Cardiology Test Review 2022

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Question 1:

- Answer: D; Switch lisinopril to valsartan-sacubitril

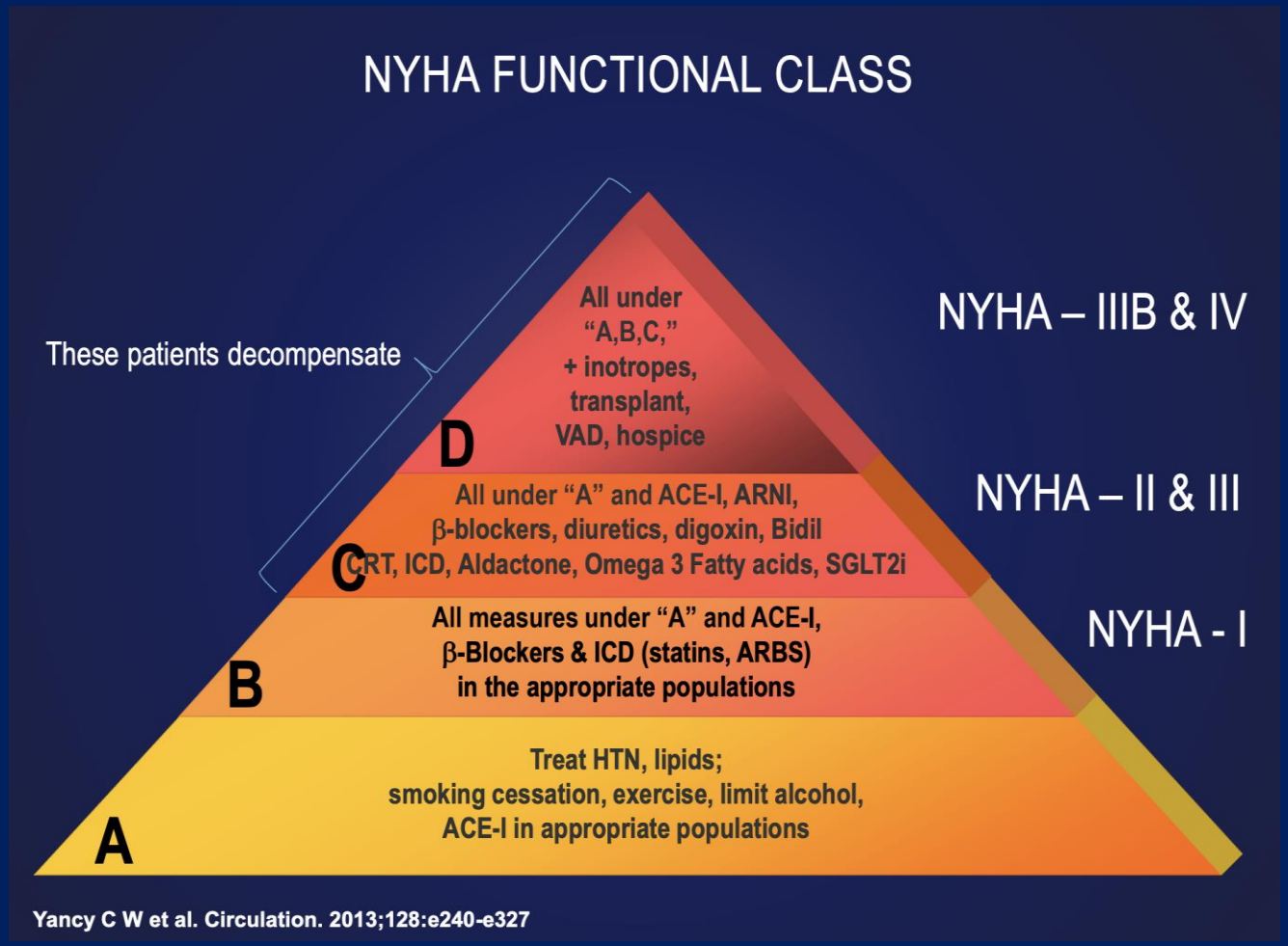
Management of Chronic Systolic Heart Failure

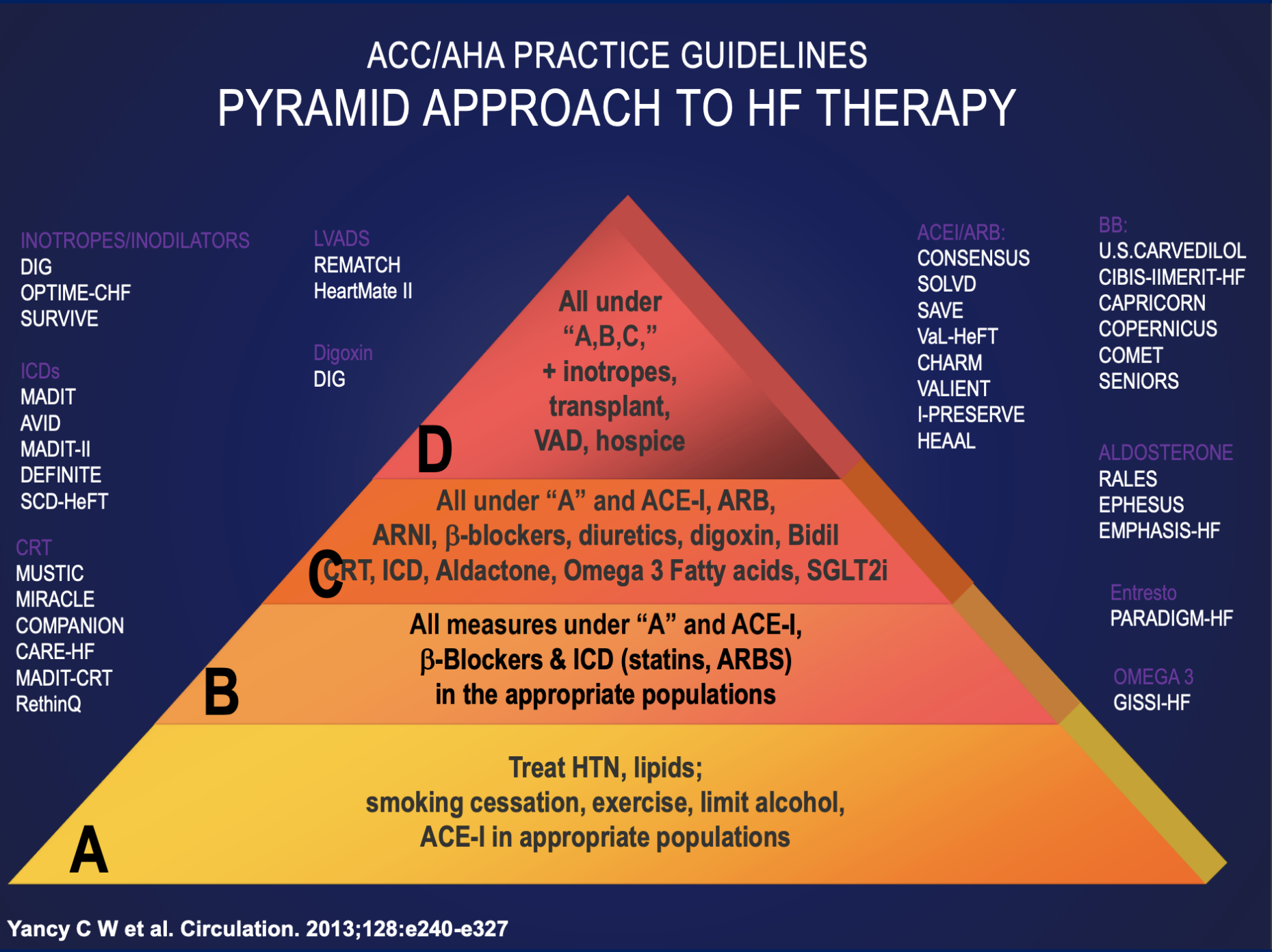
Stages of HF

- A=At Risk
- B=Borderline (no symptoms)
- C=Chronic Hospitalizations
- D=Dying

Definition of HF by EF

- HFpreservedEF $\geq$ 50% EF
- HFreducedEF $\leq$ 40% EF
- HFmrEF (mildly reduced)
  - EF 41-49% EF
- HFimprovedEF > 40%





Yancy C W et al. Circulation. 2013;128:e240-e327

PARADIGM-HF:*(2013)

1. In patients with symptoms of HF and EF<40% valsartan-sacubitril reduced mortality and HF hospitalization by 20% compared with enalapril.

2. ACEI (but not ARBs) should be discontinued at least ***36 hours prior to starting ARB-neprolysin inhibitor*** due to risk of angioedema

3. ***Pro-NT BNP*** is USEFUL in patients on Entresto, but BNP can be falsely elevated

Question 1: ***Wrong*** Answers

- A. Add isosorbide-dinitrate-hydralazine (Bidil)
  - Use when ACEI/ARB/ARNI is contraindicated for afterload reduction
  - Use in people of AA ancestry when *all other goal directed medical therapy already* optimized in III-IV NYHA patient (Val-Heft)
- B. Add ivabradine
  - Use in NYHA class II-IV, EF<35% with symptoms *after all other GDMT, in SINUS rhythm with HR > 70*
- C. Increase carvedilol dose
  - Pt's HR is 60, do not increase B-blocker

Question 2:

- Answer: A; Diagnose infiltrative cardiac disease

Cardiac Amyloid Infiltration

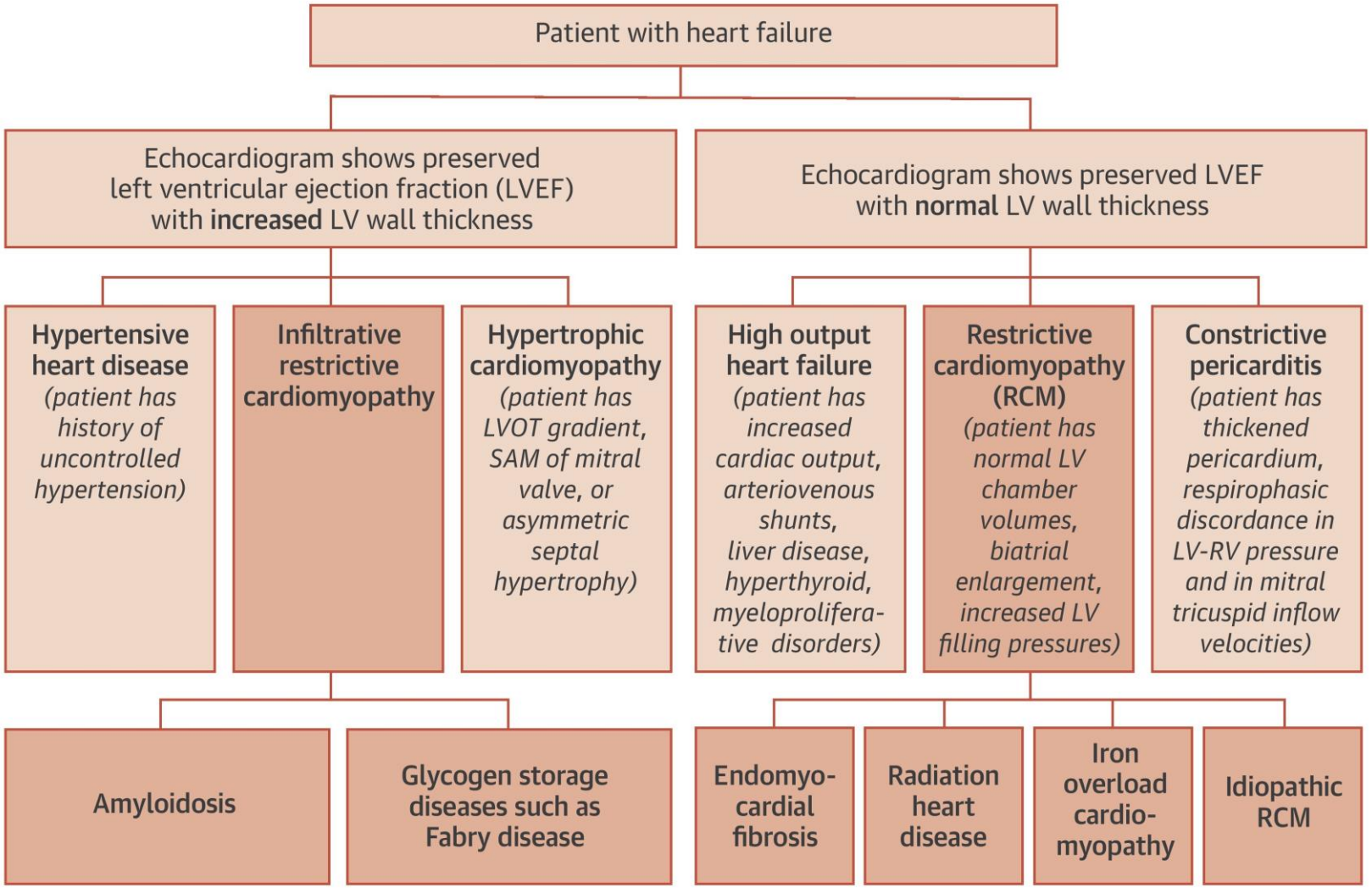
Problem List

- Clinical symptoms of heart failure, EF 50%
- BNP elevated
- Echocardiogram LV/RV *increased wall thickness*
- ECG: *low voltage (50%)*
- *Bilateral carpal tunnel syndrome*

Infiltrative Diseases of the Myocardium

- Amyloidosis
- Sarcoidosis
- Hemachromatosis
- Fabry's disease
- Danon Disease

CENTRAL ILLUSTRATION: Diagnostic Approach to Various Causes of Restrictive Cardiomyopathy When Patients Present With Heart Failure With Preserved Ejection Fraction



Pereira, N.L. et al. J Am Coll Cardiol. 2018;71(10):1130–48.

Different Types of Amyloidosis: Abnormally folded protein infiltrates tissue

- Light chain amyloid (AL)
  - Plasma cell dyscrasia (think multiple myeloma)
  - Monoclonal gammopathy
    - SPEP/IFE
    - Abnormal serum free light chain ratio
  - Amyloid deposits in fat pad or organ biopsy (kidney, heart, etc)
    - Congo red stain, apple green birefringence
  - Abnormal bone marrow biopsy
    - Malignant clone of plasma cells
  - Treat as Multiple Myeloma

- Hereditary Transthyretin amyloid (ATTR)
  - Genetic mutation of TTR gene (occurs in 3.4% of black persons in US)
  - Wild type ATTR (spontaneous)
  - Sensory and autonomic neuropathies
  - Bilateral Carpal tunnel
  - Initial gadolinium enhanced MRI of the heart (does not distinguish AL from ATTR disease)
  - 99m-technetium pyrophosphate scintigraphy of heart confirms diagnosis of ATTR disease if SPEP/IFE, free light chains are negative

Bejar D, Colombo PC, Latif F, Yuzefpolskaya M. Infiltrative Cardiomyopathies. Clin Med Insights Cardiol. 2015 Jul 8;9(Suppl 2):29-38. doi: 10.4137/CMC.S19706. PMID: 26244036; PMCID: PMC4498662

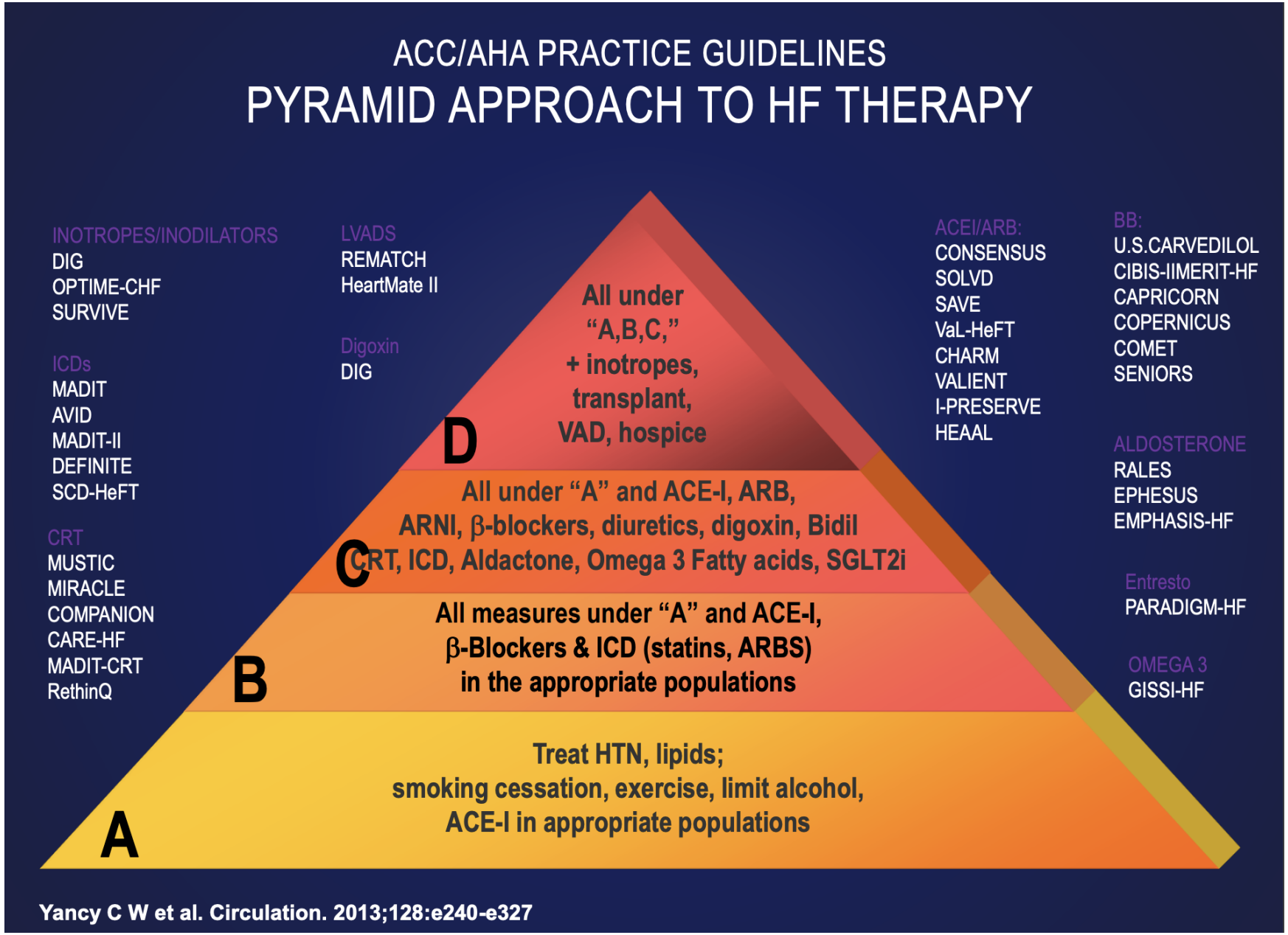
Question 2: *Wrong* Answers

- B; Exercise echocardiogram is not indicated: no anginal symptoms and no valvular disease
- C; Restrictive cardiomyopathy is in differential, however increased thickness of myocardium on echo indicates secondary process of amyloid or glycogen storage disease
- D; Fabry's disease in the differential, however it presents in childhood, whereas amyloidosis usually presents later in life

Question 3:

- B; Empagliflozin

Management of Chronic Systolic Heart Failure



SGLT2 inhibitors in DM (and non-DM) patients with heart failure with reduced EF

DAPA-HF Trial (2019)

Dapagliflozin in Patients with Heart Failure and Reduced Ejection Fraction' (DAPA-HF trial)

Evaluated the efficacy of the SGLT2-inhibitor therapy in patients with heart failure and a reduced ejection fraction, regardless of the presence or absence of diabetes.

This trial showed that dapagliflozin reduces the risk of death from cardiovascular causes by 18% (RR) 1.9% (ARR), and the risk of hospitalization for heart failure by 30% (RR) 3.7% (ARR) regardless of diabetes status, suggesting that these benefits are independent of the drug's glucose-lowering effect.[1]

EMPEROR-Reduced trial (2020)

Empagliflozin outcome trial in patients with chronic heart failure with reduced ejection fraction.

Empagliflozin also reduced the composite risk of cardiovascular death and heart failure hospitalization in patients with known heart failure with reduced ejection fraction regardless of diabetes status.[16]

In both of these trials, the risk reduction seen in their primary outcomes was principally driven by a reduction in hospitalizations for heart failure.[15 16] It appears to be independent of glucose control and diuresis.

Joshi SS, Singh T, Newby DE, *et al* Sodium-glucose co-transporter 2 inhibitor therapy: mechanisms of action in heart failure *Heart* 2021;**107:**1032-1038.

Question 3: ***Wrong*** Answers

- A; Digoxin can help reduce hospitalizations but does not reduce mortality, has a narrow therapeutic index, and is not recommended for most patients with systolic heart failure

- C: Loop diuretics are not indicated in this patient who does not exhibit signs of volume overload

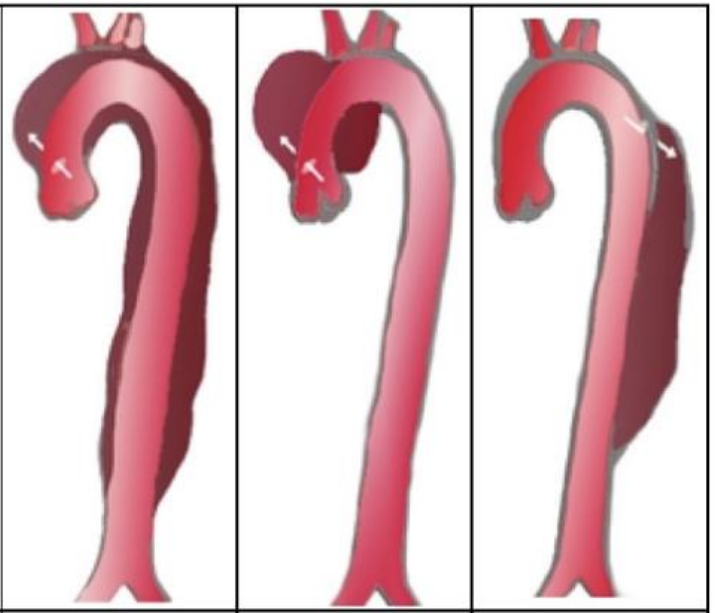
- D: Isosorbide-dinitrate-hydralazine is indicated in black patients ***in addition*** to GDMT for HFrEF or in non-black patients who cannot tolerated an ACEI/ARB or ARNI due to side effects or CKD. This patient does not meet either of those criteria.

Question 4.

- Answer: C; Repair the descending aorta

Treat Type A Aortic Dissection and *Complicated* Type B Dissection with Surgery

Classification of aortic dissection



Percentage	60%	10–15%	25–30%
Type	DeBakey I	DeBakey II	DeBakey III
	Stanford A (Proximal)		Stanford B (Distal)

Stanford Type A (Ascending)
Acute surgical emergency

Stanford Type B (simple):
Medical management (Boring)

Stanford Type B (Complicated):

- Limb or end-organ ischemia
- Persistent hypertension and pain
- Propagation of the dissection
- Enlargement of the Descending aorta
- Rupture
- ENDOVASCULAR REPAIR preferred over surgical/open

Question 4: *Wrong* Answers

- A, B and D: Recognize that although this patient was initially admitted with Stanford type B aortic dissection, she is now experiencing a complication of continued pain and ischemia which requires surgical intervention

Complications of Type B Aortic Dissection Requires Endovascular Surgical repair!

- Limb or end-organ ischemia
- Persistent hypertension and pain
- Propagation of the dissection
- Enlargement of the Descending aorta
- Rupture

Question 5.

- Answer: C; Calculate 10-year risk for atherosclerosis and cardiovascular disease

Who needs evaluation of 10-year risk by AHA Pooled Cohort Equation for Primary Prevention?*

- Calculate ASCVD risk by PCE
  - Age 40-75
  - NOT diabetic AND
  - LDL 70-189

- Age 40-75 *WITH* DM
  - Start moderate intensity
  - Increased risk ? (Table 42 Gen Med 1 MKSAP or PCE) change to high intensity
- Any age with LDL > 190
  - NO need for PCE calculation
  - Start high dose intensity statin

- Risk
  - High (≥ 20%)
    - Start high intensity statin to decrease LDL by 50% or more
    - Add ezetimibe for those who do not decrease LDL by 50% or those whose LDL is > 100
  - Intermediate (≥ 7.5% to < 20%)
    - Moderate intensity statin to reduce LDL by 30-49%
    - Consider Coronary CT for Calcium score if unsure
  - Borderline (5 to < 7.5%)
  - Low (< 5%)

*ACC/AHA Guidelines 2018

Question 5: *Wrong* Answers

- D; Fasting lipids
  - HDL and total cholesterol remain similar and prognostically useful in both fasting and non-fasting samples

- Fasting lipids is only required if:
  - Non-fasting TGs are > 400

Question 6.

- Answer: B: Hypertrophic Cardiomyopathy

Hypertrophic (Obstructive) Cardiomyopathy

What WORSENS the obstruction (and makes the murmur LOUDER):

1. Decreased Preload
2. Increased Contractility
3. Decreased Afterload

Squat to stand:

Decrease preload: LOUDER

Supine with elevating legs:

Increase preload: SOFTER

Post-PVC:

Increase preload: SOFTER

Valsalva:

Decrease preload: LOUDER

Isometric hand grip:

Increase afterload: SOFTER

Stand to Squat:

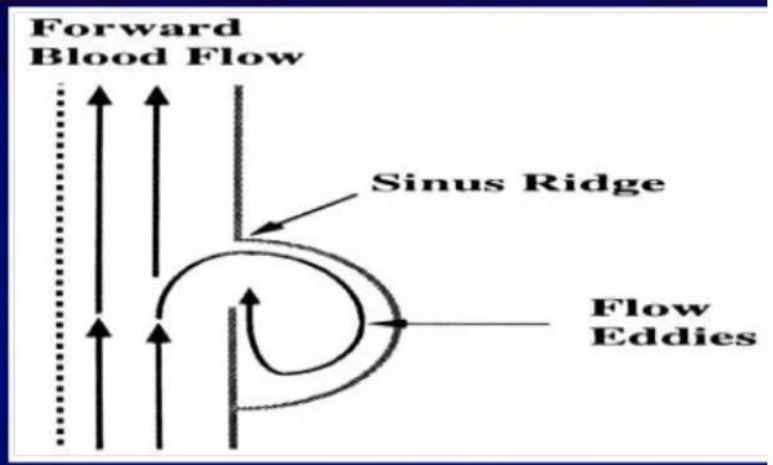
Increase preload: SOFTER

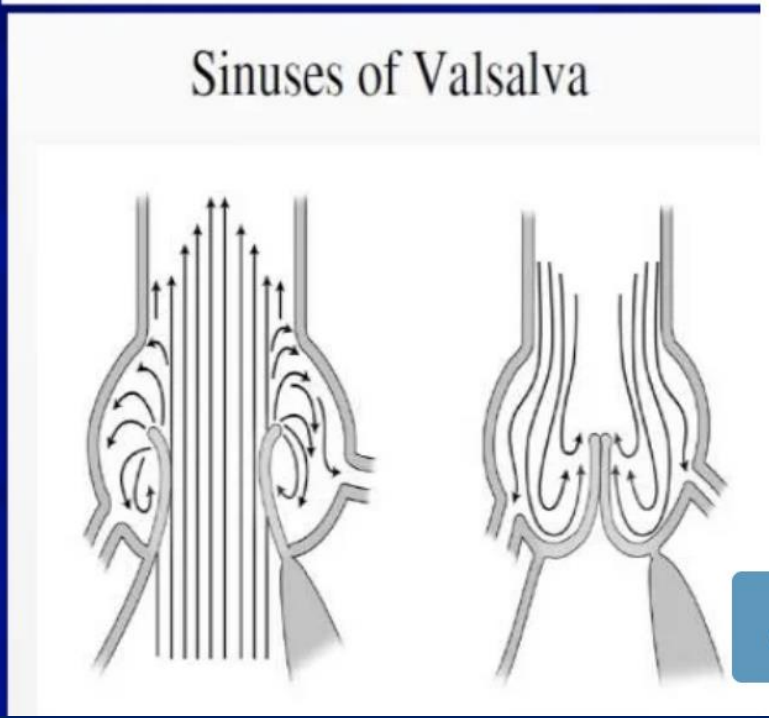
Question 6: *Wrong* Answers

- A; Bicuspid aortic stenosis is a fixed obstruction (not dynamic) and the murmur would not change as described with a fixed obstruction. Also, the carotid pulse would be delayed.
- C; A restrictive membranous ventricular septal defect does not present with dyspnea and a harsh pan-systolic mumur at the left lower sternal border
- D; Sinus of Valsalva aneurysm of the coronary cusp may rupture into the right heart and cause acute dyspnea. Because the aortic pressure is always higher than the right heart, a continuous murmur is heard in both systole and diastole.

SINUS OF VALSALVA

- 3 sinuses named after- Antonio Valsalva.
- **Provide space** behind the open aortic leaflets so that the leaflets do not occlude the coronary artery orifices.
- Secondly, this space favours the development of **eddy currents** behind the leaflets when they are open.
- Magnetic resonance imaging has shown- in aiding leaflet opening through the creation of a low-pressure system by means of the Venturi effect.
- **In valve sparing aortic valve surgery**, maintenance or recreation of the sinuses has been beneficial in terms of normal leaflet movement and valve durability





Question 7.

- Answer: A; Exercise ankle-brachial index

Peripheral Arterial Disease: CAD equivalent

ABI Value	Interpretation	Recommendation
Greater than 1.4	Calcification / Vessel Hardening	Refer to vascular specialist
1.0 - 1.4	Normal	None
0.9 - 1.0	Acceptable	
0.8 - 0.9	Some Arterial Disease	Treat risk factors
0.5 - 0.8	Moderate Arterial Disease	Refer to vascular specialist
Less then 0.5	Severe Arterial Disease	Refer to vascular specialist

Stanford Medicine 25

- Asymptomatic patient with one risk for PAD (ACC/AHA): Order ABI
  - 1. age> 65
  - 2. age 50-64 with risk factors for atherosclerosis
  - 3. age < 50 with diabetes + one risk factor, or
  - 4. known vascular disease in another location

- Symptomatic patient with claudication
  Order ABI
  - If 0.91-1.4 (normal), order ***exercise*** ABI
  - If > 1.4 (indicating arterial calcification), order toe brachial index (TBI)
  - If 0.5-0.8, refer to vascular surgery +
    - Stop smoking!
    - Aspirin (100 mg) + rivaroxaban 2.5 mg q day
    - High dose statin
    - BP control <130 systolic
    - Cilostazol (contraindicated in heart failure)

Question 8.

- Answer: C; Echocardiographic surveillance

Bicuspid aortic valve is associate with aortopathies!

BICUSPID AORTIC VALVE-THINK of:

1. Ascending Aortic aneurysms
2. Dissection
3. Aortic Coarctation

EXAMINE AORTA WITH:

Cardiac MRI (BEST)

(aortic sinus, sinotubular jxn)

Echocardiogram

CT angiography

WHEN TO OPERATE on AORTA:

- No medical therapy prevents aortic dilation in these patients

- REPLACE VALVE? YES (AS/AI)
  - If > 4.5 cm, repair aorta at time of valve surgery

- REPLACE VALVE? NO
  - Repair aorta >5.5 cm OR
  - Repair aorta > 5 cm if
    - Dilates > 0.5 cm/year
    - Family hx of dissection

Question 9.

- Answer: A; Add eplerenone

Management of Chronic Systolic Heart Failure

7.3.3. Mineralocorticoid Receptor Antagonists (MRAs)		
COR	**LOE**	**Recommendations**
1	A	1. In patients with HFrEF and NYHA class II-IV symptoms, an MRA (spironolactone or eplerenone) is recommended to reduce morbidity and mortality, if eGFR is >30 mL/min/1.73 m^2 and serum potassium is <5.0 mEq/L. Careful monitoring of potassium, renal function, and diuretic dosing should be performed at initiation and closely monitored thereafter to minimize risk of hyperkalemia and renal insufficiency.
Value Statement: High Value (A)		2. In patients with HFrEF and NYHA class II-IV symptoms, MRA therapy provides high economic value.
3: Harm	B-NR	3. In patients taking MRA whose serum potassium cannot be maintained at <5.5 mEq/L, MRA *should be discontinued* to avoid life-threatening hyperkalemia.

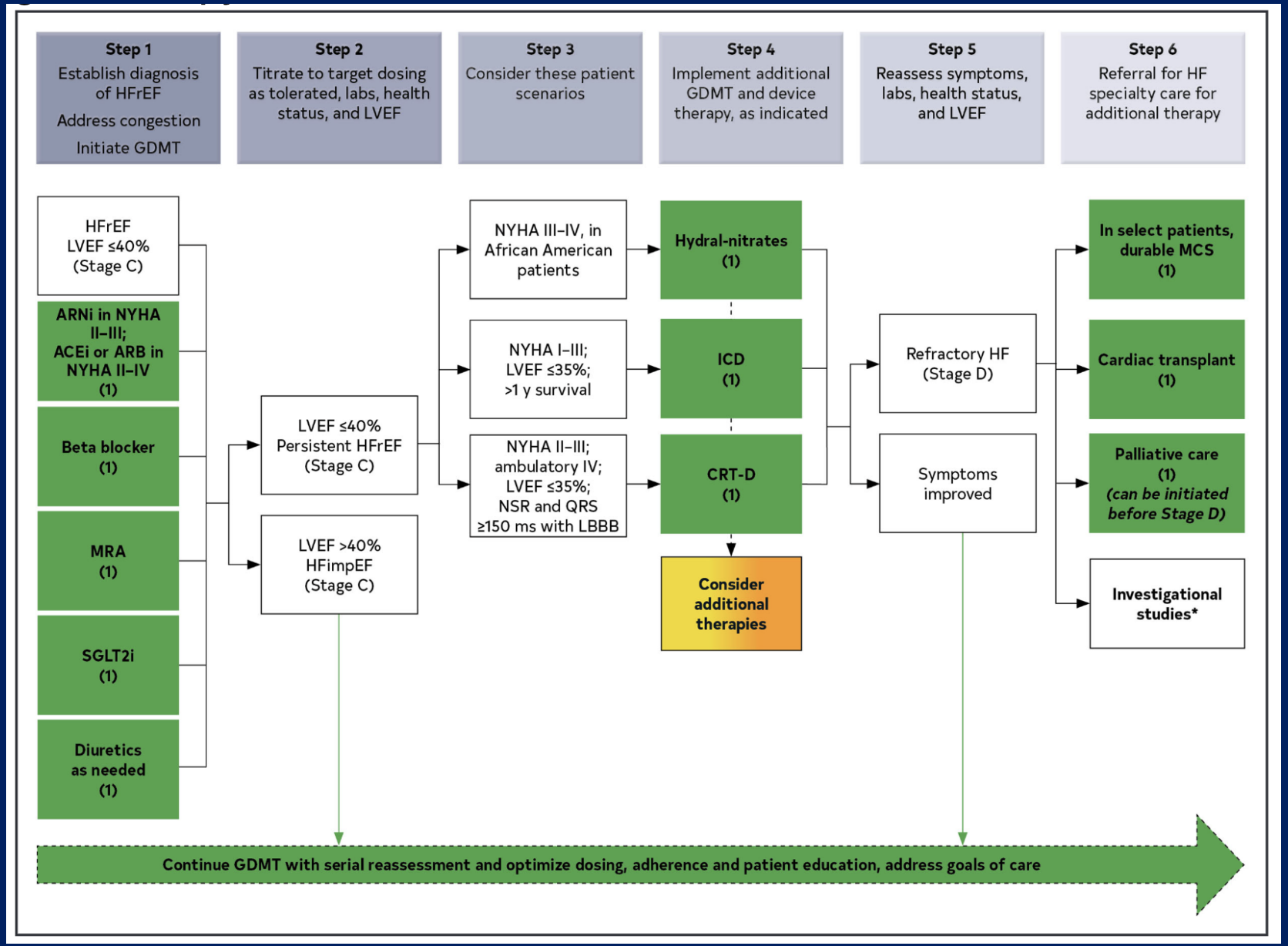
- Starting dose of spironolactone or epleronone is 25 mg q day with up-titration to 50 mg q day in one month
- GFR 31-49 should have half of usual dose
- Check K at 1 week then 4 weeks then 6- month intervals

https://www.ahajournals.org/doi/epub/10.1161/CIRCULATIONAHA.122.059104

Valsartan-sacubitril is contraindicated in patients who have had angioedema to either ACEI or ARB.

An ARB is not absolutely contraindicated in ACEI induced angioedema.*

Spironolactone can cause gynecomastia in 10% men whereas eplerenone causes gynecomastia in 0.5% of men.



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*https://www.ccjm.org/content/ccjom/80/12/755.full.pdf

Table 15. Benefits of Evidence-Based Therapies for Patients With HFrEF[3–6,8,10–14,23,31–42] (Table view)

Evidence-Based Therapy	Relative Risk Reduction in All-Cause Mortality in Pivotal RCTs, %	NNT to Prevent All-Cause Mortality Over Time*	NNT for All-Cause Mortality (Standardized to 12 mo)	NNT for All- Cause Mortality (Standardized to 36 mo)
ACEi or ARB	17	22 over 42 mo	77	26
ARNi†	16	36 over 27 mo	80	27
Beta blocker	34	28 over 12 mo	28	9
Mineralocorticoid receptor antagonist	30	9 over 24 mo	18	6
SGLT2i	17	43 over 18 mo	63	22
Hydralazine or nitrate‡	43	25 over 10 mo	21	7
CRT	36	12 over 24 mo	24	8
ICD	23	14 over 60 mo	70	23

Question 10.

- Answer: C; Discontinue clopidogrel

Discontinue clopidogrel after DES in a patient with a high risk of bleeding (SIHD or ACS??)

Recommendations for Duration of DAPT in Patients With SIHD Treated With PCI

COR	LOE	RECOMMENDATIONS
I	A	In patients with SIHD treated with DAPT after BMS implantation, $P2Y_{12}$ inhibitor therapy (clopidogrel) should be given for a minimum of 1 month (94,95).
I	B-R [SR]	In patients with SIHD treated with DAPT after DES implantation, $P2Y_{12}$ inhibitor therapy (clopidogrel) should be given for at least 6 months (17,18,21,30,96,97).
I	B-NR	In patients treated with DAPT, a daily aspirin dose of 81 mg (range, 75 mg to 100 mg) is recommended (56–60,75–78).
IIb	A [SR]	In patients with SIHD treated with DAPT after BMS or DES implantation who have tolerated DAPT without a bleeding complication and who are not at high bleeding risk (e.g., prior bleeding on DAPT, coagulopathy, oral anticoagulant use), continuation of DAPT with clopidogrel for longer than 1 month in patients treated with BMS or longer than 6 months in patients treated with DES may be reasonable (16,22,24–26,30,50).
IIb	C-LD	In patients with SIHD treated with DAPT after DES implantation who develop a high risk of bleeding (e.g., treatment with oral anticoagulant therapy), are at high risk of severe bleeding complication (e.g., major intracranial surgery), or develop significant overt bleeding, discontinuation of $P2Y_{12}$ inhibitor therapy after 3 months may be reasonable (19,20,34,36,37).

https://www.jacc.org/doi/epdf/10.1016/j.jacc.2016.03.513

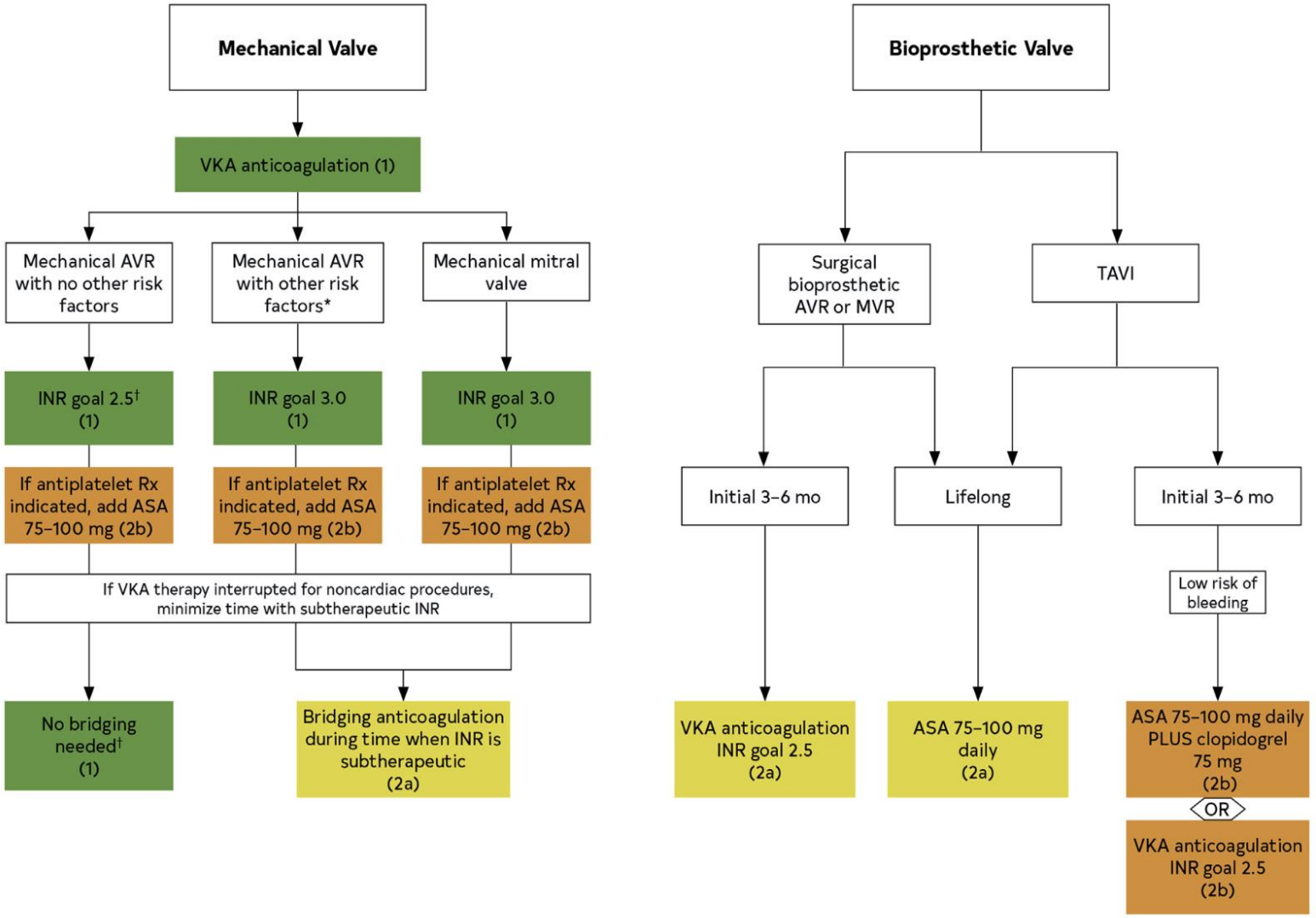
Question 10: *Wrong* Answers

- A; Platelet function analysis is not useful to assess clinical outcomes and is not recommended.
- B; Lifelong aspirin (unless contraindicated) is recommended for secondary prevention patients with established CAD.
- D; PPIs were thought to interfere with pharmacologic action of clopidogrel, but clinical studies have not shown a significant increase in adverse CV events in patients taking PPI and clopidogrel. PPI may be given to people at high risk for upper GI bleeding on DAPT but is not recommended routinely.

Question 11.

- Answer: D; Continue warfarin

FIGURE 12 Antithrombotic therapy for prosthetic valves



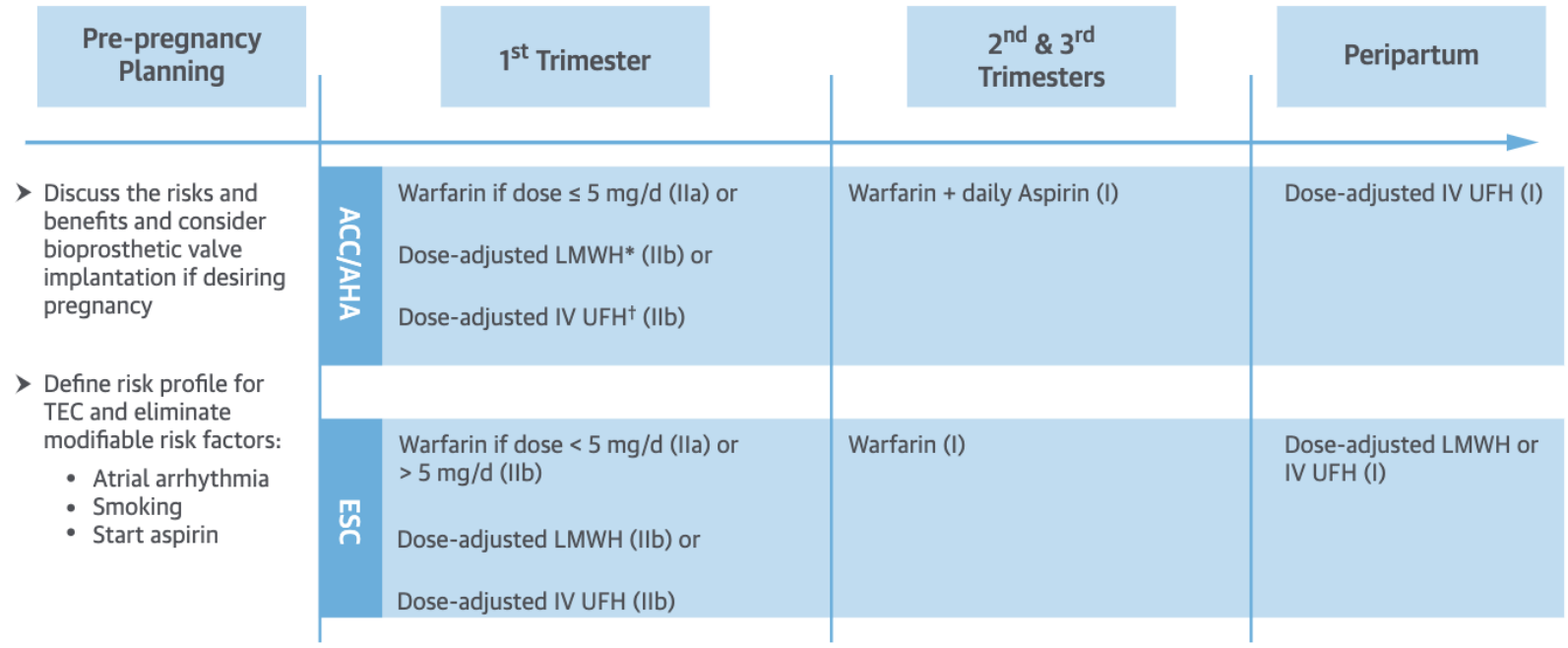
Colors correspond to Table 2. *Thromboembolic risk factors include an older-generation valve, AF, previous thromboembolism, hypercoagulable state, and LV systolic dysfunction. †For a mechanical On-X AVR and no thromboembolic risk factors, a goal INR of 1.5-2.0 plus aspirin 75-100 mg daily may be reasonable starting ≥3 months after surgery. ASA indicates aspirin; AVR, aortic valve replacement; INR, international normalized ratio; MVR, mitral valve replacement; VKA, vitamin K antagonist; Rx, medication; and TAVI, transcatheter aortic valve implantation.

Anticoagulation for Prosthetic Valves; Guidelines 2020.

https://www.jacc.org/doi/epdf/10.1016/j.jacc.2020.11.018

Anticoagulation in Pregancy

FIGURE 1 Management Strategy for Women of Childbearing Age With Prosthetic Heart Valves



*Start 1 mg/kg twice daily, guided by weekly anti-Xa levels to achieve a peak 0.1 to 1.2 U/ml and trough >0.6 U/ml. †Activated partial thromboplastin time at least 2× control. ACC/AHA = American College of Cardiology/American Heart Association; ESC = European Society of Cardiology; IV = intravenous; LMWH = low molecular weight heparin; TEC = thromboembolic complications; UFH = unfractionated heparin.

Alshawabkeh L, Economy K, Valente A, et al. Anticoagulation During Pregnancy. *J Am Coll Cardiol.* 2016 Oct, 68 (16) 1804–1813.**https://doi.org/10.1016/j.jacc.2016.06.076**

Anticoagulation for MHV in Pregnancy

Anticoagulation during pregnancy must balance maternal and fetal risks, but there is no optimal strategy. While VKAs are safer for the mother, LMWH is safer for the fetus.

Contrary to the 2014 American Heart Association/American College of Cardiology Valvular Disease Guideline, the use of UFH throughout pregnancy is not supported by this review. The guideline also recommends warfarin throughout pregnancy if the dose is ≤5 mg/day, but this still confers 2.3% risk to the fetus.

Sequential treatment with heparin during the first trimester does not eliminate fetal risk. Given the heterogeneity of existing studies, unanswered questions remain regarding the optimal protocol for anti-Xa levels with LMWH, specific international normalized ratio goals with VKAs, and the use of concomitant aspirin treatment.

Patients need to be informed about the risks involved with each strategy and actively involved in decision making.

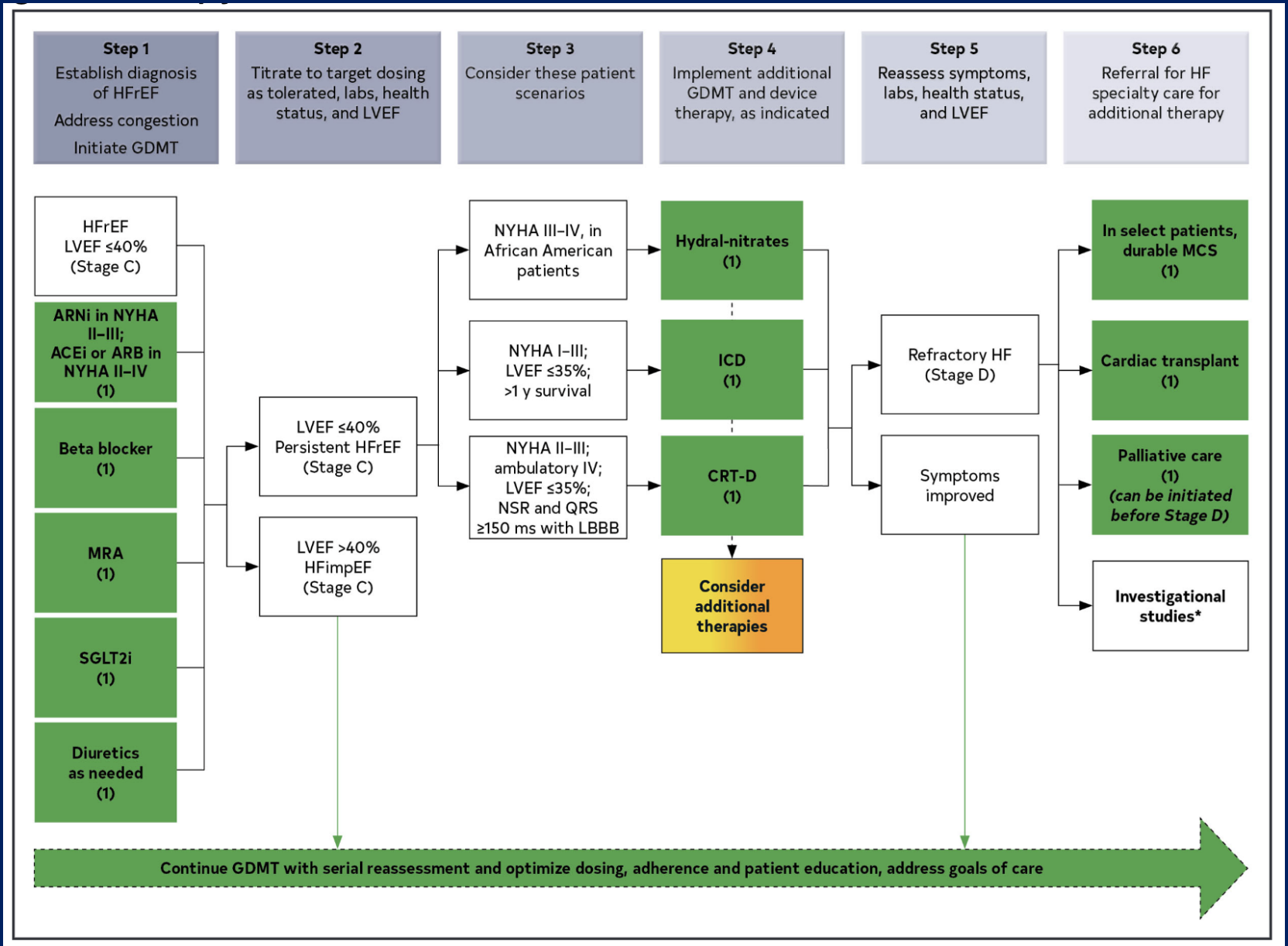
Rohan D'Souza, Jackie Ostro, Prakesh S. Shah, Candice K. Silversides, Ann Malinowski, Kellie E. Murphy, Mathew Sermer, Nadine Shehata, Anticoagulation for pregnant women with mechanical heart valves: a systematic review and meta-analysis, *European Heart Journal*, Volume 38, Issue 19, 14 May 2017, Pages 1509–1516, https://doi.org/10.1093/eurheartj/ehx032

Question 11: *Wrong* Answers

- Answer A; Bivalrudin is a direct thrombin inhibitor and has not been approved for anticoagulation for mechanical prosthetic valves.
- Answer B; Dabigatran was compared with warfarin for prosthetic valves in the RE-ALIGN trial. It was stopped prematurely for excessive thrombotic and bleeding complications in the dabigatran arm
- Answer C; In. patients who choose not to take warfarin in the first trimester, intravenous unfractionated heparin may be used but not subQ heparin.
- Intravenous heparin is used around the time of delivery for pregnant women with mechanical valves and does not cross the placenta.

Question 12.

- Answer; A, Cardiac Resynchronization Therapy-Defibrillator



Indications for ICD in systolic heart failure for primary prevention of SCD:

- On GDMT 90 days
- LVEF ≤ 35%
- NYHA I-III
- > 1 yr survival

Indications for Bi-ventricular pacer in systolic heart failure (Resynchronization therapy)

- On GDMT 90 days
- LVEF ≤ 35%
- NYHA II-IV
- Normal sinus rhythm
- QRS ≥ 150 ms with LBBB Class 1
- QRS 120-149 ms with LBBB Class 2a

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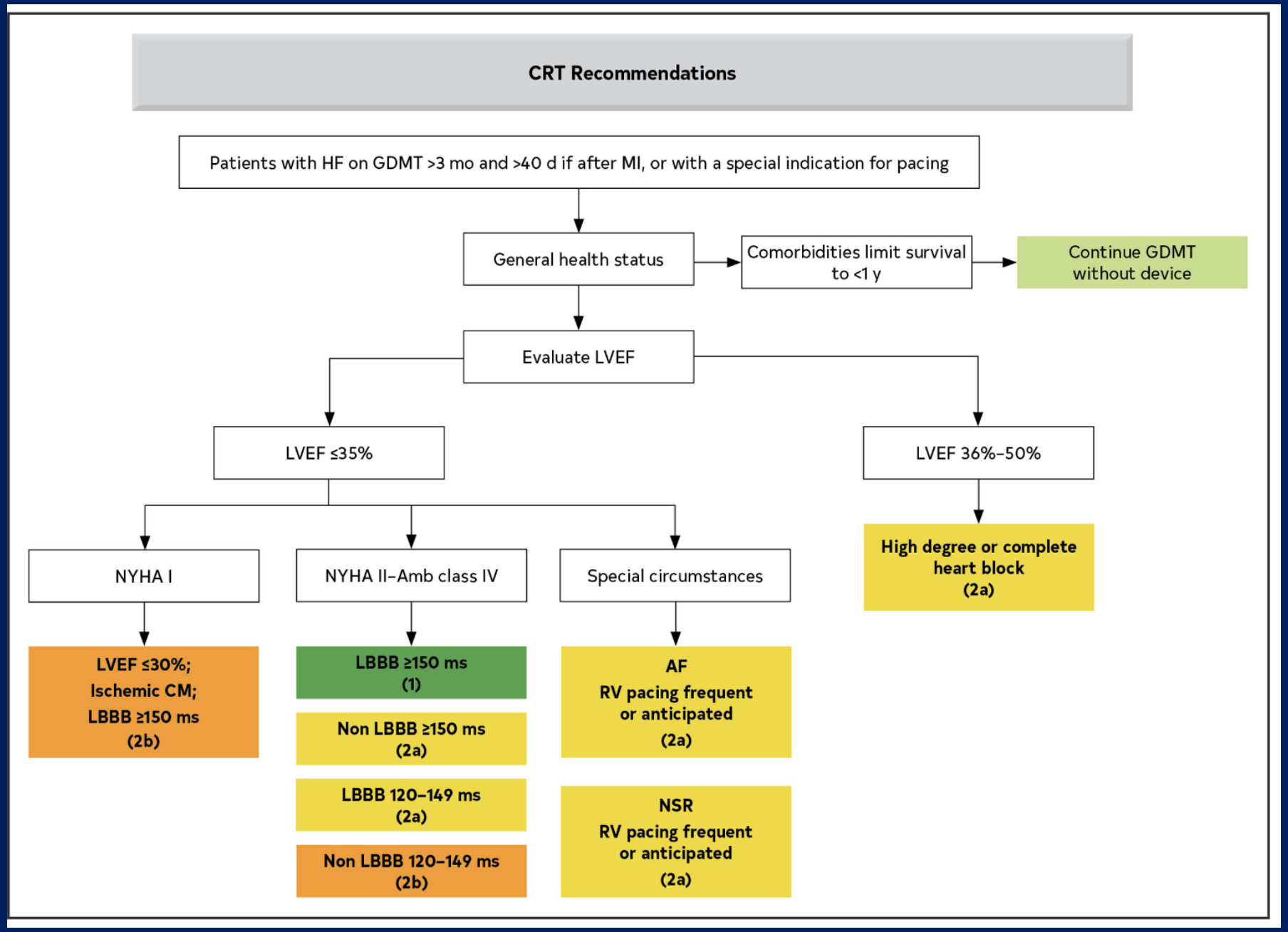

CRT Recommendations
Patients with HF on GDMT >3 mo and >40 d if after MI, or with a special indication for pacing
General health status
Comorbidities limit survival to <1 y
Continue GDMT without device
Evaluate LVEF
LVEF ≤35%
LVEF 36%–50%
NYHA I
NYHA II–Amb class IV
Special circumstances
High degree or complete heart block (2a)
LVEF ≤30%; Ischemic CM; LBBB ≥150 ms (2b)
LBBB ≥150 ms (1)
Non LBBB ≥150 ms (2a)
LBBB 120–149 ms (2a)
Non LBBB 120–149 ms (2b)
AF RV pacing frequent or anticipated (2a)
NSR RV pacing frequent or anticipated (2a)

Question 12: *Wrong* Answers

- B; Implantable defibrillator is indicated in this patient, but not alone. Sinus rhythm, LBBB pattern, QRS >120 ms indicates benefit from CRT for possible improvement in functional status.

- C; Implantable pulmonary artery pressure sensor (CardioMEMs)- useful to monitor hemodynamics in patients who have frequent hospitalizations, which this patient has not had.

- D; Wearable cardioverter-defibrillator (lifevest) may be used as a bridge to ICD in patients at high risk of arrhythmia (post-MI, while waiting 90 days GDMT for improvement in EF).

Question 13.

- Answer: C; Aortic repair before pregnancy

Pre-pregnancy Evaluation in Marfan syndrome

- Autosomal dominant
- 25% of cases are spontaneous mutation
- 1:3000-5000 individuals
- *FBN1* gene on chromosome 15
- Abnormal fibrillin (main component of elastin fibers)
- Cystic medial degeneration of the aorta

- Criteria for diagnosis
  1. Aortic root dilation Z-score ≥ 2 OR dissection
  2. Ectopia lentis
  3. FBN1 Gene abnormality
  4. Family history
  5. Other physical criteria
     - Ghent criteria (2010)

https://marfan.org/dx/rules/

Marfan syndrome and Pregnancy

5. Genetic Syndromes Associated With Thoracic Aortic Aneurysms and Dissection

5.1. Recommendations for Genetic Syndromes

Class I

1. **An echocardiogram is recommended at the time of diagnosis of Marfan syndrome to determine the aortic root and ascending aortic diameters and 6 months thereafter to determine the rate of enlargement of the aorta. (*Level of Evidence: C*)**

2. **Annual imaging is recommended for patients with Marfan syndrome if stability of the aortic diameter is documented. If the maximal aortic diameter is 4.5 cm or greater, or if the aortic diameter shows significant growth from baseline, more frequent imaging should be considered. (*Level of Evidence: C*)**

Class IIa

2. **For women with Marfan syndrome contemplating pregnancy, it is reasonable to prophylactically replace the aortic root and ascending aorta if the diameter exceeds 4.0 cm.[74] (*Level of Evidence: C*)**

People with Marfan Syndrome often have a tall, slender build (top) and flexible joints (bottom). Photo Credits: The Marfan Foundation.

https://www.ahajournals.org/doi/10.1161/cir.0b013e3181d4739e?cookieSet=1#d3e9092

Question 13 *Wrong* Answers

- A: Statin drugs are contraindicated in those who wish to become pregnant or are pregnant (CNS and limb fetal abnormalities)
- B; ACEI and ARBs are contraindicated in pregnancy, however LOSARTAN has been shown to help slow aortic root dilation in patients with Marfans (not in bicuspid aortic valve pts)
- D: A high risk patient with family history of dissection and 4 cm aortic root should have surgical repair prior to pregnancy

Question 14.

- C; Pharmacologic myocardial perfusion imaging

Chest Pain Evaluation: Pre-Test Probability

Age, Years	Chest Pain Criteria 1. Substernal chest discomfort with characteristic quality and duration 2. Provoked by exertion or emotional stress 3. Relieved promptly by rest or nitroglycerin					
	Nonanginal Chest Pain 1 of 3 Criteria		**Atypical Angina** 2 of 3 Criteria		**Typical Angina** 3 of 3 Criteria	
	Male	Female	Male	Female	Male	Female
30 – 39	4%	2%	34%	12%	76%	26%
40 - 49	13%	3%	51%	22%	87%	55%
50 - 59	20%	7%	65%	33%	93%	73%
60 - 69	27%	14%	72%	51%	94%	86%

LOW
= < 10%

INTERMEDIATE
= 11-89%

HIGH
=>90%

Test for CAD in patients with LBBB

- Options for Stress
  - Exercise
  - Inotrope
  - Vasodilator
- Options for Imaging
  - None (ECG interpretation only)
  - Nuclear
  - Echo

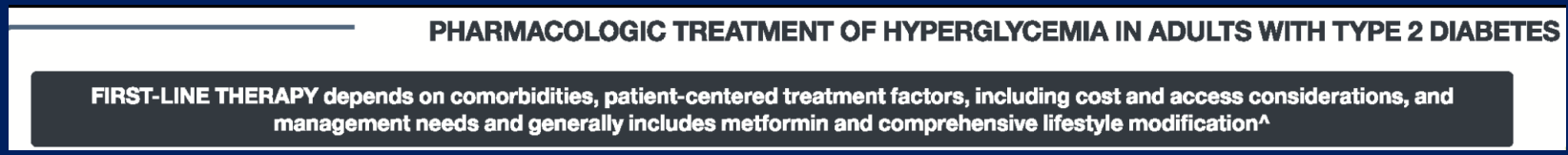
https://consultqd.clevelandclinic.org/in-patients-with-left-bundle-branch-block-whats-the-best-test-forcad/#:~:text=Exercise%20nuclear%20single%2Dphoton%20emission,anterior%20descending%20artery%20(Figure%202

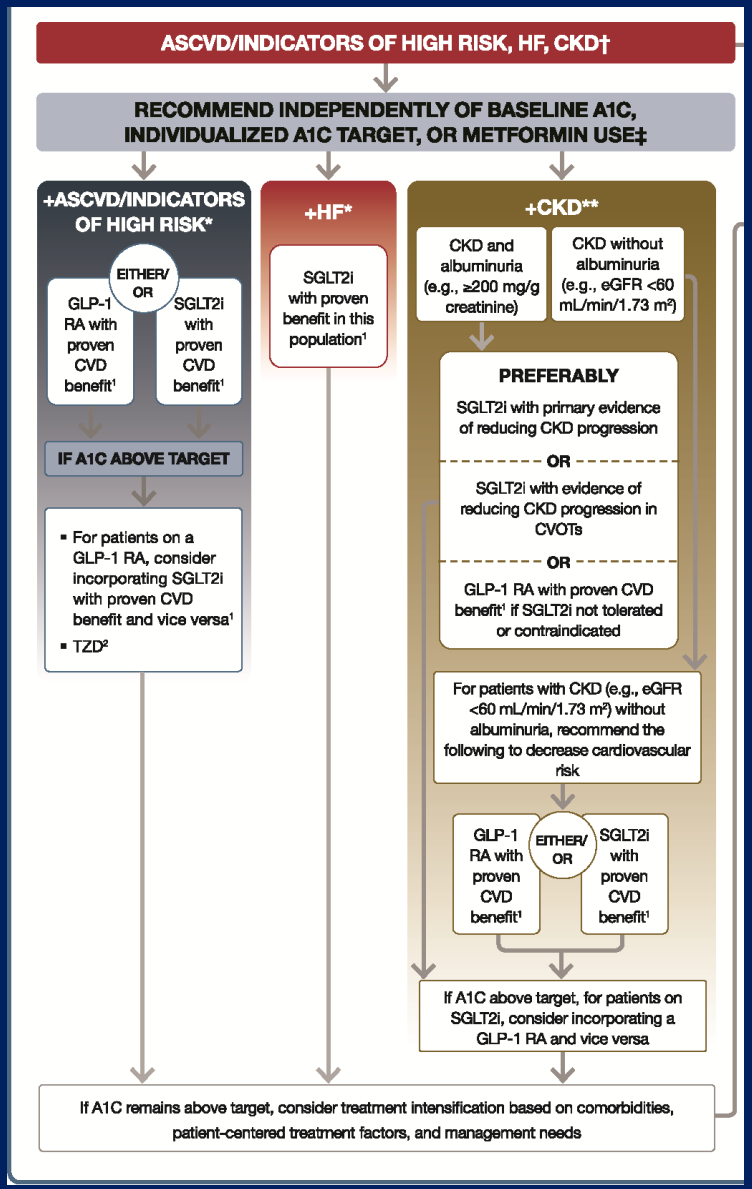
- ECG cannot be interpreted in patient with baseline abnormal ECG (LBBB, paced, digoxin effect)
- Exercise stress in patients with LBBB is *not recommended* due to the development of septal perfusion defects at rest and during exercise in the absence of obstructive disease in the left anterior descending artery on nuclear imaging and low sensitivity and specificity with echo imaging

Question 15.

- Answer: A; Begin empaglifozin

This patient has high risk for ASCVD due to history of stroke and diabetes.





Use of SGLT2 inhibitor in this population is associated with a 14% reduction in cardiovascular death.

https://diabetesjournals.org/clinical/article/40/1/10/139035/Standards-of-Medical-Care-in-Diabetes-2022

TABLE 9.2

Drug-Specific and Patient Factors to Consider When Selecting Antihyperglycemic Treatment in Adults With Type 2 Diabetes

	Efficacy	Hypoglycemia	Weight change	CV effects		Cost	Oral/SQ	Renal effects		Additional considerations
				ASCVD	HF			Progression of DKD	Dosing/use considerations*	
Metformin	High	No	Neutral (potential for modest loss)	Potential benefit	Neutral	Low	Oral	Neutral	▪ Contraindicated with eGFR <30 mL/min/1.73 m^2	▪ Gastrointestinal side effects common (diarrhea, nausea) ▪ Potential for B12 deficiency
SGLT2 inhibitors	Intermediate	No	Loss	Benefit: empagliflozin†, canagliflozin†	Benefit: empagliflozin‡, canagliflozin, dapagliflozin‡, ertugliflozin	High	Oral	Benefit: canagliflozin§, empagliflozin, dapagliflozin§	▪ See labels for renal dose considerations of individual agents ▪ Glucose-lowering effect is lower for SGLT2 inhibitors at lower eGFR	▪ Should be discontinued before any scheduled surgery to avoid potential risk for DKA ▪ DKA risk (all agents, rare in T2D) ▪ Risk of bone fractures (canagliflozin) ▪ Genitourinary infections ▪ Risk of volume depletion, hypotension ▪ ↑LDL cholesterol ▪ Risk of Fournier's gangrene
GLP-1 RAs	High	No	Loss	Benefit: dulaglutide†, liraglutide†, semaglutide (SQ)† Neutral: exenatide once weekly, lixisenatide	Neutral	High	SQ; oral (semaglutide)	Benefit on renal end points in CVOTs, driven by albuminuria outcomes: liraglutide, semaglutide (SQ), dulaglutide	▪ See labels for renal dose considerations of individual agents ▪ No dose adjustment for dulaglutide, liraglutide, semaglutide ▪ Caution when initiating or increasing dose due to potential risk of nausea, vomiting, diarrhea, or dehydration. Monitor renal function in patients reporting severe adverse GI reactions when initiating or increasing dose of therapy.	▪ **FDA Black Box:** Risk of thyroid C-cell tumors in rodents; human relevance not determined **(liraglutide, dulaglutide, exenatide extended release, semaglutide)** ▪ GI side effects common (nausea, vomiting, diarrhea) ▪ Injection site reactions ▪ Pancreatitis has been reported in clinical trials but causality has not been established. Discontinue if pancreatitis is suspected.

https://diabetesjournals.org/clinical/article/40/1/10/139035/Standards-of-Medical-Care-in-Diabetes-2022

Question 16.

- C; Hospitalize and begin ibuprofen and colchicine

TREATMENT OF ACUTE PERICARDITIS IN ADULTS

- **NSAID**
- **Colchicine**
- **Rx Underlying Condition**

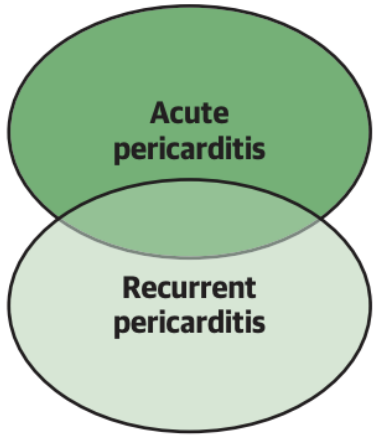
Are any of the following high-risk markers present?

- Fever >38°C (100.4°F)
- Subacute course (without acute onset of chest pain)
- Hemodynamic compromise suggesting cardiac tamponade
- Large pericardial effusion seen by echocardiography
- Immunosuppression or immunodepressed patient
- Treatment with vitamin K antagonist or novel oral anticoagulant
- Acute trauma
- Elevated troponin suggesting myopericarditis

https://www.jacc.org/doi/pdf/10.1016/j.jacc.2019.11.021

If Present Admit to Hospital

FIGURE 3 Treatment for Acute and Recurrent Pericarditis and Their Complications



DRUG	DOSE	DURATION
Aspirin	750-1,000 mg every 8 h	1-2 weeks
Ibuprofen	600-800 mg every 8 h	1-2 weeks
Colchicine	0.5-1.2 mg in one or divided doses	3 months
Aspirin	750-1,000 mg every 8 h	Weeks-months
Ibuprofen	600-800 mg every 8 h	Weeks-months
Indomethacin	25-50 mg every 8 h	Weeks-months
Colchicine	0.5-1.2 mg in one or divided doses	At least 6 months
Prednisone	0.2-0.5 mg/kg/daily	Months
Anakinra	1-2 mg/kg/daily up to 100 mg/daily	Months
Rilonacept	320 mg once, then 160 mg weekly	Months
Azathioprine	1 mg/kg/daily up to 2-3 mg/kg/daily	Months
Methotrexate	10-15 mg weekly	Months
MMF	2,000 mg daily	Months
IVIGs	400-500 mg/kg/day	5 days

Pericardiocentesis

Pericardial window

Active inflammation
- Yes → Anti-inflammatory therapy as first line, pericardiectomy for refractory cases
- No → Pericardiectomy

Different treatments, their dosing, and duration according to clinical presentation are summarized. IVIGs = intravenous immunoglobulins; MMF = mycophenolate mofetil.

Check for drug-drug interactions with colchicine!

Question 17.

- B; Implantable cardioverter-defibrillator

HOCM Workup & Therapy

Workup

- Doppler echo for gradient
- Cardiac MR
- 24-hour ambulatory ECG
- BP response to exercise*
- Alcohol ablation/surgical myotomy for mod/severe obstruction refractory to med therapy or syncope not due to arrhythmia

ICD for Primary Prevention

1. Sudden death in first-degree relative <age 50
2. Maximum LV thickness $\geq$ 30 mm
3. Recent, unexplained syncope
4. NSVT $\geq$ 3 beats
5. Abnormal blood pressure response to exercise

Trivedi A, Knight BP. ICD Therapy for Primary Prevention in Hypertrophic Cardiomyopathy. Arrhythm Electrophysiol Rev. 2016;5(3):188-196. doi: 10.15420/aer.2016:30:2. PMID: 28116084; PMCID: PMC5248664.

Question 17 *Wrong* Answers

- A; Disopyramide (1A antiarrhythmic agent) is indicated for patients with HOCM who remain symptomatic despite treatment with B-blockers or nondihydropyridine calcium channel blockers in combination with septal reduction therapy
- C; A peak LV outflow gradient (resting or provoked) of 50 mm Hg or greater is indication for septal reduction therapy in patients with refractory symptoms

Question 18.

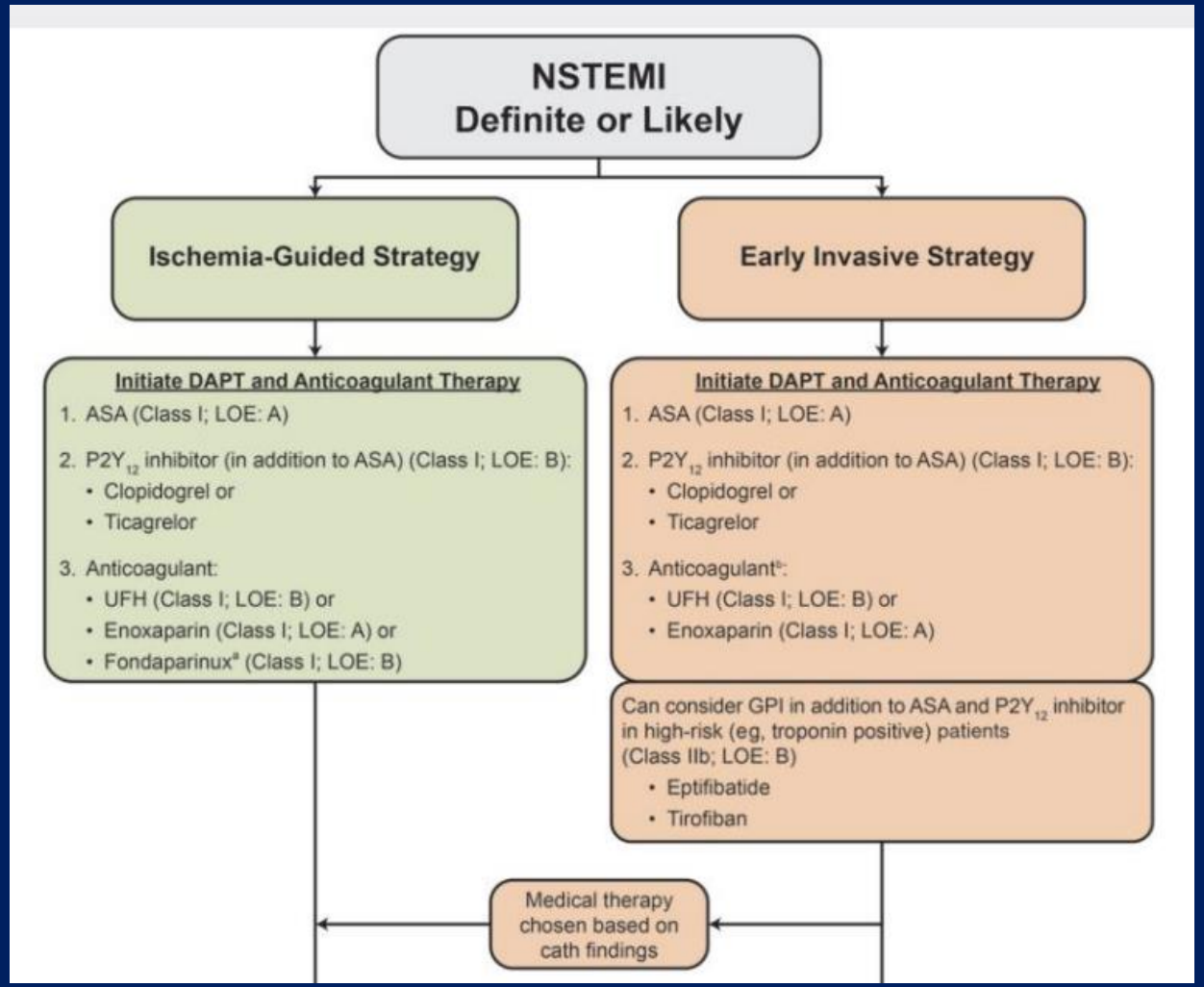
- Answer: A; Clopidogrel

NSTEMI

- TIMI score
  - Age ≥ 65
  - ≥ 3 risk factors
  - Known CAD (stenosis ≥ 50%)
  - ASA use in past 7 days
  - Severe angina (≥ 2 episodes/24h)
  - ECG ST changes ≥ 0.5 mm
  - Positive Biomarker

- Six = high risk= Early invasive strategy

(PLATO). Ticagrelor is superior to clopidogrel (9.8% vs 11.7%) with slight increased risk of bleeding. (11.2% vs 11.6%). ***Ticagrelor can cause dyspnea and bradycard***ia.



Clinical Cardiology, Volume: 43, Issue: 3, Pages: 242-250, First published: 10 January 2020, DOI: (10.1002/clc.23308)

Question 18 *Wrong* Answers

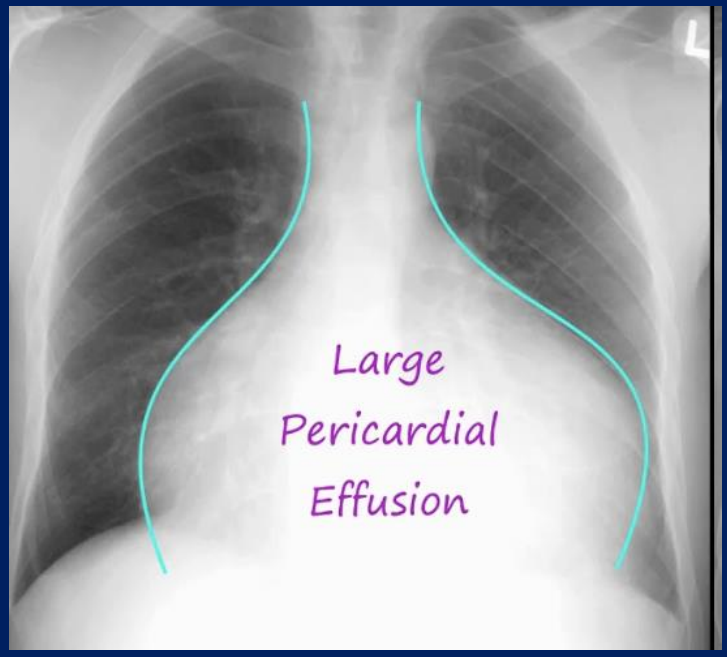
- B; Prasugrel is given to patients after they have a stent placed. It is contraindicated in patients over age 75, with history of stroke or TIA, and < 60 kg.
- C; Thrombolytic agents are not given to patients with NSTEMI
- D; GIIb/IIIa inhibitors are potent antiplatelet agents that are NOT given prior to coronary angiography and intervention

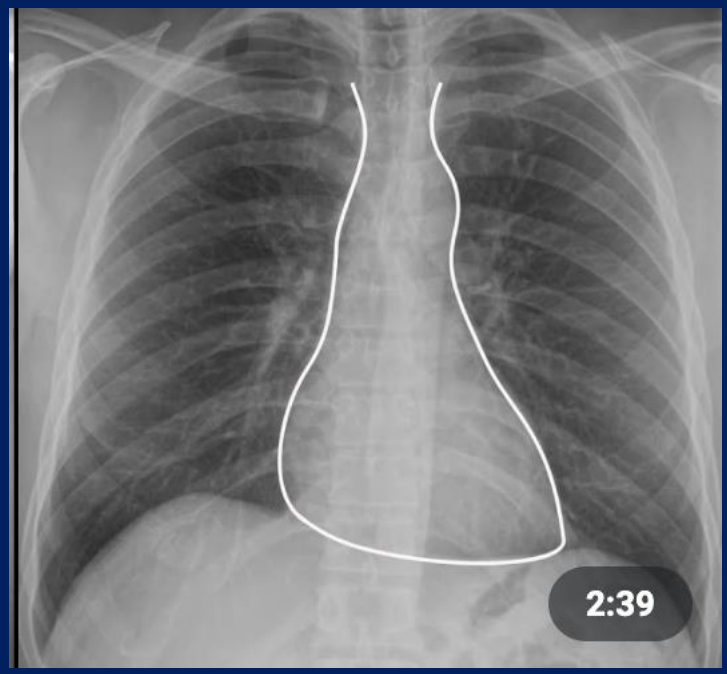
Question 19.

- Answer: E; Transthoracic echocardiogram

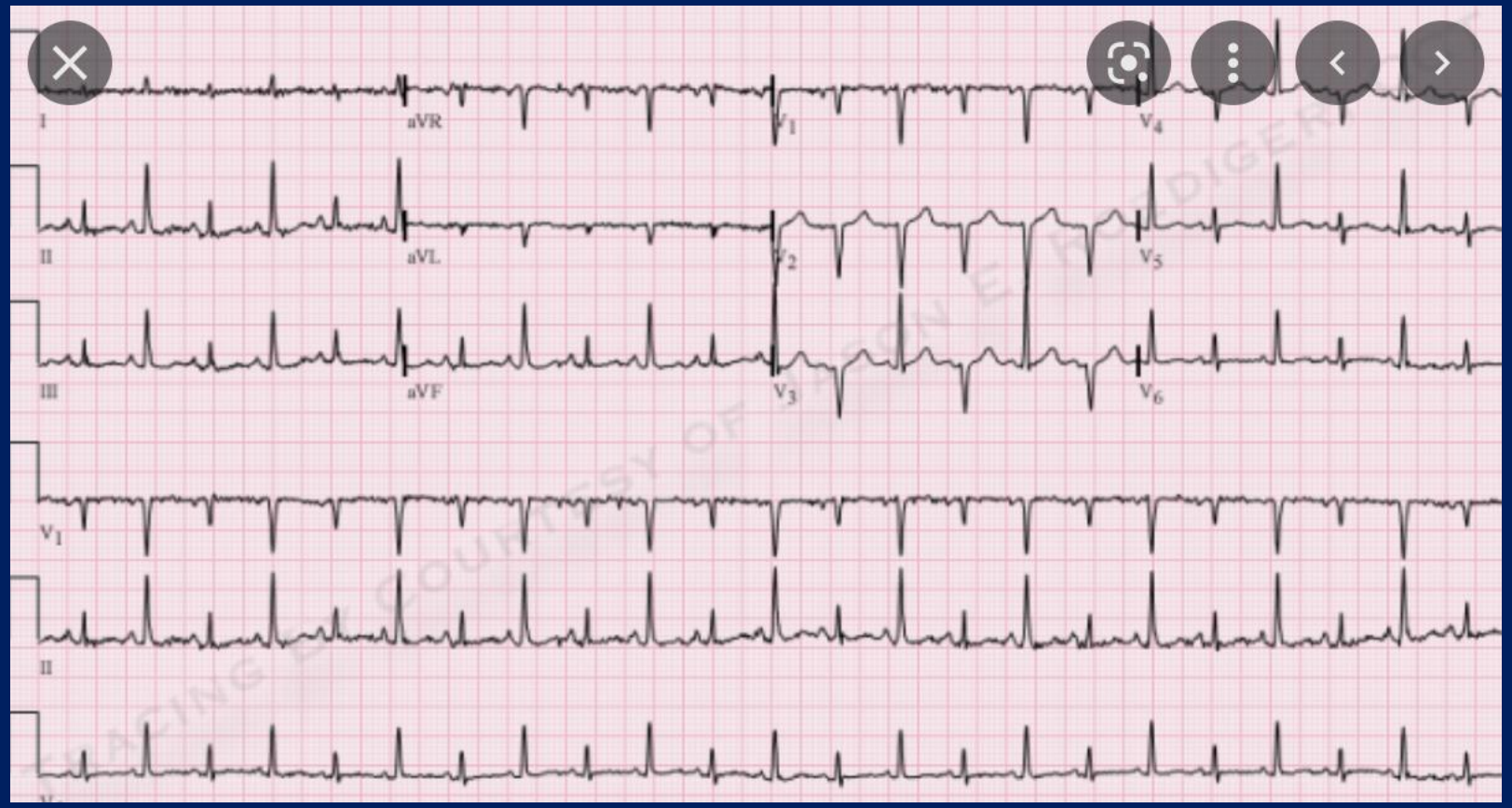
Cardiac Tamponade

- Describe the physiology
- How do you perform a pulsus paradoxus?
- Is there any other test that could help you diagnose tamponade prior to the echocardiogram?
  - ECG
    - Low voltage
    - Pulsus paradoxus





Cardiac Tamponade: Electrical Alternans



Pulse oximetry plethysmography

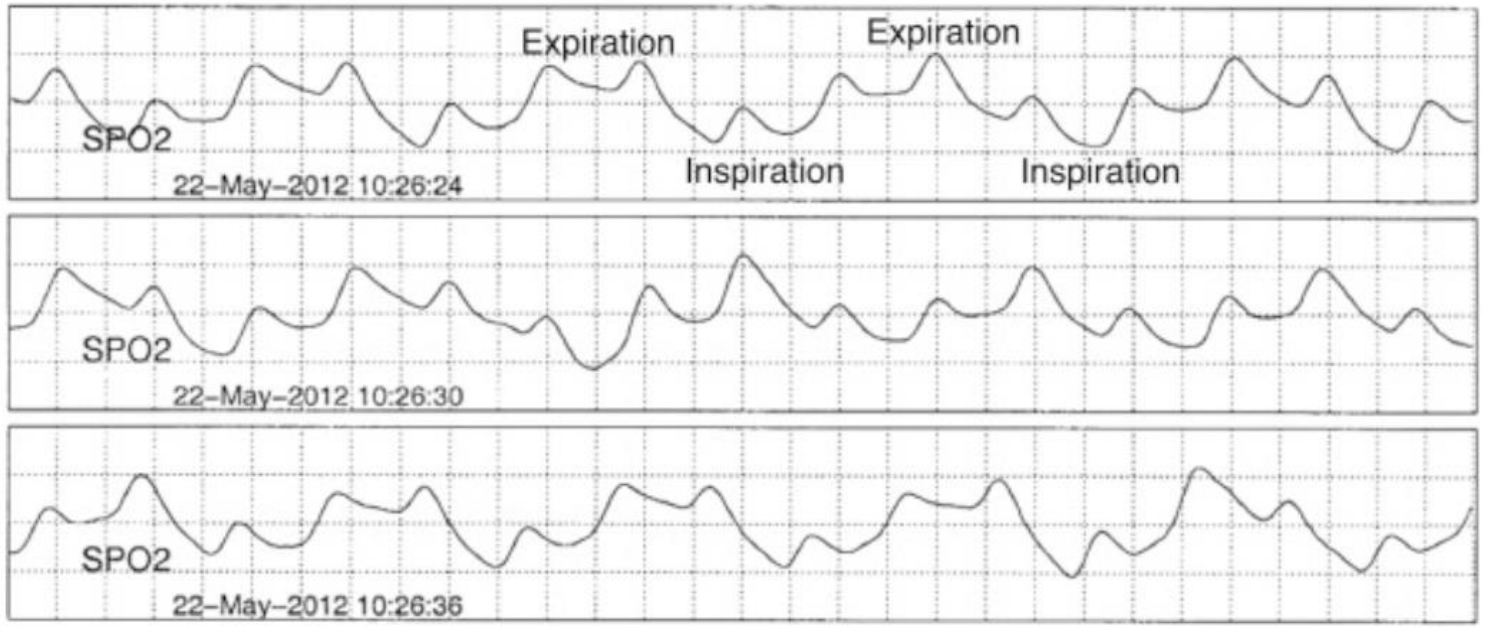


Figure 1 Pulse oximetry waveform prior to pericardiocentesis demonstrates significant phasic respiratory variation in plethysmography amplitude with inspiration and expiration suggestive of cardiac tamponade.

https://www.jpeds.com/action/showPdf?pii=S00223476%2815%2901333-5

Question 20.

- Answer: B, Nonanginal chest pain

Pre-Test Probability of Chest Pain being due to a Cardiac Cause

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE ARCHIVE

Analysis of Probability as an Aid in the Clinical Diagnosis of Coronary-Artery Disease

George A. Diamond, M.D., and James S. Forrester, M.D.

June 14, 1979
N Engl J Med 1979; 300:1350-1358
DOI: 10.1056/NEJM197906143002402

Chest Pain Evaluation: Pre-Test Probability

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