulmonary Hypertension

- Fixed split S2 at upper left sternal border
- Left parasternal heave from right ventricular hypertension
- EKG
  - RVH, RAE
- Echocardiogram
  - Increased pulmonary artery pressures  $> 35$  mmHg
  - Gold standard for Dx is right heart cath with PA pressure  $> 25$ mmHg

# Heart murmur summary

- 2-3/6 harsh midsystolic M @ URSB: AS
- 1-2/6 blowing early diastolic M @ LLSB better heard during expiration, leaning forward: AR
- 1-2/6 mid-late sys M at apex radiating to axilla: MR
- Mid systolic click: MVP
- Murmurs that change with respiration: right heart (PS/PR, TS/TR)

# Subacute Bacterial Endocarditis Prophylaxis

# Spontaneous Bacterial Endocarditis (SBE) Prophylaxis - Which Patients

- ACC/AHA Guidelines changed significantly in 2007
- Clinical Indications (Who) for SBE prophylaxis
  - **Prosthetic valves and materials used to repair heart valves:  
mechanical, biosynthetic, and homograft**
  - Prior History of Infective Endocarditis
  - Unrepaired cyanotic congenital heart disease
  - Repaired congenital heart defects within the first months after repair
  - Repaired congenital heart disease with residual defects
  - Cardiac valvulopathy in a transplanted heart



# SBE Prophylaxis – Which procedures

- Dental procedures that manipulate the gingiva or periapical region of the teeth, or perforate the oral mucosa. Not normal cleaning.
  - Cutting the gum → consider prophylaxis
- Respiratory tract procedures that break the mucosal lining
- Procedures in patients with ongoing GI/GU infections (possible enterococcus)
- Procedures on infected skin, skin structures, or MSK tissue
- Surgery to replace heart valves, intravascular or intracardiac procedures

# SBE – Which drug

- Amoxicillin in non-PCN allergic patients
  - 2 gm 30-60 minutes before procedure
- PCN allergy
  - Cephalexin (2 gm), azithromycin (500 mg), clarithromycin (500 mg), or clindamycin (600 mg)
- Pts unable to take oral
  - Ampicillin IV/IM (2 gm)
  - PCN allergic
    - Cefazolin or ceftriaxone (1 gm IV) or clinda IV (600mg)

# SBE prophylaxis

## Key points

- Prophylaxis indicated for all patients with an artificial valve, previous infective endocarditis, or congenital heart disease
- Not indicated for MVP with or w/o MR
- Indicated in procedures that are intracardiac or intravascular, break a mucosal lining, or occur through infected skin or tissue.

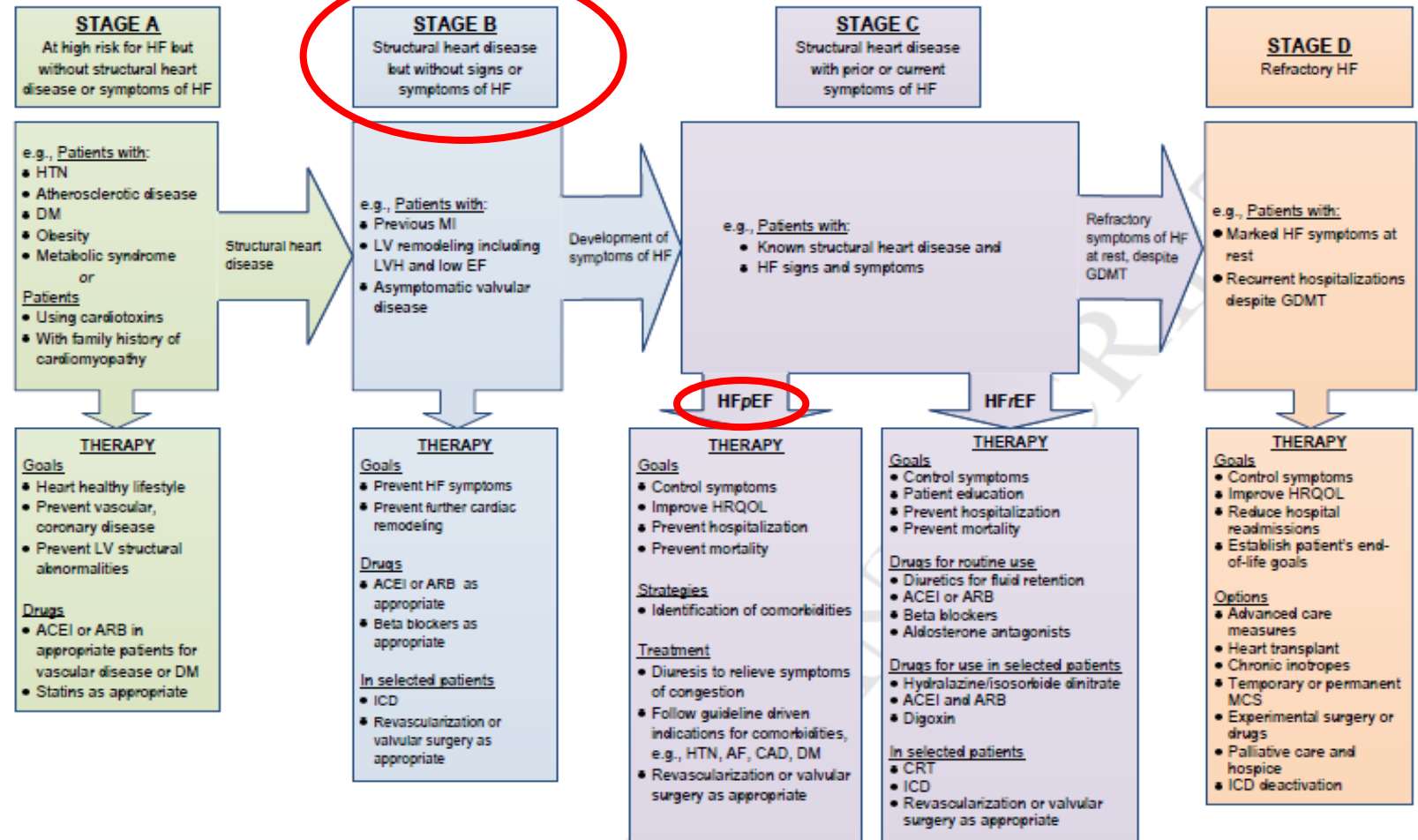
# Heart failure

A patient presents for a routine evaluation for hypertension. She feels well and has no complaints. A 2-3/6 late sys murmur is heard and a subsequent echo shows an EF 33% with 2+ mitral regurgitation. What stage HF does she have?

- A. Stage A
- B. Stage B
- C. Stage C
- D. Stage D

Yancy, CW et al.

2013 ACCF/AHA Heart Failure Guideline: Executive Summary

**At Risk for Heart Failure****Heart Failure**

**STAGE B**  
Structural heart disease  
but without signs or  
symptoms of HF

2013  
Update

# Stages of HF: ACC/AHA

Stages of HF: ACC/AHA		NYHA Functional Class
Stage A High risk for developing heart failure		
Stage B Asymptomatic, LV dysfunction, structural DZ		
Stage C Past or current symptoms of HF	}	Class I symptoms at activity levels that would limit normal individuals
		Class II symptoms of HF with ordinary exertion
		Class III symptoms of HF with less than ordinary exertion
Stage D End-stage HF		Class IV Symptoms of HF at rest

A 62 yo female has a history of heart failure with EF = 35%. She is not having chest pain but does have dyspnea walking more than 5 minutes. She is currently on lisinopril 40 mg daily and furosemide 20 mg bid. Which medication should be added to her regimen?

- A. Carvedilol titrated to 25 mg bid
- B. Metoprolol tartrate 50 mg bid
- C. Atenolol 50 mg daily
- D. Losartan 50 mg daily

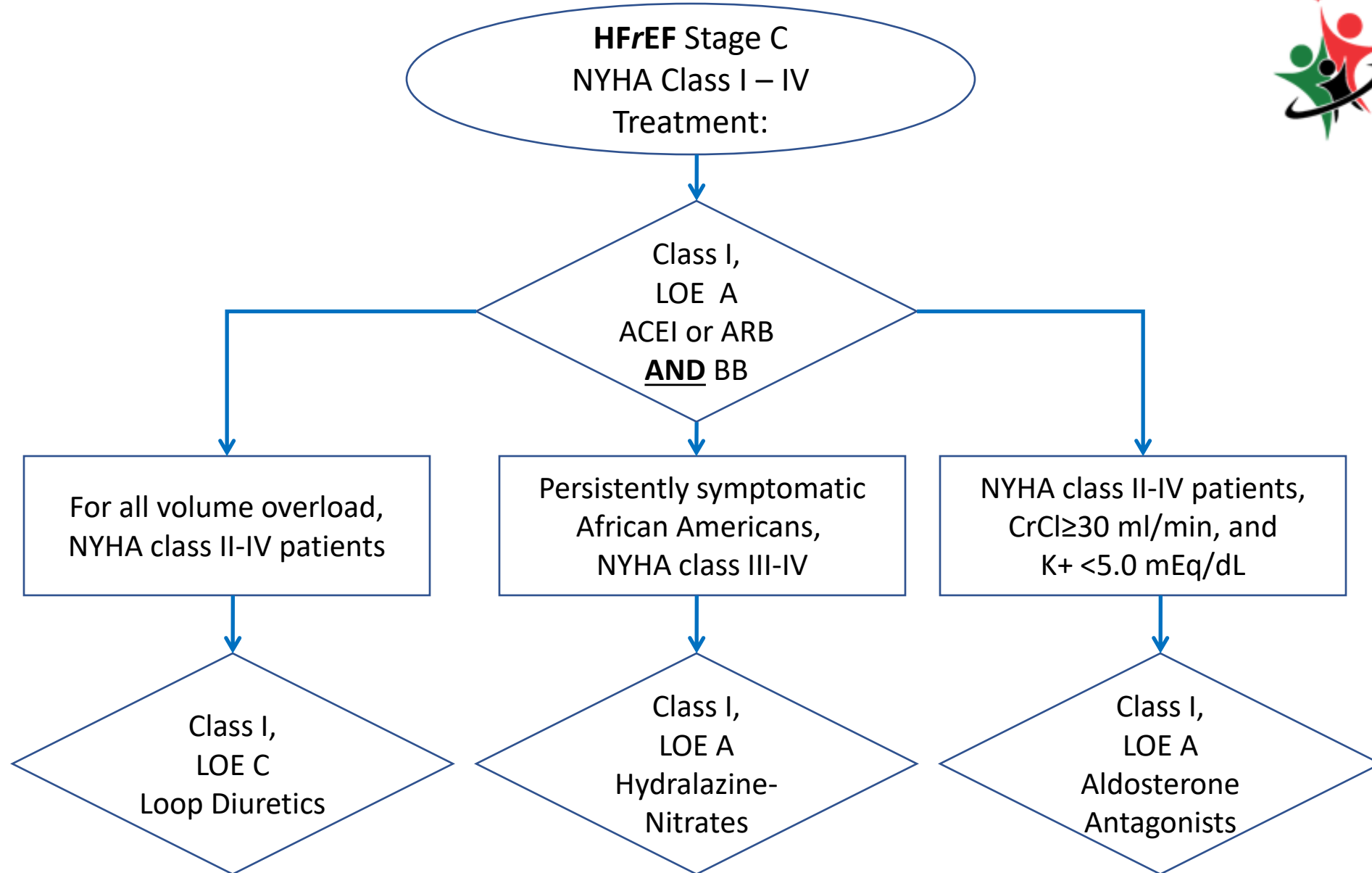


# Correct answer is A

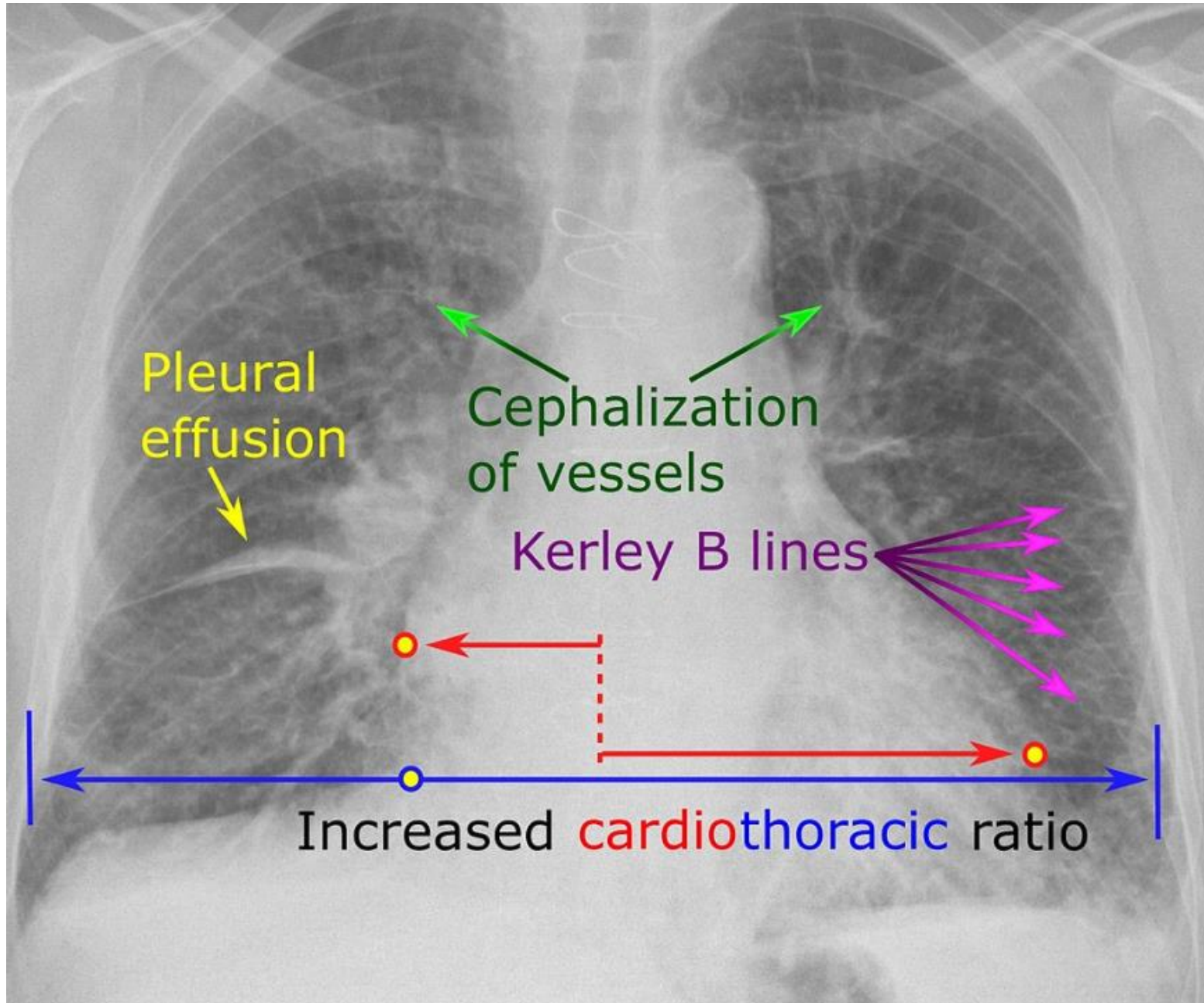
- Guideline-directed medical therapy (GDMT) for HFrEF is ACEI or ARB (not both) + BB for all patients. Loop diuretics can be added to help control edema.
- Additional medications can be considered after GDMT above is implemented.
- Losartan is not a good choice as an ARB should not be given with and ACEI without first adding a BB. (CHARM trials)
- The three BB that show benefit in treating HFrEF are:
  - Carvedilol, metoprolol succinate (once daily), and bisoprolol

# Heart failure GDMT

- HFrEF: EF < 40%
  - ACEI/ARB + BB
  - Diuretics to help control fluid
  - Add spironolactone if sx not controlled
  - Add isosorbide dinitrate/hydralazine for self-identified Black patients
- HFpEF: EF > 50%
  - GDMT for all other conditions
  - Diuretics for fluid overload
  - Empagliflozin (EMPEROR-preserved trial) – 2021 data
- Device therapy for EF < 35%:
  - Implantable cardioverter defibrillator (ICD)
  - Cardiac resynchronization therapy (CRT) with LBBB and QRS > 150



# Heart Failure CXR



# Heart failure new meds to consider

- Sacubitril/valsartan in place of ACEI/ARB
  - Neprilysin inhibitor/ARB
- Ivabradine/Corlanor
  - Patients on optimum GDMT still having sx and pulse > 70
- Dapagliflozin and empagliflozin
  - Not yet on ACC guideline pathways
  - In patients on optimum/maximum GDMT still having sx → consider adding
  - Diabetics with HF - Yes

# Cardiomyopathies

- Hypertrophic CM
  - Young patient (teens – 30's) with syncope playing sports.
  - 2-3/6 systolic murmur
- Postpartum patient with persistent edema and dyspnea
  - Peripartum cardiomyopathy (not just postpartum)
- 65 yo female whose husband died 2 weeks previous now with acute signs/sx of heart failure. ST segment elevations in EKG.
  - Takotsubo's CM. Normal coronary arteries, most patients resolve
- COVID and other viral causes of CM
- Amyloidosis – restrictive CM, large tongue and eyelids
- 35 yo patient from Central/South America with HFrEF
  - Chagas' disease – Trypanosoma cruzi

# Hypertension

A 55 yo male presents with three BP readings averaging 154/94. His lab tests and other evaluations are all normal. He does not smoke. Which of the following medications is a preferred initial therapy?

- A. Furosemide 20 mg bid
- B. Metoprolol tartrate 50 mg bid
- C. Metoprolol succinate 50 mg daily
- D. Amlodipine 10 mg daily



# Correct answer is D

- Initial selection of medications for the treatment of hypertension include ACEI/ARB (preferring ACEI first), CCB (dihydropyridine), and thiazide diuretics.
- Furosemide is a loop diuretic and is not used to treat HTN – only removal of excess fluid (HF, venous insufficiency, lymphedema)
- Beta blockers, short or long acting, are no longer initial medications for isolated hypertension.

A 63 yo female is treated with lisinopril 40 mg, nifedipine 90 mg and HCTZ 25 mg daily. Her BP continues to be high at 162/94. Assuming she is otherwise stable, which medication is best to add for resistant HTN?

- A. Spironolactone 25-50 mg daily
- B. Clonidine 0.2 mg bid
- C. Minoxidil 10 mg bid
- D. Atenolol 50 mg daily

# Correct answer is A

- Spironolactone has been shown to be the best add on medication for resistant hypertension.
- Clonidine has the potential for rebound hypertension
- Minoxidil is a vasodilator and should be combined with a BB and diuretic to help balance the reflex tachycardia and potential edema that may ensue.
- Atenolol is a BB and no longer indicated as first line treatment for HTN. If adding a BB, both carvedilol and metoprolol would be better choices.



Friendly Florida,  
Shake hands with a  
manatee

