An Introduction to Heart Failure

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Disclosures

- Paid advisory board member for Pfizer
- Paid advisory board member and speaker for Alnylam
- Paid advisory board and speaker for AstraZeneca
- Paid speaker for BridgeBio

Agenda

- What is heart failure
- What are the signs and symptoms
- What are the types of heart failure
- Diagnostic tools
- Treatment Modalities
- Advanced heart failure and when to refer

What is Heart Failure?

- Most basic terms: the heart is not pumping blood like it should

What is Heart Failure?

- Causes:
  - Ischemia
  - Chemotherapy and other cardiotoxic medications
  - Rheumatologic or autoimmune conditions
  - Endocrine/metabolic (thyroid, pheo, DM, obesity, acromegaly)
  - Familial/inherited/genetic heart disease
  - Arrhythmia
  - Hypertension
  - Infiltrative (amyloid, sarcoid, hemochromatosis)
  - Myocarditis (infectious, toxin, or medication, immunologic, hypersensitivity
  - Peripartum
  - Stress cardiomyopathy (Takotsubo)
  - Illicit substance use (alcohol, cocaine, methamphetamine)

Signs and Symptoms of Heart Failure

- Decreased exercise capacity/easy fatiguability
- Edema
- Abdominal bloating and/or lack of appetite
- Orthopnea
- PND
- Tachycardia and hypotension

Types of Heart Failure: terms

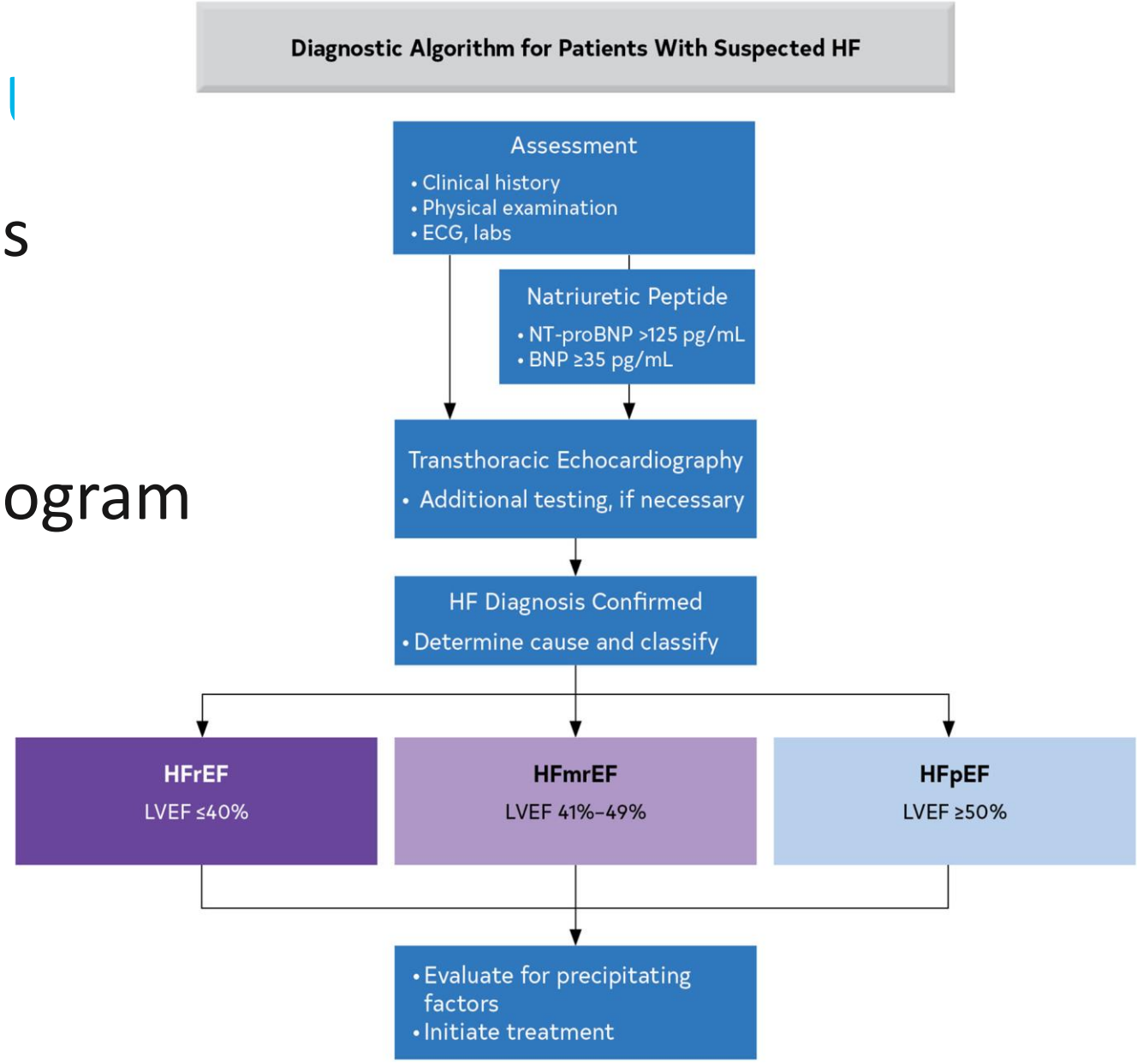
- Systolic/reduced ejection fraction
- Midrange ejection fraction
- Diastolic/preserved ejection fraction
- Restrictive cardiomyopathy

Types of Heart Failure

Type	Finding
HFrEF	LVEF ≤ 40%
HFmrEF	LVEF 41-49%
HFpEF	LVEF ≥ 50% but evidence of increased LV filling pressures

Types of Heart Fail

- Initial diagnostic modalities
  - EKG
  - Lab testing
  - Transthoracic echocardiogram



Types of Heart Failure

- Additional initial testing

COR	LOE	Recommendations
1	B-NR	1. For patients presenting with HF, the specific cause of HF should be explored using additional laboratory testing for appropriate management.[1–8]
1	C-EO	2. For patients who are diagnosed with HF, laboratory evaluation should include complete blood count, urinalysis, serum electrolytes, blood urea nitrogen, serum creatinine, glucose, lipid profile, liver function tests, iron studies, and thyroid-stimulating hormone to optimize management.
1	C-EO	3. For all patients presenting with HF, a 12-lead ECG should be performed at the initial encounter to optimize management.

Reduced/midrange Heart Failure

Reduced/midrange Heart Failure

Type	Finding
HFrEF	LVEF ≤ 40%
HFmrEF	LVEF 41-49%

Reduced/midrange Heart Failure

- Causes: ischemic vs. nonischemic

Reduced/midrange Heart Failure

- Ischemic evaluation
  - Noninvasive
    - Stress testing
    - Coronary CTA
  - Invasive
    - Left heart catheterization and diagnostic angiography

Reduced/midrange Heart Failure

- Additional testing
  - CMR
  - Cardiac monitor
  - Other specific testing
  - Genetic testing

Reduced/midrange Heart Failure

- Treatment

Reduced/midrange Heart Failure

- Treatment
  - NYHA class
  - AHA class

Reduced/midrange Heart Failure

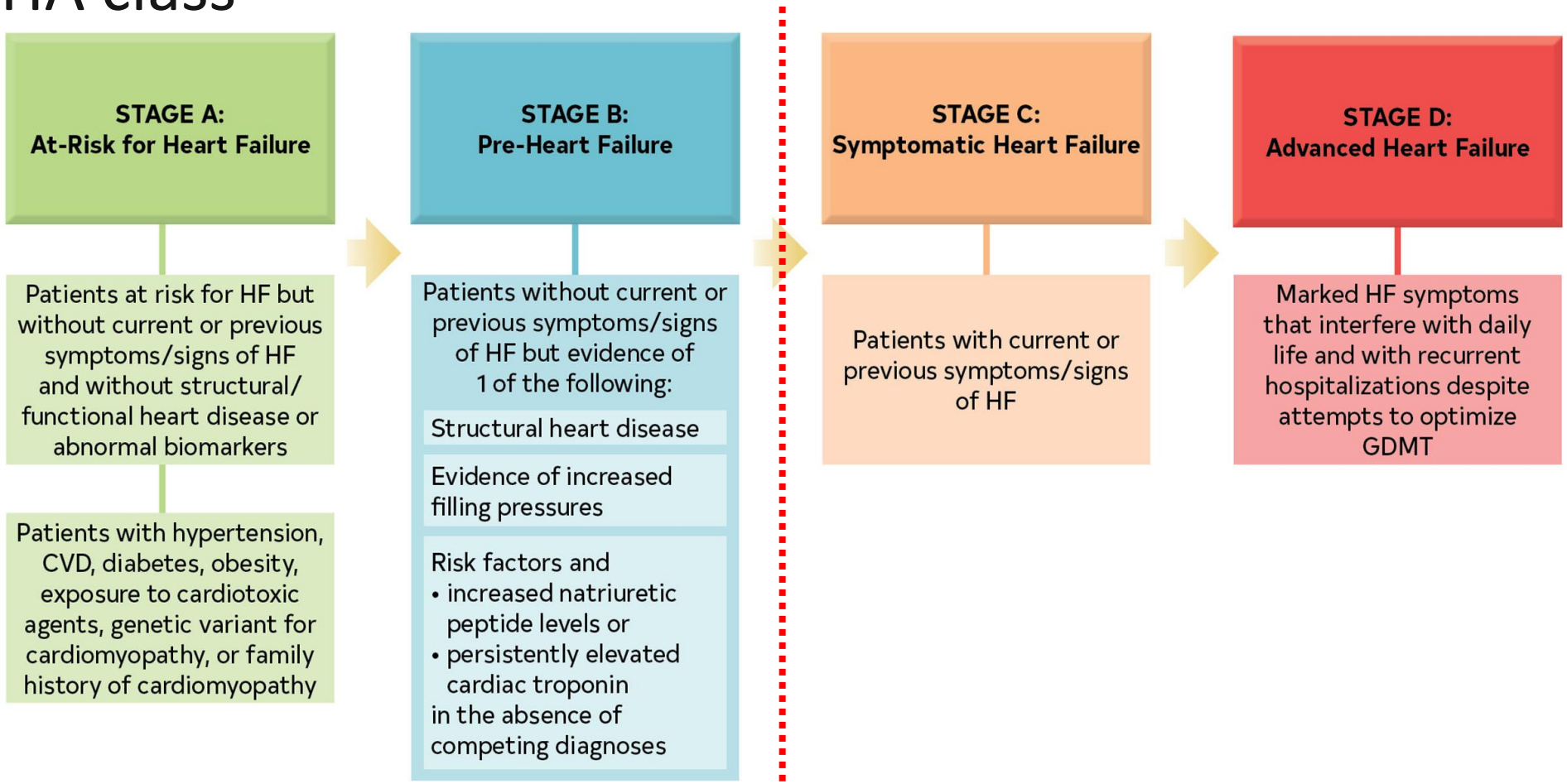
- NYHA class
  - I: no limitations in active
  - II: dyspnea with ordinary activity
  - III: dyspnea with less than ordinary activity
  - IV: dyspnea at rest

Reduced/midrange Heart Failure

- AHA class
  - A
  - B
  - C
  - D

Reduced/midrange Heart Failure

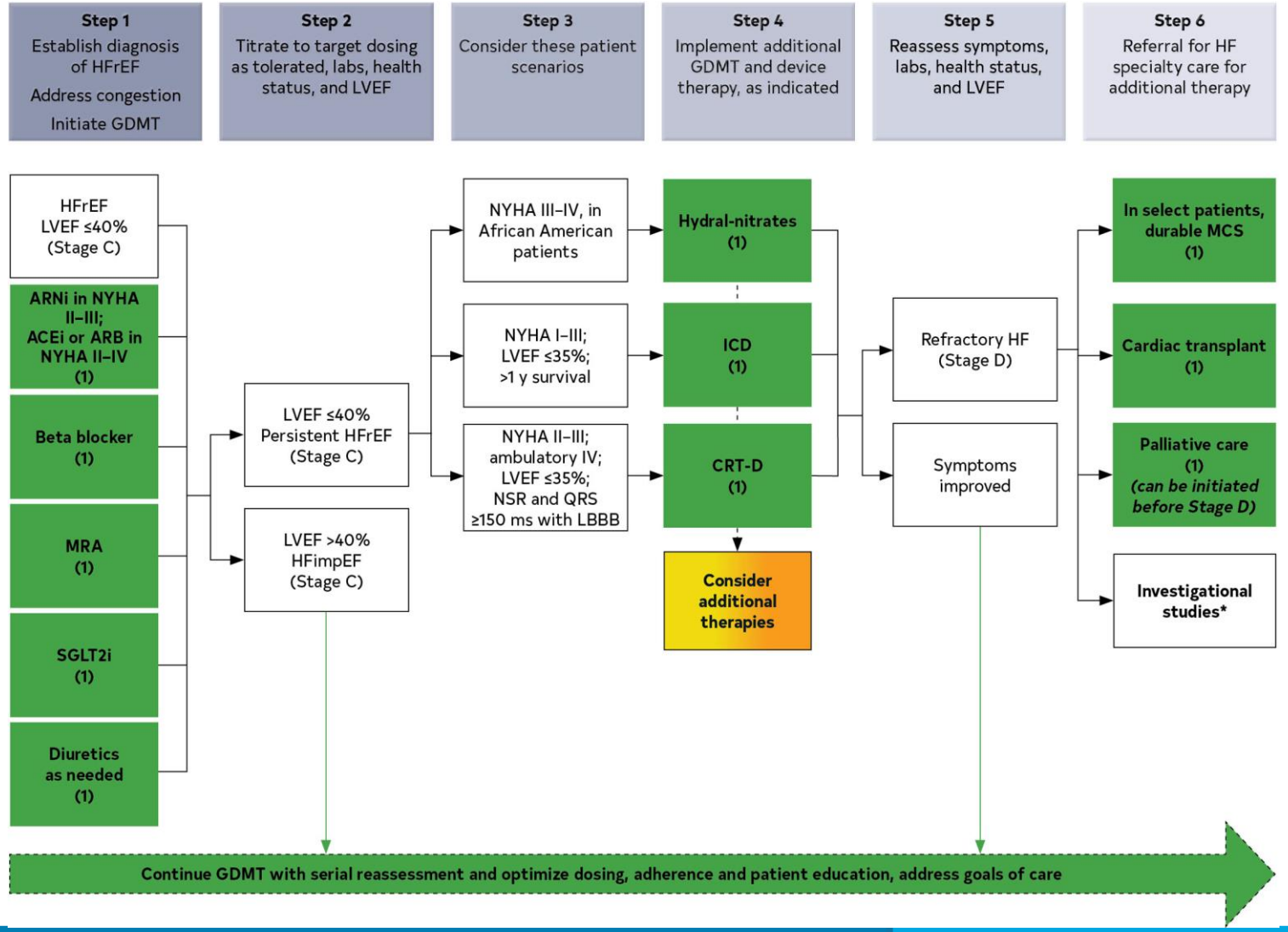
- AHA class



Reduced Heart Failure

- Treatment

Reduced Heart Failure



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Reduced Heart Failure

- Medications
  - Goal directed medical therapy: mortality benefit
    - 1st tier: Beta blockers, RAAS blockade, mineralocorticoid antagonists, SGLT2 inhibitors
    - 2nd tier: Hydralazine and nitrate combination
  - Supportive care: symptom management without mortality benefit

Reduced Heart Failure

- Beta blockade
  - Selective: Bisoprolol, Toprol XL
  - Nonselective: Coreg
  - Indicated for AHA B or greater
  - Target HR goal 70-80 BPM
  - Coreg preferred over others in DM
  - Depression: possibly avoid Coreg

COR	LOE	Recommendation
1	A	1. In patients with HFrEF, with current or previous symptoms, use of 1 of the 3 beta blockers proven to reduce mortality (eg, bisoprolol, carvedilol, sustained-release metoprolol succinate) is recommended to reduce mortality and hospitalizations.[1–3]
Value Statement: High Value (A)		2. In patients with HFrEF, with current or previous symptoms, beta-blocker therapy provides high economic value.[4–8]

Reduced Heart Failure

- RAAS blockade
  - ACEi, ARBs, ARNIs
  - Indicated for AHA B or greater
  - Avoid if eGFR ≤30 mL/min/1.73 m^2

COR	LOE	Recommendations
1	A	1. In patients with HFrEF and NYHA class II to III symptoms, the use of ARNi is recommended to reduce morbidity and mortality.[1–5]
1	A	2. In patients with previous or current symptoms of chronic HFrEF, the use of ACEi is beneficial to reduce morbidity and mortality when the use of ARNi is not feasible.[6–13]
1	A	3. In patients with previous or current symptoms of chronic HFrEF who are intolerant to ACEi because of cough or angioedema and when the use of ARNi is not feasible, the use of ARB is recommended to reduce morbidity and mortality.[14–18]
Value Statement: High Value (A)		4. In patients with previous or current symptoms of chronic HFrEF, in whom ARNi is not feasible, treatment with an ACEi or ARB provides high economic value.[19–25]

Reduced Heart Failure

- RAAS blockade
  - ARNI: PARADIGM-HF significantly reduced the composite endpoint of cardiovascular death or HF hospitalization by 20% relative to enalapril.

1	B-R	5. In patients with chronic symptomatic HFrEF NYHA class II or III who tolerate an ACEi or ARB, replacement by an ARNi is recommended to further reduce morbidity and mortality.[1–5]
Value Statement: High Value (A)		6. In patients with chronic symptomatic HFrEF, treatment with an ARNi instead of an ACEi provides high economic value.[26–29]

Reduced Heart Failure

- RAAS blockade
  - Converting ACEi to ARNI
  - History of angioedema
  - Wary if ≥30% acute increase in serum creatinine
  - Hyperkalemia ≥ 5.6 mEq/L

3: Harm	B-R	7. ARNi should not be administered concomitantly with ACEi or within 36 hours of the last dose of an ACEi.[30,31]
3: Harm	C-LD	8. ARNi should not be administered to patients with any history of angioedema.[32–35]
3: Harm	C-LD	9. ACEi should not be administered to patients with any history of angioedema.[36–39]

Reduced Heart Failure

- Mineralocorticoid antagonists
  - Spironolactone and Eplerenone
  - Indication for AHA C NYHA II-IV
  - Close monitoring if renal dysfunction or hyperkalemia.
  - Avoid if eGFR ≤30 mL/min/1.73 m^2 or serum potassium ≥5.0 mEq/L
  - Stop if potassium > 5.5 mEq/L

COR	LOE	Recommendations
1	A	1. In patients with HFrEF and NYHA class II to 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.[1–3]
Value Statement: High Value (A)		2. In patients with HFrEF and NYHA class II to IV symptoms, MRA therapy provides high economic value.[4–7]
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.[8,9]

Reduced Heart Failure

- SGLT2 inhibitors
  - Dapagliflozin, Empagliflozin, ~~Canagliflozin~~
  - Avoid if eGFR ≤30 mL/min/1.73 m^2
    - 20? 15? mL/min/1.73

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.[1,2]
Value Statement: Intermediate Value (A)		2. In patients with symptomatic chronic HFrEF, SGLT2i therapy provides intermediate economic value.[3,4]

Reduced Heart Failure

- Hydralazine and nitrate
- Indication
  - AHA C NYHA III-IV in addition to optimal GDMT
    - Primary benefit is in African-Americans
  - Intolerant of RAAS blockade

COR	LOE	Recommendations
1	A	1. For patients self-identified as African American with NYHA class III-IV HFrEF who are receiving optimal medical therapy, the combination of hydralazine and isosorbide dinitrate is recommended to improve symptoms and reduce morbidity and mortality.[1,2]
Value Statement: High Value (B-NR)		2. For patients self-identified as African American with NYHA class III to IV HFrEF who are receiving optimal medical therapy with ACEi or ARB, beta blockers, and MRA, the combination of hydralazine and isosorbide dinitrate provides high economic value.[3]
2b	C-LD	3. In patients with current or previous symptomatic HFrEF who cannot be given first-line agents, such as ARNi, ACEi, or ARB, because of drug intolerance or renal insufficiency, a combination of hydralazine and isosorbide dinitrate might be considered to reduce morbidity and mortality.[4,5]

Reduced Heart Failure

- Why treat?

Reduced Heart Failure

- Why treat?

Evidence-Based Therapy	Relative Risk Reduction in All-Cause Mortality, %	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

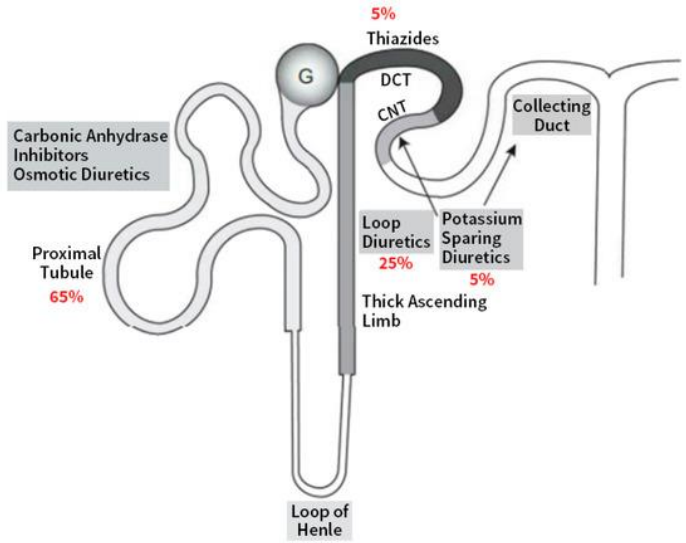
Reduced Heart Failure

- Other supportive care:
  - Diuretics
  - Ivabradine
  - Vericiguat
  - Digoxin

Reduced Heart Failure

- Diuretics
  - Loop diuretics: Lasix, Bumex, Torsemide
  - Thiazide diuretics: Metolazone, Chlorothiazide, HCTZ, Chlorthalidone
  - Daily weights in the AM. If the weight increases by more than 3 lbs from baseline dry weight, take an extra dose of diuretic.

COR	LOE	Recommendations
1	B-NR	1. In patients with HF who have fluid retention, diuretics are recommended to relieve congestion, improve symptoms, and prevent worsening HF.[1–5]
1	B-NR	2. For patients with HF and congestive symptoms, addition of a thiazide (eg, metolazone) to treatment with a loop diuretic should be reserved for patients who do not respond to moderate- or high-dose loop diuretics to minimize electrolyte abnormalities.[6]



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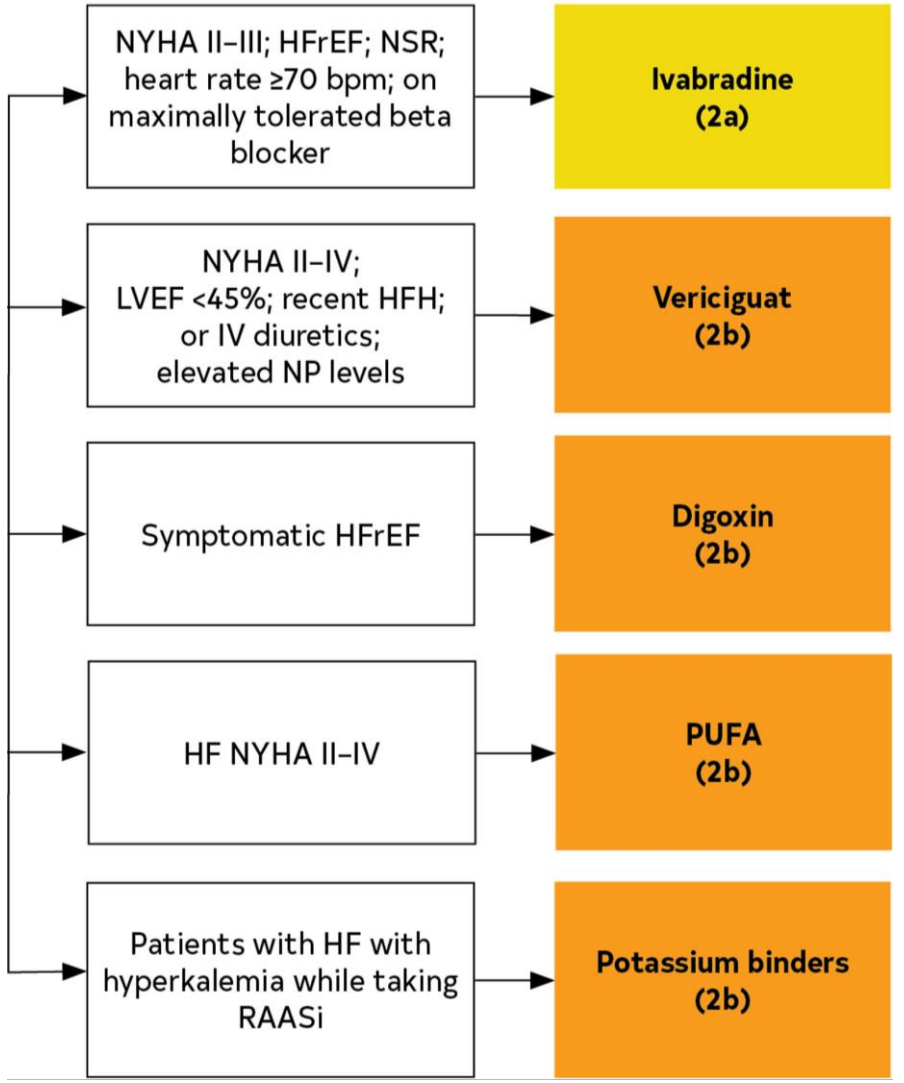
Reduced Heart Failure

Drug	Initial Daily Dose	Max. Daily Dose	Duration of Action
Loop diuretics			
Bumetanide	0.5–1.0 mg 1-2x/d	10 mg	4–6 h
Furosemide	20–40 mg 1-2x/d	600 mg	6–8 h
Torsemide	10–20 mg 1x/d	200 mg	12–16 h
Thiazide diuretics			
Chlorthiazide	250–500 mg 1-2x/d	1000 mg	6–12 h
Chlorthalidone	12.5–25 mg 1x/d	100 mg	24–72 h
Hydrochlorothiazide	25 mg 1-2x/d	200 mg	6–12 h
Indapamide	2.5 mg once	5 mg	36 h
Metolazone	2.5 mg once	20 mg	12–24 h

Reduced Heart Failure

- Other supportive care:
  - Ivabradine
  - Vericiguat
  - Digoxin



Reduced Heart Failure

- Other supportive care:
  - Ivabradine
    - Indication AHA C NYHA II-III LVEF <35% in sinus rhythm with a HR 70+ BPM

COR	LOE	Recommendation
2a	B-R	1. For patients with symptomatic (NYHA class II to III) stable chronic HFrEF (LVEF ≤35%) who are receiving GDMT, including a beta blocker at maximum tolerated dose, and who are in sinus rhythm with a heart rate of ≥70 bpm at rest, ivabradine can be beneficial to reduce HF hospitalizations and cardiovascular death.[1,2]

Reduced Heart Failure

- Other supportive care:
  - Vericiguat
    - Indication LVEF <45% and recent exacerbation

COR	LOE	Recommendation
2b	B-R	1. In selected high-risk patients with HFrEF and recent worsening of HF already on GDMT, an oral soluble guanylate cyclase stimulator (vericiguat) may be considered to reduce HF hospitalization and cardiovascular death.[1]

Reduced Heart Failure

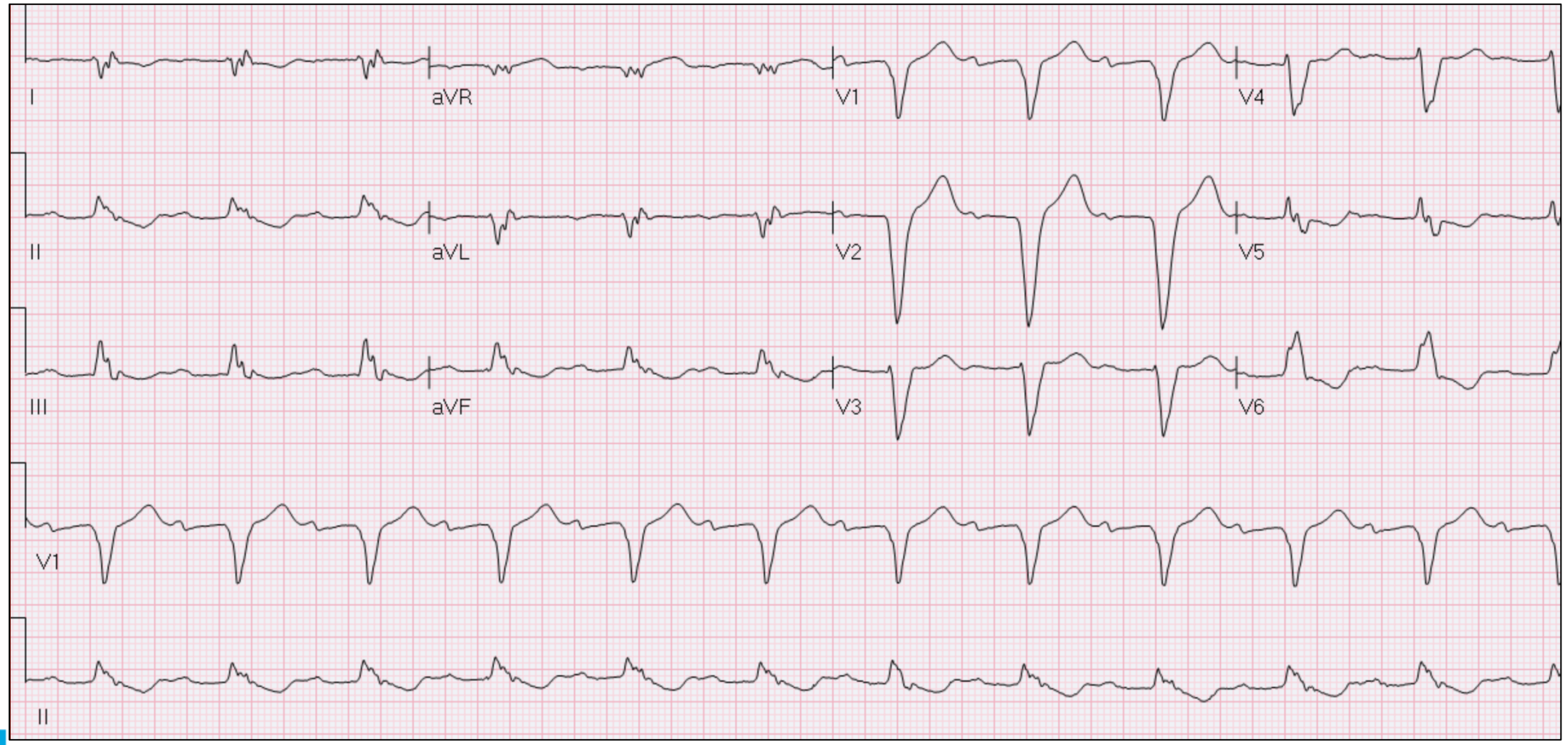
- Other supportive care:
  - Digoxin

COR	LOE	Recommendation
2b	B-R	1. In patients with symptomatic HFrEF despite GDMT (or who are unable to tolerate GDMT), digoxin might be considered to decrease hospitalizations for HF.[1,2]

Reduced Heart Failure

- Other treatment modalities

Reduced Heart Failure



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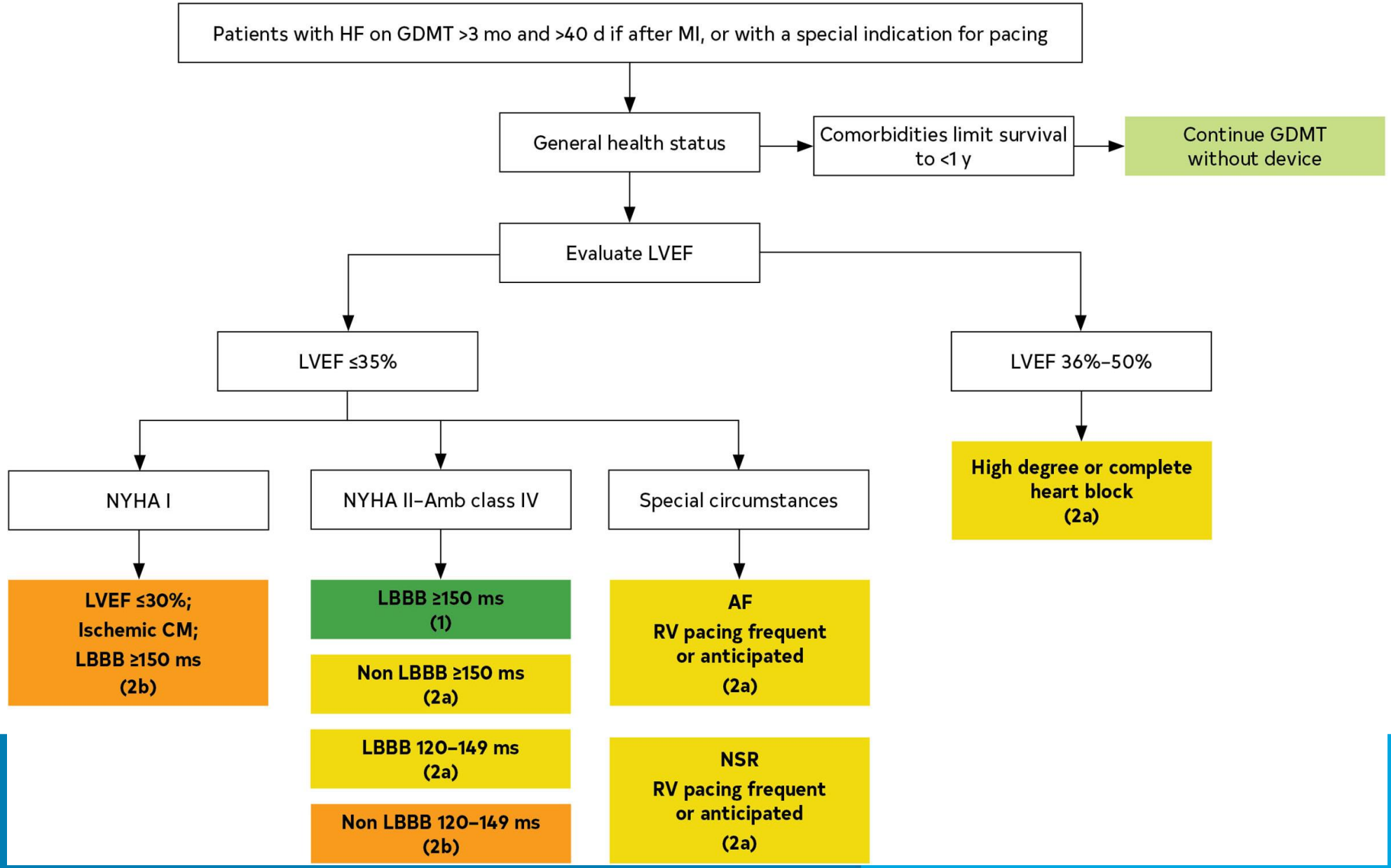
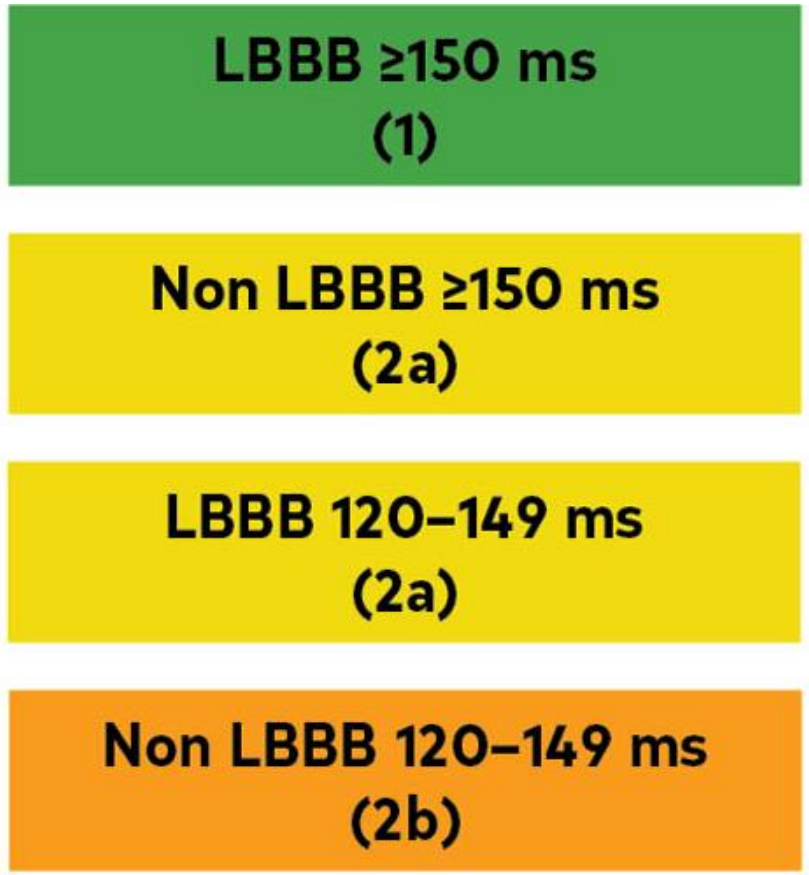
Reduced Heart Failure



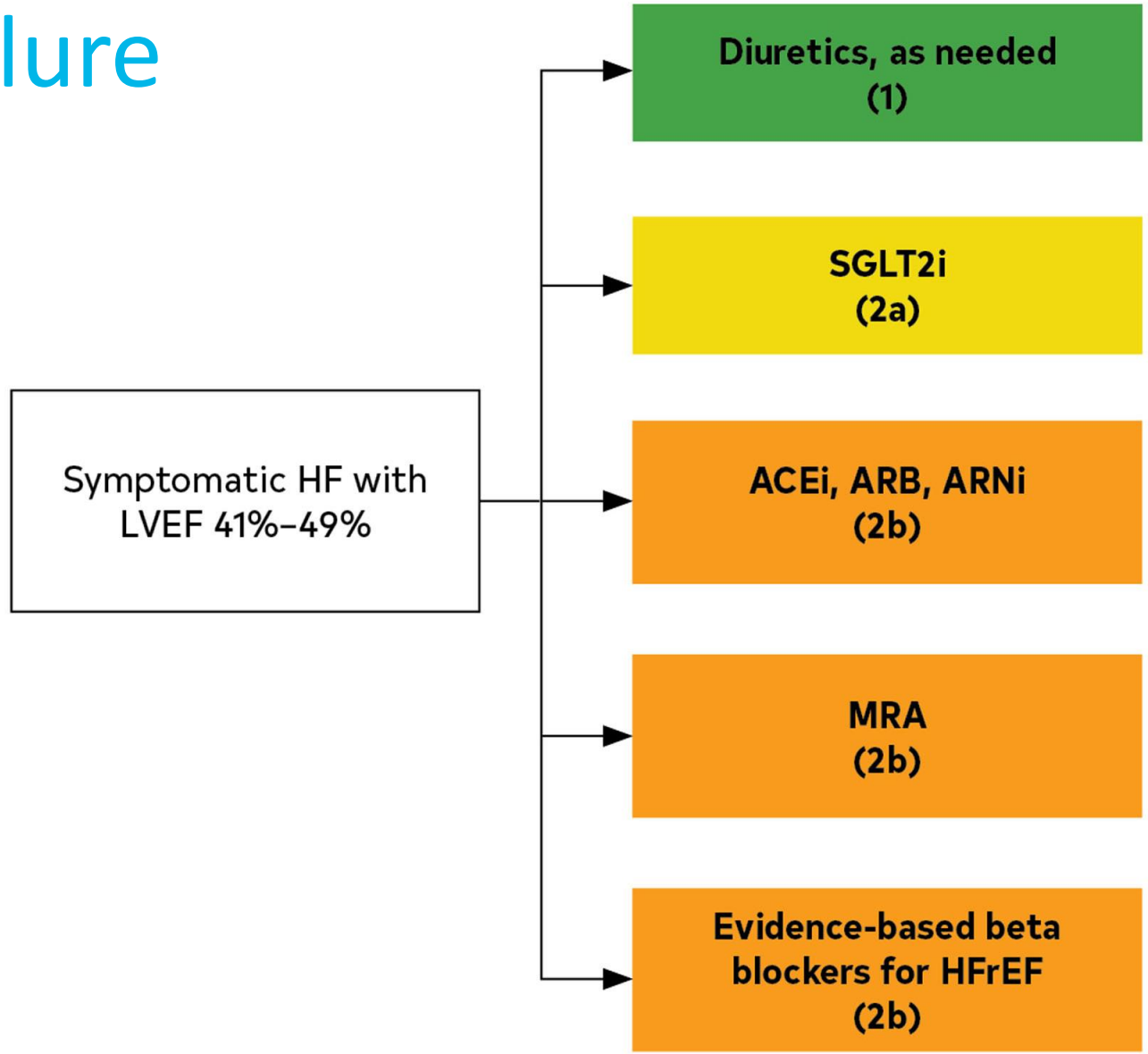
Reduced Heart Failure

- CRT
  - **LBBB**
    - **(1) 150 ms**
    - (2a) 120-149 ms
  - Non-LBBB
    - (2a) 150 ms
    - (2b) 120-149 ms



Midrange Heart Failure

- Diuretic as needed
- SGLT2i (2a)
  - RAAS (2b)
  - MRA (2b)
  - Beta blocker (2b)



Other Considerations

- Iron deficiency anemia
  - IV repletion of iron showed:
    - Improved NYHA class, 6MWT, QOL (FAIR HF trial)
    - Reduce hospitalizations (AFFIRM trial)

Other Considerations

- OSA
  - Avoid adaptive servo-ventilation: this can worsen heart failure

Improved Heart Failure

"I feel so good now, do I really need all these medicines?"

Rx List
Toprol XL 200 mg PO daily
Entresto 49-51 mg PO BID
Farxiga 10 mg PO daily
Eplerenone 25 mg PO daily

Improved Heart Failure

"I feel so good now, do I really need all these medicines?"

a. Toprol XL
b. Entresto
c. Farxiga
d. Eplerenone
e. None

Rx List
Toprol XL 200 mg PO daily
Entresto 49-51 mg PO BID
Farxiga 10 mg PO daily
Eplerenone 25 mg PO daily

Improved Heart Failure

"I feel so good now, do I really need all these medicines?"

a. Toprol XL

Rx List
Toprol XL 200 mg PO daily

COR	LOE	Recommendation
1	B-R	1. In patients with HFimpEF after treatment, GDMT should be continued to prevent relapse of HF and LV dysfunction, even in patients who may become asymptomatic.[1]

Improved Heart Failure

- Always treat these patients like HFrEF even if LVEF normalizes
  - Avoid nondihydropyridine calcium channel blockers

Preserved Heart Failure

Preserved Heart Failure

- Causes
  - Hypertensive heart disease
  - Metabolic disorders
  - Valvular heart disease
  - Constriction or restriction
  - Infiltrative cardiomyopathies: amyloidosis, hemochromatosis
  - Hypertrophic cardiomyopathy

Preserved Heart Failure

- H_2FPEF Score

Prior to completion, confirm patient has exertional dyspnea and LVEF > 40%.

Enter the points in the fields to the right for all conditions that apply to the patient.

H_2	Heavy	Body mass index > 30 kg/m²	+2	
	Hypertensive	On > 2 anti-hypertensives	+1	
F	Atrial Fibrillation	Paroxysmal or Persistent AF	+3	
P	Pulmonary Hypertension	RVSP > 35 mmHg	+1	
E	Elder	Age > 60 years	+1	
F	Filling Pressure	E/e' > 9	+1	
		Score (Sum of above numbers)		

Consider sending high probability HFpEF patients for further evaluation

A score of	3	4	5	6+
Indicates a HFpEF probability of	>50%	>70%	>80%	>90%

Preserved Heart Failure

- Additional testing
  - Labs
  - Stress echo
  - CPET
  - CMR
  - Nuclear scintigraphy scan (PYP scan)
  - Genetic testing

Preserved Heart Failure

- Additional testing
  - Labs
    - NT proBNP <450 pg/ml or BNP <150 pg/ml is diagnostic

Preserved Heart Failure

- Additional testing
  - Stress echo and CPET
    - Shows dynamic changes in diastolic function

Preserved Heart Failure

- Additional testing
  - CMR: useful for looking for underlying pathophysiology such as infiltrative processes, constriction, previous infarcts or ischemic events.
    - If hemochromatosis is suspect must order with T2 star mapping.

Preserved Heart Failure

- Additional testing
  - Nuclear scintigraphy scan (PYP scan): used to diagnose ATTR-CM
  - May need a tissue sample

Preserved Heart Failure

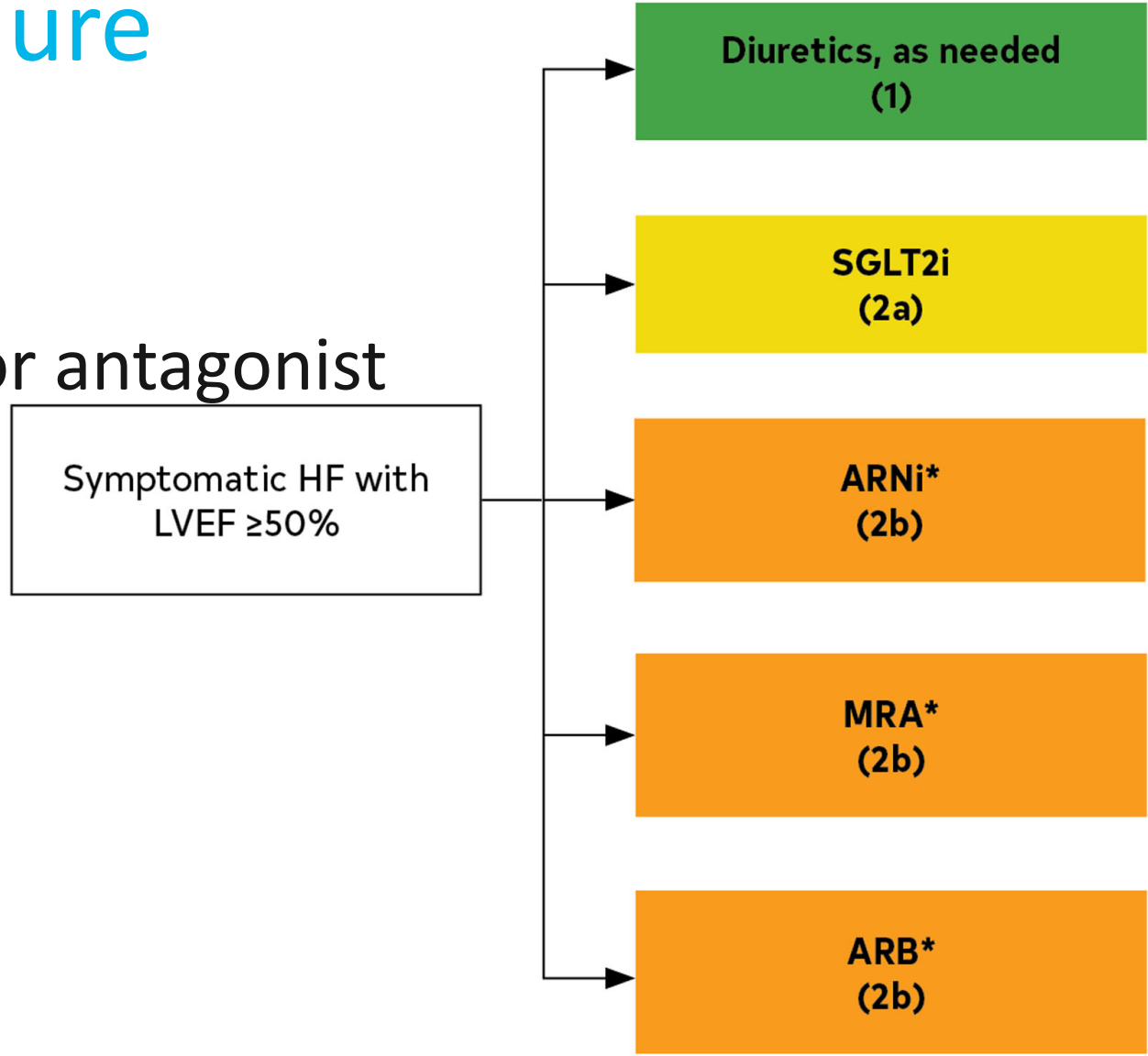
- Medications

Preserved Heart Failure

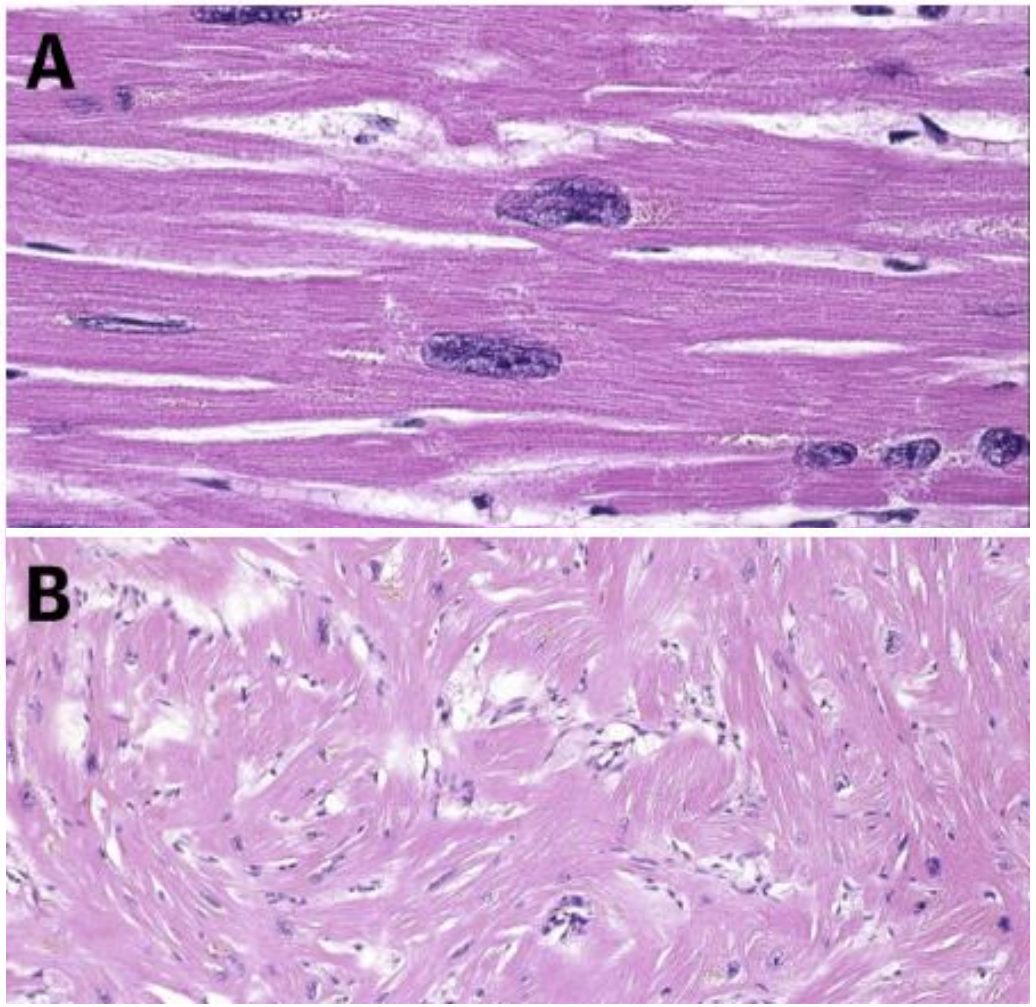
COR	LOE	Recommendations
1	C-LD	1. Patients with HFpEF and hypertension should have medication titrated to attain blood pressure targets in accordance with published clinical practice guidelines to prevent morbidity.[1–3]
2a	B-R	2. In patients with HFpEF, SGLT2i can be beneficial in decreasing HF hospitalizations and cardiovascular mortality.[4]
2a	C-EO	3. In patients with HFpEF, management of AF can be useful to improve symptoms.
2b	B-R	4. In selected patients with HFpEF, MRAs may be considered to decrease hospitalizations, particularly among patients with LVEF on the lower end of this spectrum.[5–7]
2b	B-R	5. In selected patients with HFpEF, the use of ARB may be considered to decrease hospitalizations, particularly among patients with LVEF on the lower end of this spectrum.[8,9]
2b	B-R	6. In selected patients with HFpEF, ARNi may be considered to decrease hospitalizations, particularly among patients with LVEF on the lower end of this spectrum.[10,11]
3: No-Benefit	B-R	7. In patients with HFpEF, routine use of nitrates or phosphodiesterase-5 inhibitors to increase activity or QOL is ineffective.[12,13]

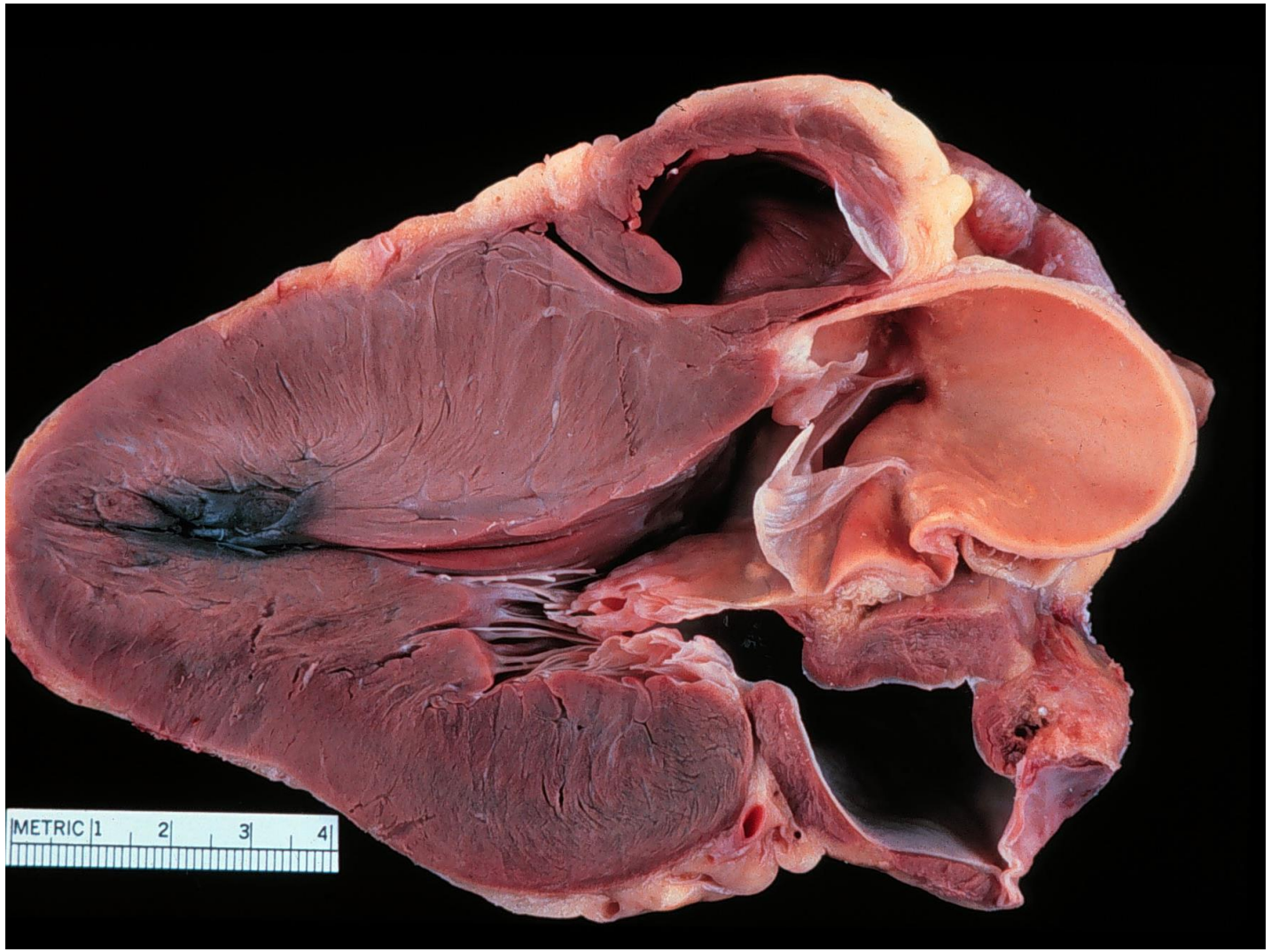
Preserved Heart Failure

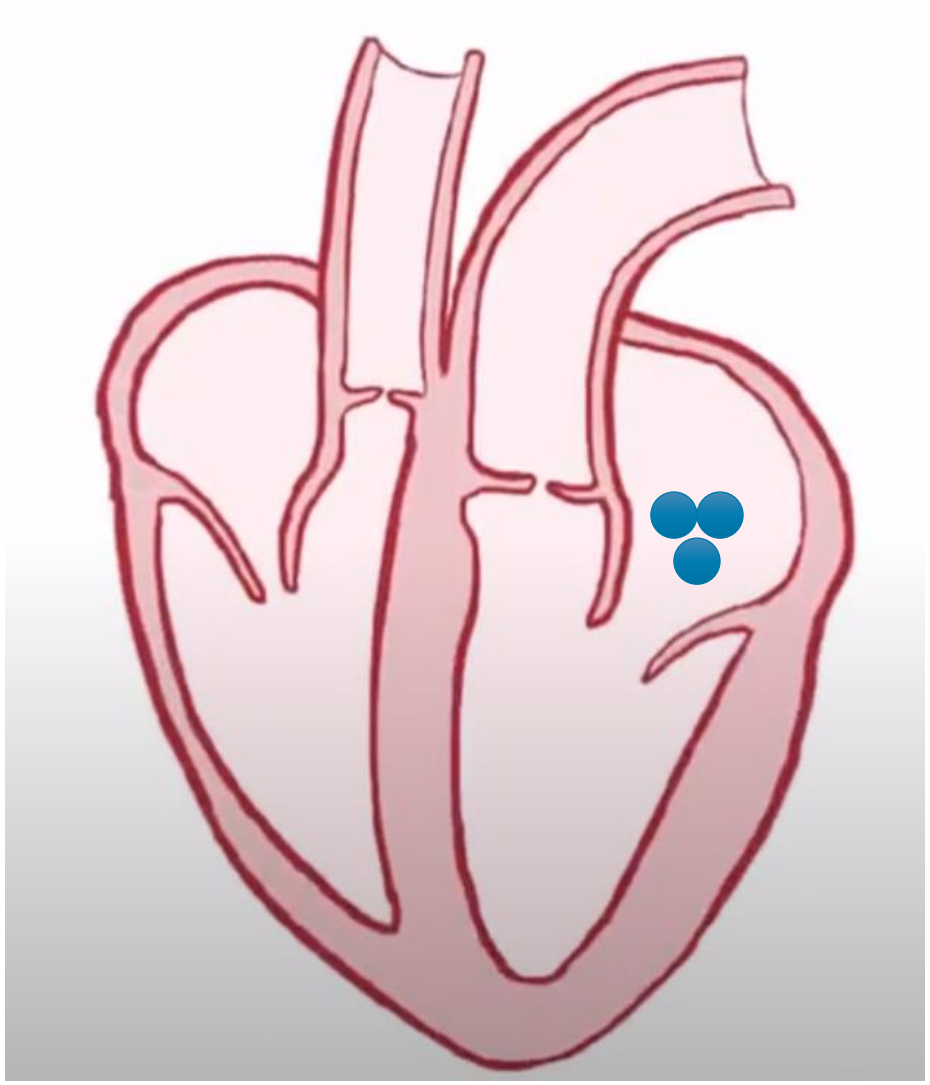
- Medications
  - SGLT2 inhibitors
  - Mineralocorticoid receptor antagonist
  - RAAS blockade: Entresto?
  - Beta blockade?

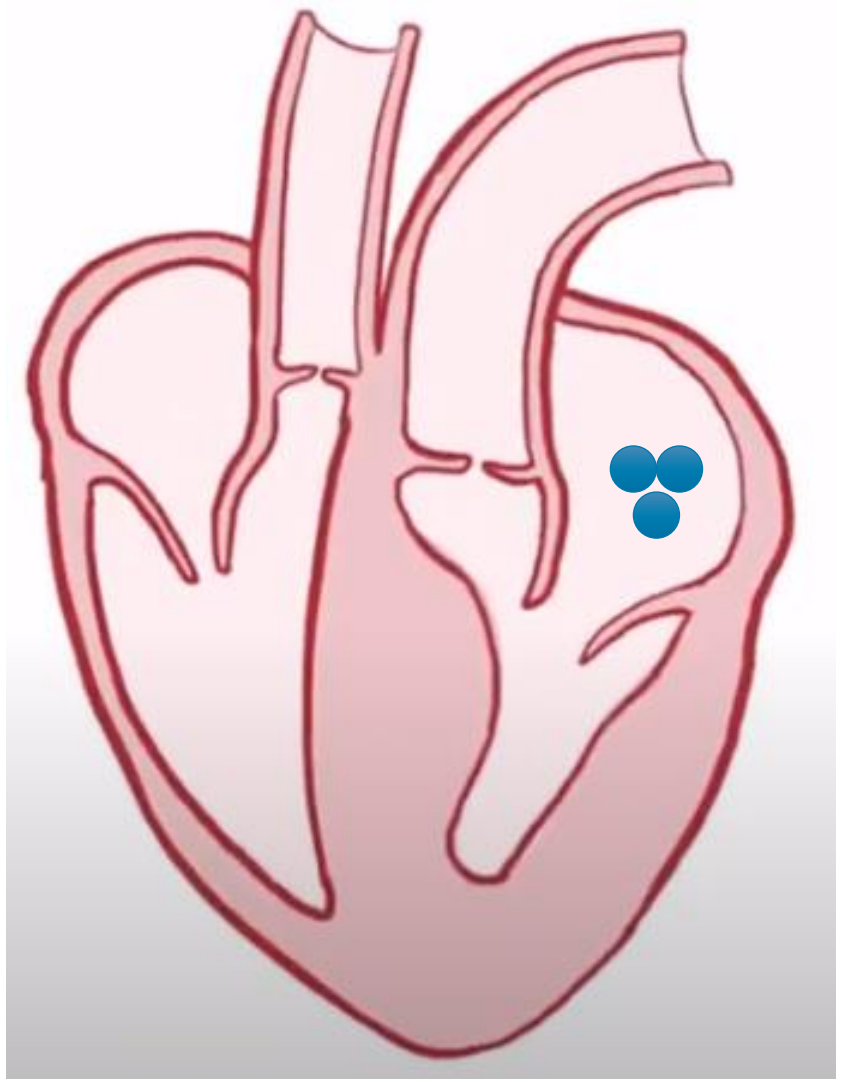


Hypertrophic Cardiomyopathy









HCM

- Benefit from BB and/or CCB to reduce diastolic filling time and negative inotropy
- Are often intolerant of afterload reducing medications
- May need consideration of disease modifying therapies like myosin inhibitor therapy, alcohol septal ablation, or myectomy.
- Are at increased risk of atrial and ventricular arrhythmias and sudden cardiac death
- Needs familial screening

Amyloidosis

- Systemic disease caused by the deposition of an insoluble protein
- Most common cardiac variants: AL and TTR

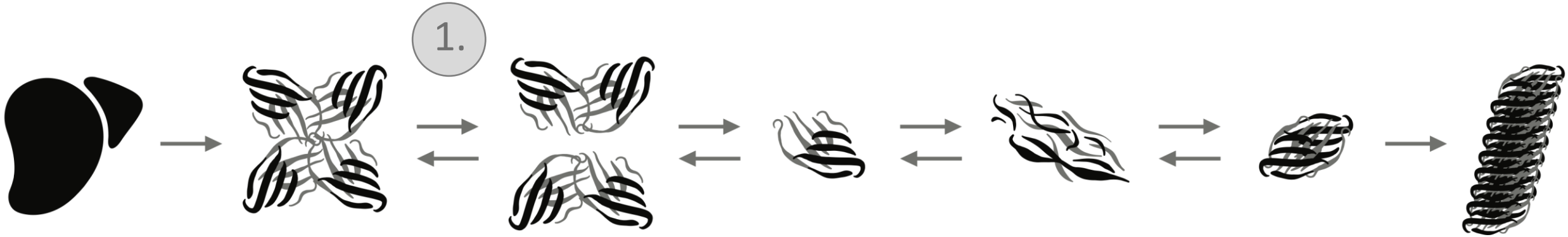
Amyloidosis: TTR

TTR **T**rans**T**hy**R**etin

- Tetramer synthesized by the liver to bind and transport the hormone thyroxine and retinol-binding protein within the systemic circulation

Amyloidosis: TTR

The TTR amyloidosis is a systemic disease caused by (1) destabilization of the tetramer into (2) unstable monomers that are then (3) misfolded and then (4) aggregate as insoluble amyloid fibrils which then (5)deposit within tissue.



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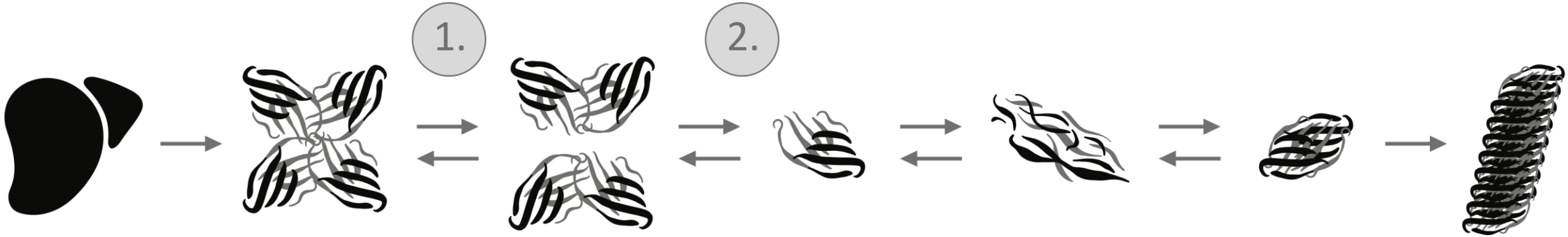

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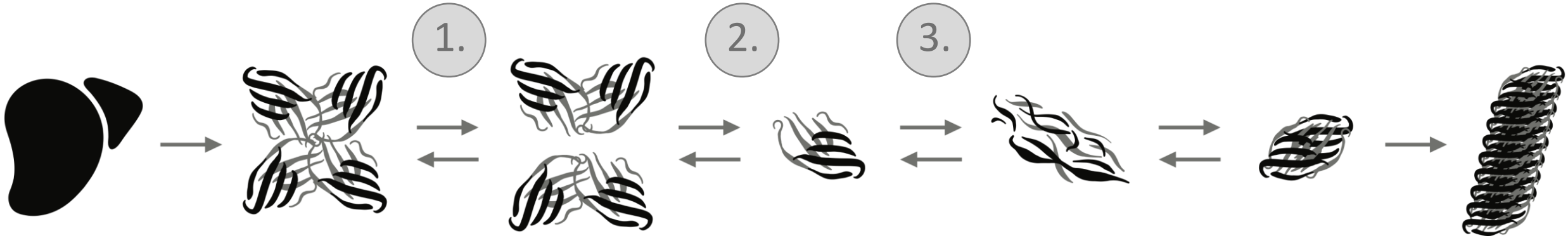

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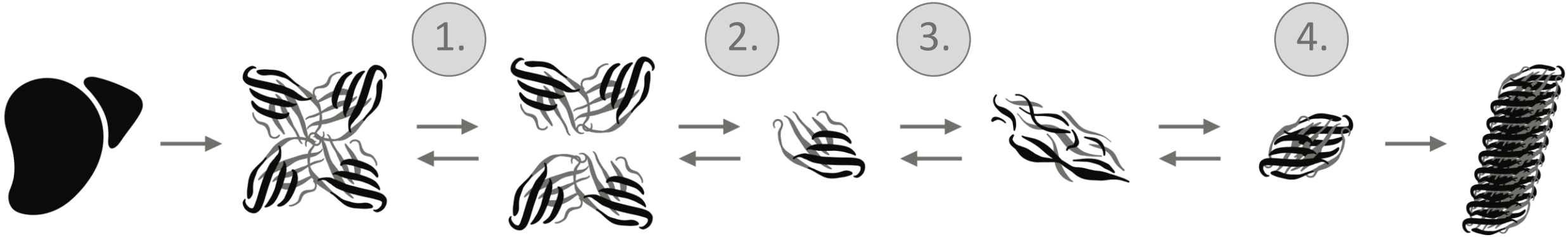

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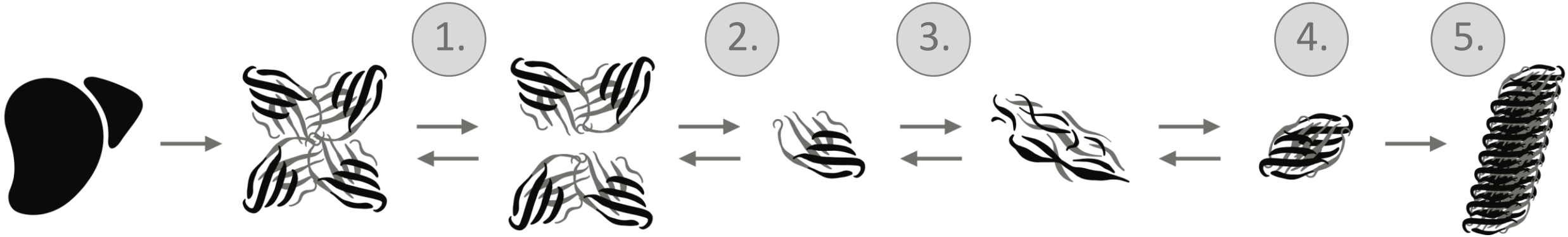


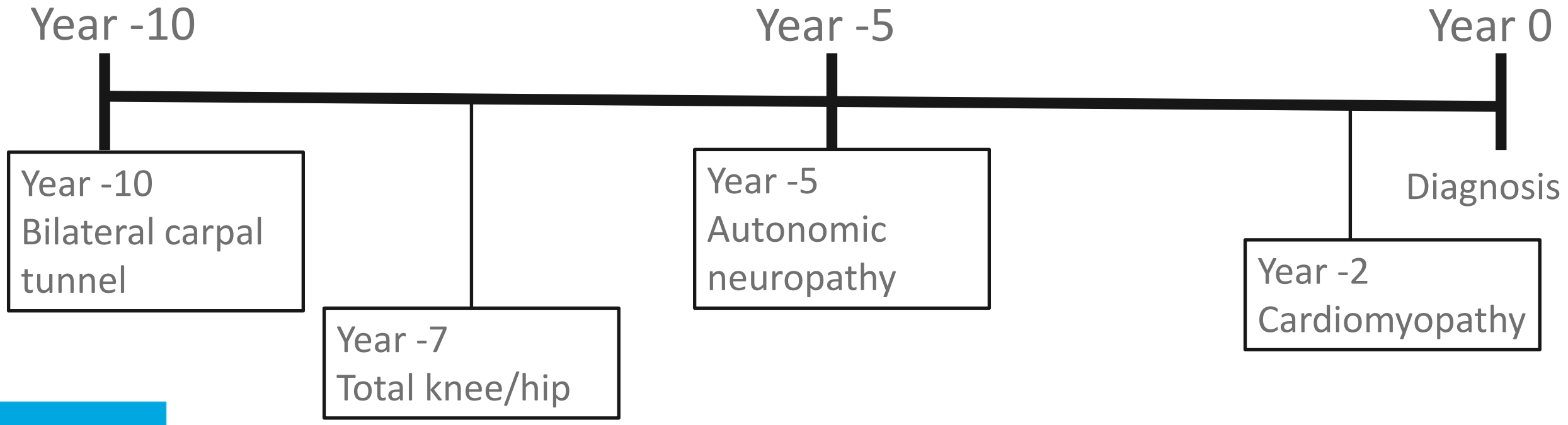
Amyloidosis: TTR

Systemic manifestations:

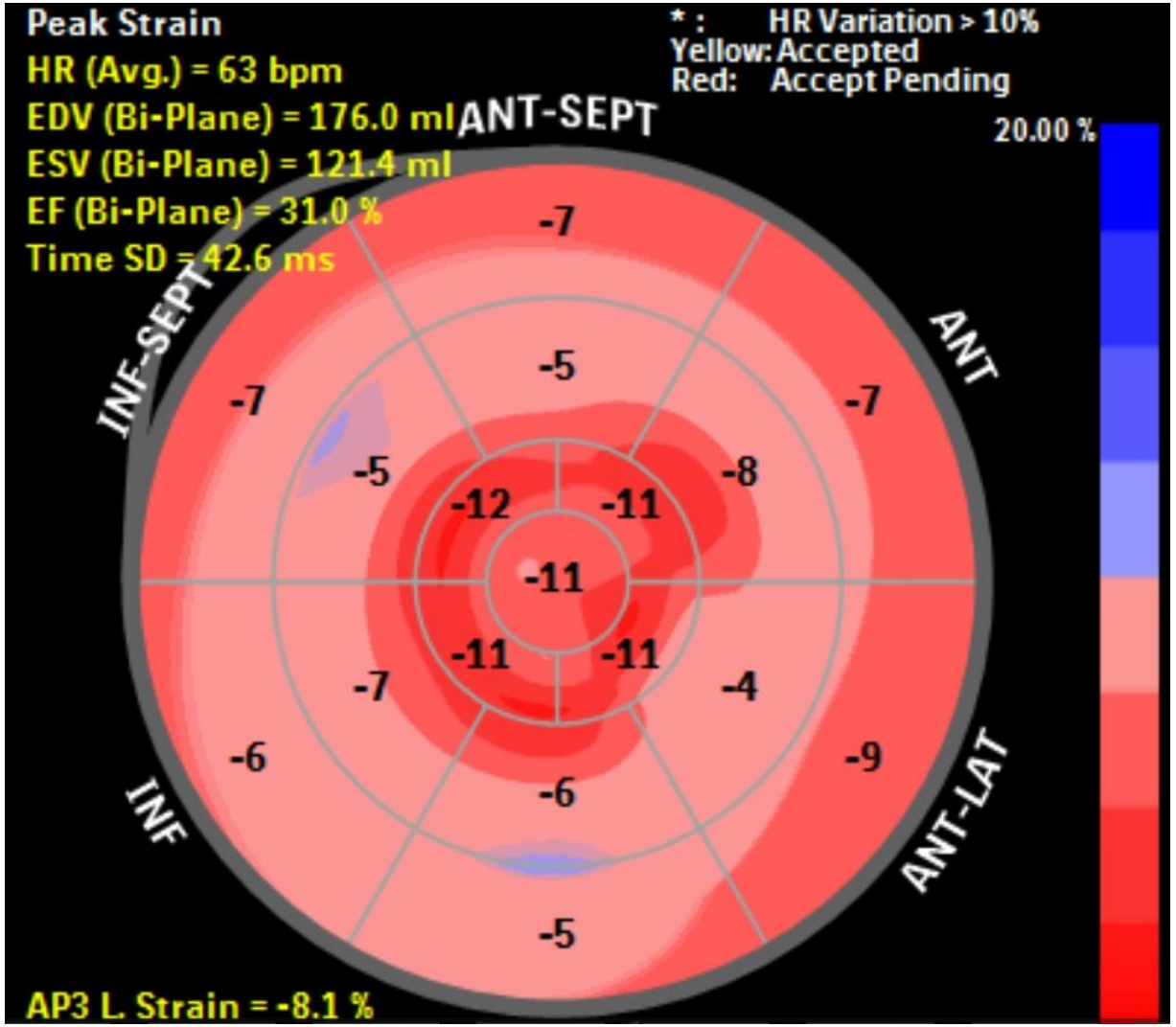
- Cardiac: Heart failure, restrictive physiology, arrhythmias, valvular heart disease (AS).
- Neuropathic: bilateral carpal tunnel, sensory neuropathies, orthostatic hypotension, diarrhea/constipation, gastroparesis, urinary retention, erectile dysfunction, sciatica.
- MSK: bicep tendon rupture, early hip/knee arthroplasties

Amyloidosis: TTR

Red flag symptoms may precede diagnosis by years…



Amyloidosis: TTR



Amyloidosis: TTR

- Often see multiple providers and go years before diagnosis.
- Are often intolerant of blood pressure medications and rate control medicines like beta blockers.
- Always require disease modifying therapies to prevent progression to reduce mortality and morbidity.
- Genetic testing is important to differentiate regardless of age.

Other Considerations

- Sleep apnea and NIV
  - CPAP associated with better quality of sleep and nocturnal oxygenation
  - Less heart failure symptoms and arrhythmias
  - Meta-analyses showed positive airway pressure therapy had a moderate reduction in BNP and improvement in blood pressure and LVEF
  - Adaptive servo-ventilation was associated with increased mortality in patients with HFrEF and central sleep apnea

Advanced Heart Failure

Repeated hospitalizations or emergency department visits for HF in the past 12 mo.
Need for intravenous inotropic therapy.
Persistent NYHA functional class III to IV symptoms despite therapy.
Severely reduced exercise capacity on CPET, 6MWT <300 m, inability to walk 1 block
Intolerance of GDMT
Recent need to escalate diuretics to maintain volume status or refractor congestion
Progressive deterioration in renal or hepatic function.
Worsening right HF or secondary pulmonary hypertension.
Frequent SBP ≤90 mm Hg.
Cardiac cachexia.
Persistent hyponatremia (serum sodium, <134 mEq/L).
Refractory or recurrent ventricular arrhythmias; frequent ICD shocks.

Advanced Heart Failure

- Reasons to refer:
- LVEF <40% with NYHA III+ symptoms with
  - 2+ hospitalizations in 1 year for HF
  - Dilated left ventricle with a left ventricular end diastolic diameter (LVEDD) of greater than 6 cm
  - Intolerance of even low dose GDMT due to hypotension
  - Low cardiac index on right heart catheterization with or without the use of home inotropes
  - Evidence of worsening end-organ perfusion (renal or hepatic) not related to other factors

Advanced Heart Failure

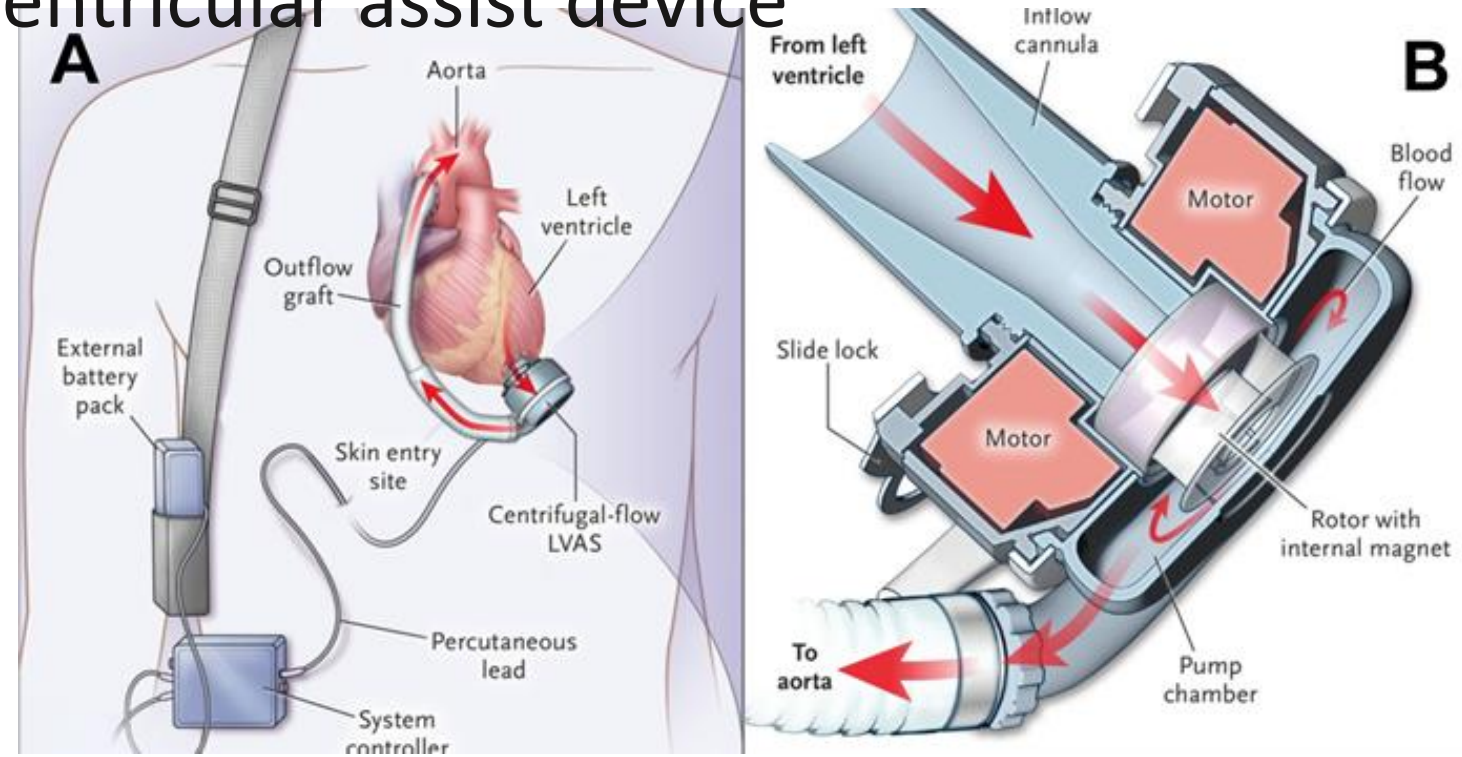
- Reasons to refer:
  - If the LVEF <30% and the LVEDD is 6 cm+ the patient is less likely to recover

Advanced Heart Failure

- Reasons to refer:
- Any LVEF
  - Cardiac amyloidosis
  - Hypertrophic cardiomyopathy
  - Fabry's
  - Hemochromatosis
  - Sarcoidosis

Advanced Heart Failure

- ASO
  - Heart transplant
  - Implantable left ventricular assist device



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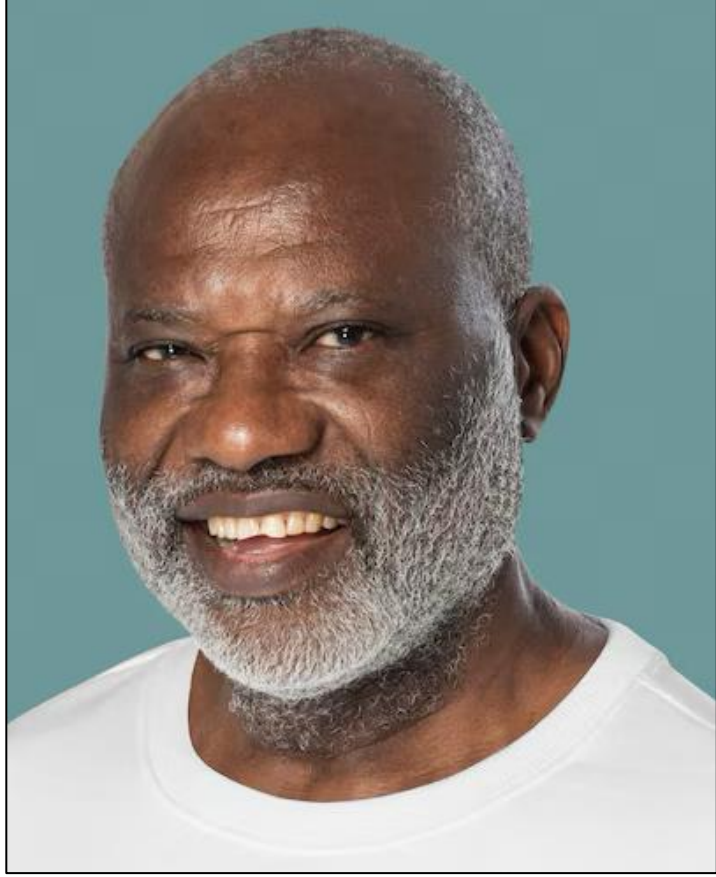
Advanced Heart Failure

- ASO

Indication	Absolute Contraindications	Relative Contraindications	
Frequent HF hospitalizations	Irreversible renal or hepatic d/s	Age >80 y/o	Impaired cognitive function
NYHA IIIb-IV symptoms	Irreversible neurologic d/s	Obesity or malnutrition	Unmanaged psychiatric disorder
Intolerance to GDMT	Medical nonadherence	Inability to rehab	Lack of social support
Inotropic dependence	Severe psychosocial limitations	Active systemic infection or prolonged intubation	Active substance use
Low peak VO2 <14-16		Untreated malignancy	
Evidence of low CO with end-organ dysfunction		Severe PVD	

Case 1



- Mr. Jones is a 56-year-old male with a PMHx of HTN, bilateral carpal tunnel syndrome, IBS, who saw you with complaints of shortness of breath. He recently saw you with complaints of dizziness when he stood up so you took him off his blood pressure medicatons.

- Family history: heart failure, carpal tunnel

Case 1

- Diagnosis?
  A. Hypertensive heart disease
  B. Cardiac amyloidosis
  C. Hypertrophic cardiomyopathy

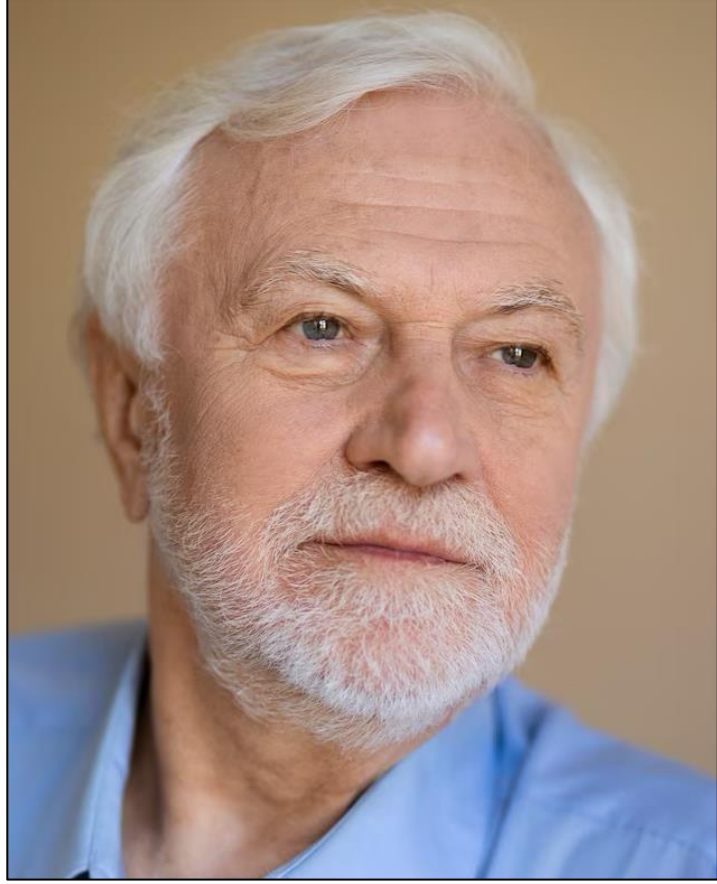
Case 1

- Diagnosis?
  - A. Hypertensive heart disease
  - **B. Cardiac amyloidosis – highly suspicious for h-ATTR**
  - C. Hypertrophic cardiomyopathy

Case 2

- Mr. Smith is a 82-year-old male with a PMHx of HTN, HFpEF, aortic stenosis s/p TAVR, sick sinus syndrome s/p pacemaker who saw you with complaints of shortness of breath, swelling, and fatigue.

- Family history: HTN, DM



Case 2

- Diagnosis?
  - A. Hypertensive heart disease
  - B. Cardiac amyloidosis
  - C. Hypertrophic cardiomyopathy

Case 2

- Diagnosis?
  - A. Hypertensive heart disease
  - **B. Cardiac amyloidosis – highly suspicious for wt-ATTR**
  - C. Hypertrophic cardiomyopathy

Case 3

- Ms. Miller is a 42-year-old female with a PMHx of passing out in her teens when running track who presented for shortness of breath. She was told she had a murmur when she was a child.

- Family history: her uncle died as a teen playing basketball of unknown cause, her grandfather died sudden while at work

Case 3

- Diagnosis?
  - A. Hypertensive heart disease
  - B. Cardiac amyloidosis
  - C. Hypertrophic cardiomyopathy

Case 3

- Diagnosis?
  - A. Hypertensive heart disease
  - B. Cardiac amyloidosis
  - **C. Hypertrophic cardiomyopathy**

Questions?

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