HEART SUCCESS is a Team Event

Heart Failure Optimization Therapy: A comprehensive Approach

Luis Hernandez, MD

Advanced Heart Failure and Transplant Cardiology

Heart Failure Medical Director, Monument Health Heart and Vascular Institute

Clinical Assistant Professor Rocky Vista University

Jessica Tvedt, NP

Audrey Bickerdyke , NP

Megan Hullinger, NP

MONUMENT HEALTH

Disclosures

Consultant for the Allay trial from Alleviant Medical

MONUMENT HEALTH

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
© 2024 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
PUBLISHED BY ELSEVIER

VOL. 83, NO. 15, 2024

EXPERT CONSENSUS DECISION PATHWAY

2024 ACC Expert Consensus Decision Pathway for Treatment of Heart Failure With Reduced Ejection Fraction

A Report of the American College of Cardiol

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
© 2023 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
PUBLISHED BY ELSEVIER

VOL. 81, NO. 18, 2023

EXPERT CONSENSUS DECISION PATHWAY

2023 ACC Expert Consensus Decision Pathway on Management of Heart Failure With Preserved Ejection Fraction

A Report of the American College of Cardiology Solution Set Oversight Committee

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
© 2023 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
PUBLISHED BY ELSEVIER

EXPERT CONSENSUS DECISION PATHWAY

2023 ACC Expert Consensus Decision Pathway on Comprehensive Multidisciplinary Care for the Patient With Cardiac Amyloidosis

A Report of the American College of Cardiology Solution Set Oversight Committee

Endorsed by the American Association of Neuromuscular & Electrodiagnostic Medicine, Heart Failure Society of America, and International Society of Amyloidosis. The American Academy of Neurology affirms the value of this statement.

MONUMENT HEALTH

Universal Heart Failure (HF) Definition

HF is a clinical syndrome with current or prior symptoms and or signs caused by a structural and/or functional cardiac abnormality (**EF of <50%, abnormal cardiac chamber enlargement, E/E' of >15, moderate / severe ventricular hypertrophy or moderate / severe valvular obstructive or regurgitant lesion**) and corroborated by at least one of the following: Elevated natriuretic peptide levels

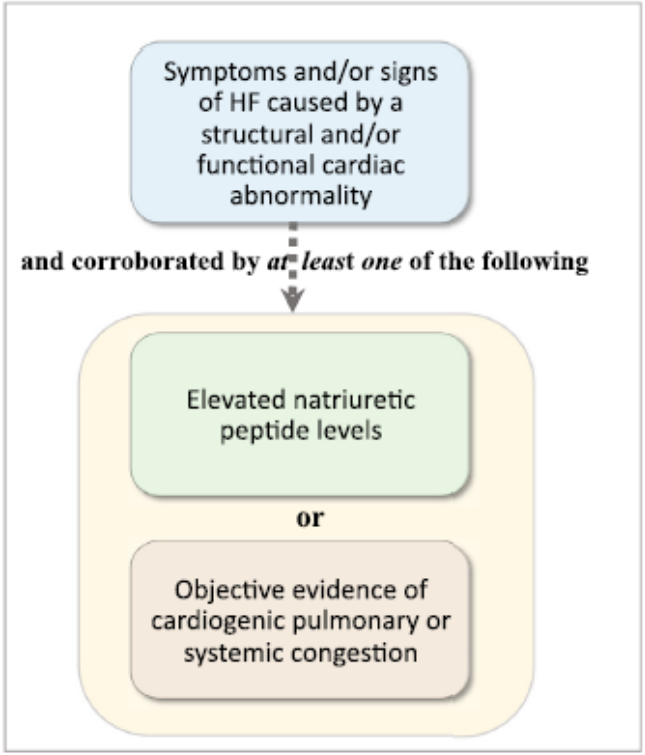
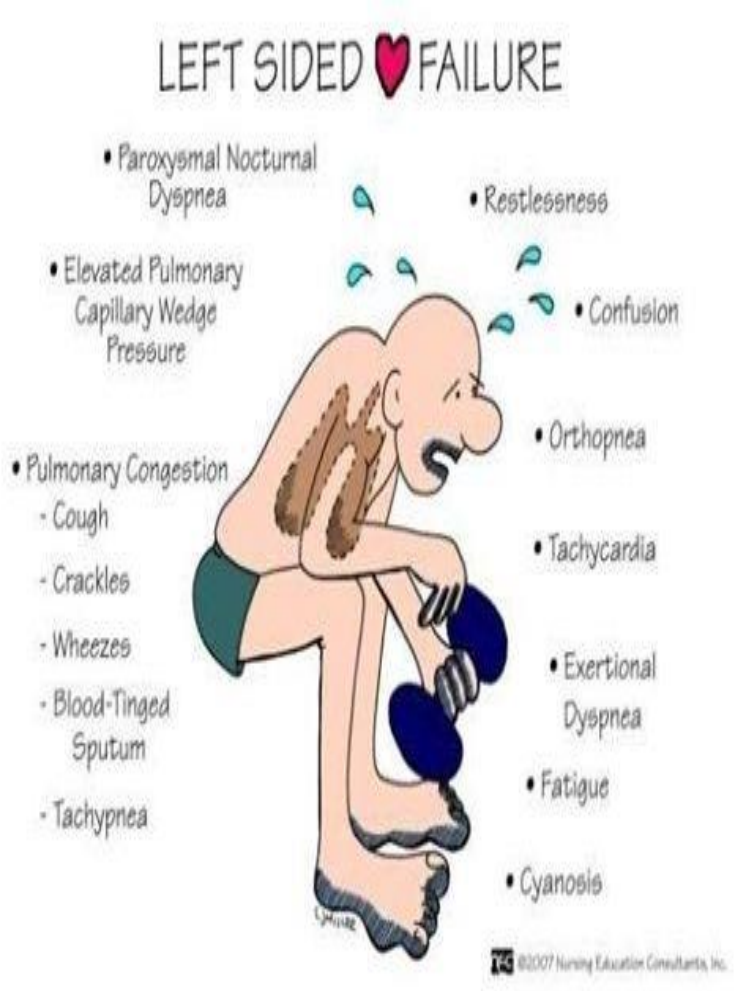


Figure 1. Universal definition of HF.

Signs and Symptoms



Natriuretic Peptide Levels Supporting Definition of HF

Table 8. Natriuretic Peptide Levels Supporting Definition of HF

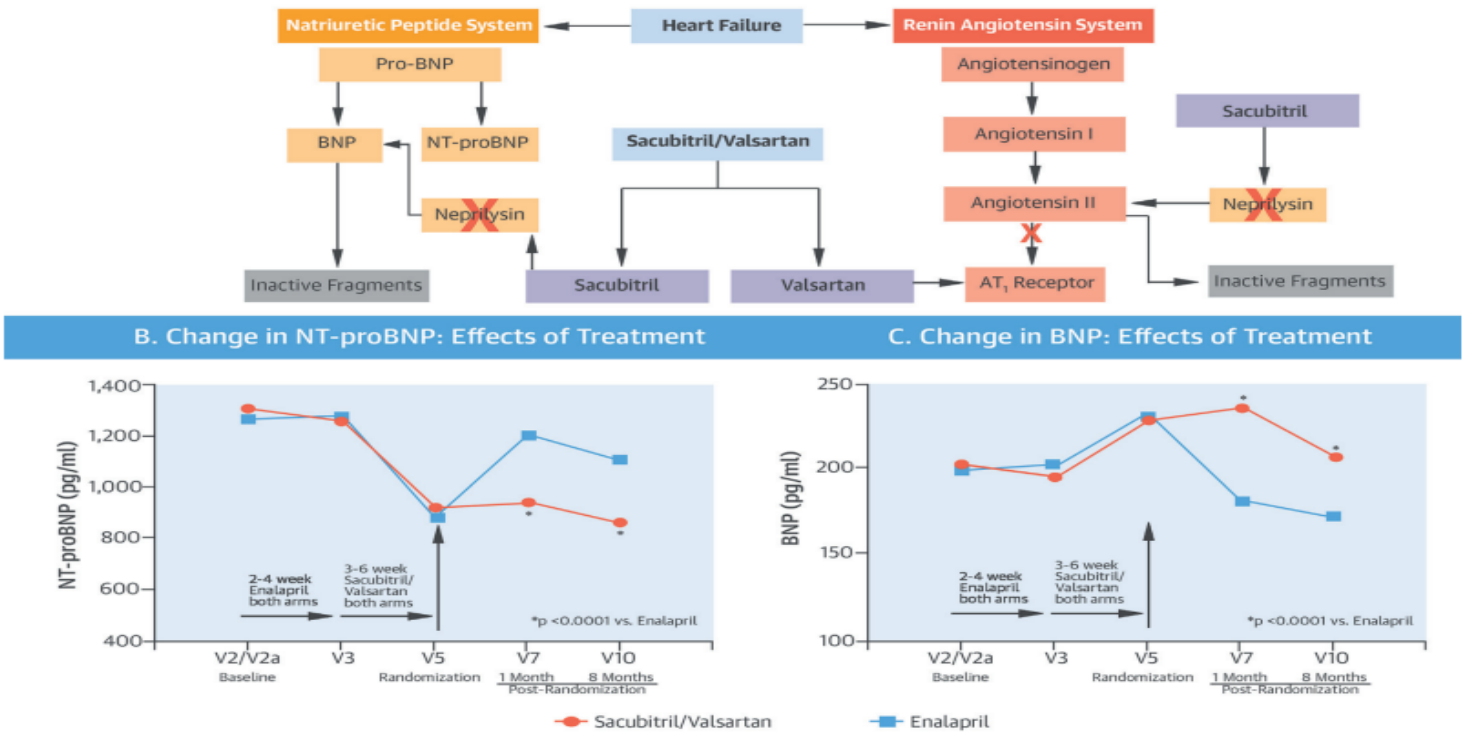
	Ambulatory	Hospitalized/ Decompensated
BNP, pg/mL	≥35	≥ 100
NT-proBNP, pg/mL	≥ 125	≥ 300

Table 7. Causes of Elevated Natriuretic Peptide Levels Other than Primary Diagnosis of HF

Cardiovascular causes
Acute coronary syndrome, MI
Pulmonary embolism
Myocarditis
Hypertrophic cardiomyopathy
Valvular heart disease
Congenital heart disease
Atrial or ventricular arrhythmias
Heart contusion, cardiac infiltration or malignancy
Cardioversion, ICD shock
Pericardial disease
Invasive or surgical procedures involving the heart
Pulmonary hypertension, right ventricular failure
Infiltrative cardiomyopathies
Noncardiovascular causes
Advanced age
Kidney disease
Critical illnesses including Sepsis syndrome, cytokine syndrome
Ischemic or hemorrhagic stroke
Pulmonary disease (pneumonia, chronic obstructive pulmonary disease)
Liver disease
Severe anemia
Severe metabolic and hormone abnormalities (eg, thyrotoxicosis, diabetic ketoacidosis, severe burns)
Causes of lower natriuretic peptide levels
Obesity or increased BMI
Pericardial disease*

Prognostic Implications of Changes in N-Terminal Pro-B-Type Natriuretic Peptide.

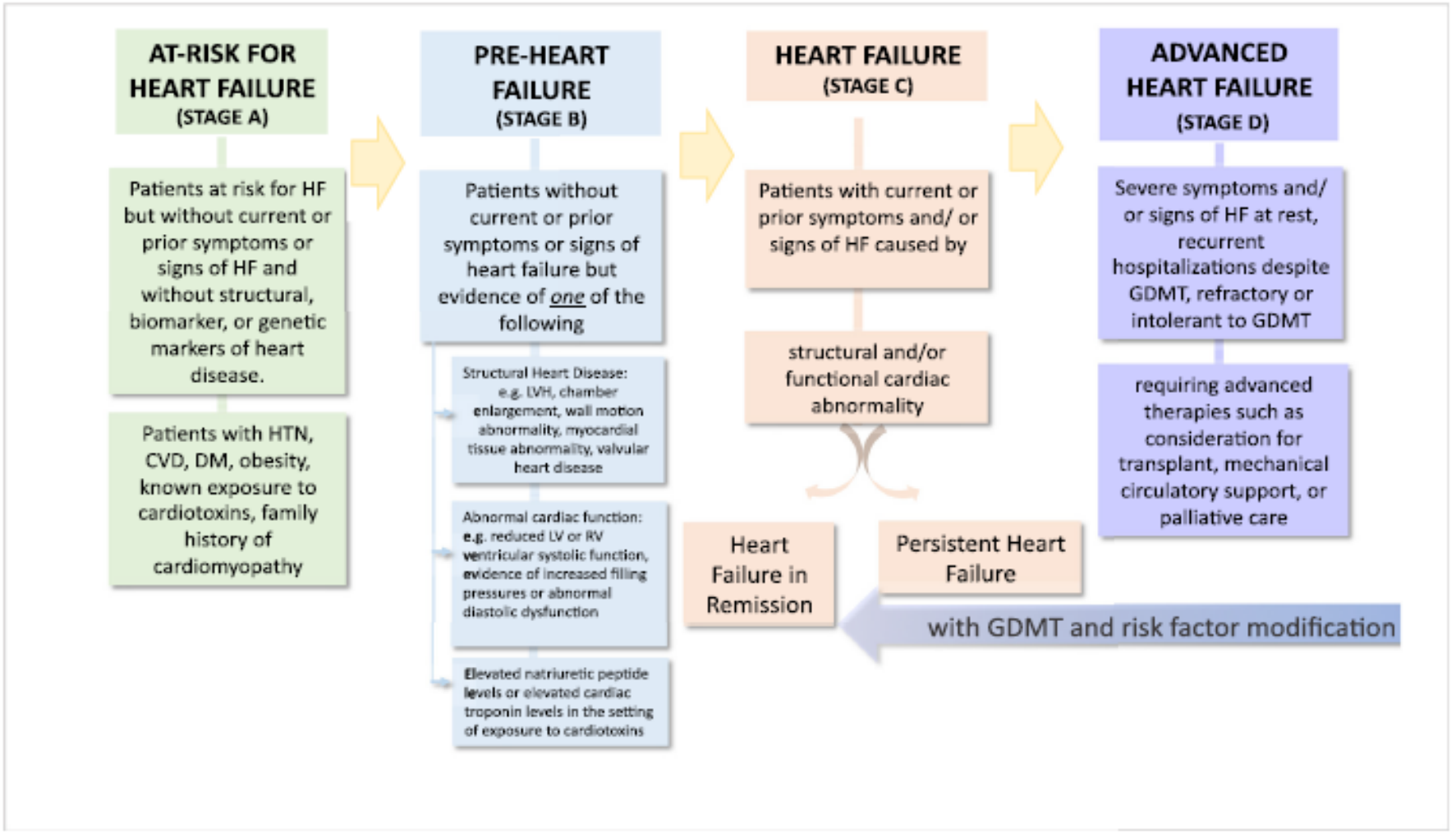
CENTRAL ILLUSTRATION **NT-proBNP in Patients With Heart Failure: Prognostic Implications of Changes**



Zile, M.R. et al. J Am Coll Cardiol. 2016;68(22):2425-36.

Sacubitril/Valsartan is a first-in-class neprilysin, angiotensin receptor inhibitor that promotes vasodilation and reduces vasoconstriction **(A)**. Effects of sacubitril/valsartan could be due to direct biochemical inhibition of neprilysin and the resultant biological effect on the determinants of natriuretic synthesis. By inhibiting neprilysin, sacubitril/valsartan reduces degradation of B-type natriuretic peptide (BNP), resulting in an increase in BNP **(C)** and other vasoactive peptides. This might decrease both preload and afterload through diuretic and cell signaling effects. Increases in BNP and other vasoactive peptides could reduce the stimulus for natriuretic peptide synthesis by acting on the determinants of its synthesis; this conclusion is supported by the observed decrease in NT-proBNP **(B)**. Treatment with sacubitril/valsartan would be expected to both increase BNP and decrease NT-proBNP.

New Heart Failure Stages



New HF Classifications

- HF with reduced EF (HFrEF): HF with **LVEF 40%.**

- HF with mildly reduced EF (HFmrEF): HF with

  LVEF 41-49%

- HF with preserved EF (HFpEF): HF with LVEF

  > 50%.

- HF with improved EF (HFimpEF): HF with a baseline

LVEF of 40%, a 10-point increase from baseline LVEF, and a second measurement of LVEF of >40%.

Heart Failure: A multidisciplinary team and its comprehensive approach

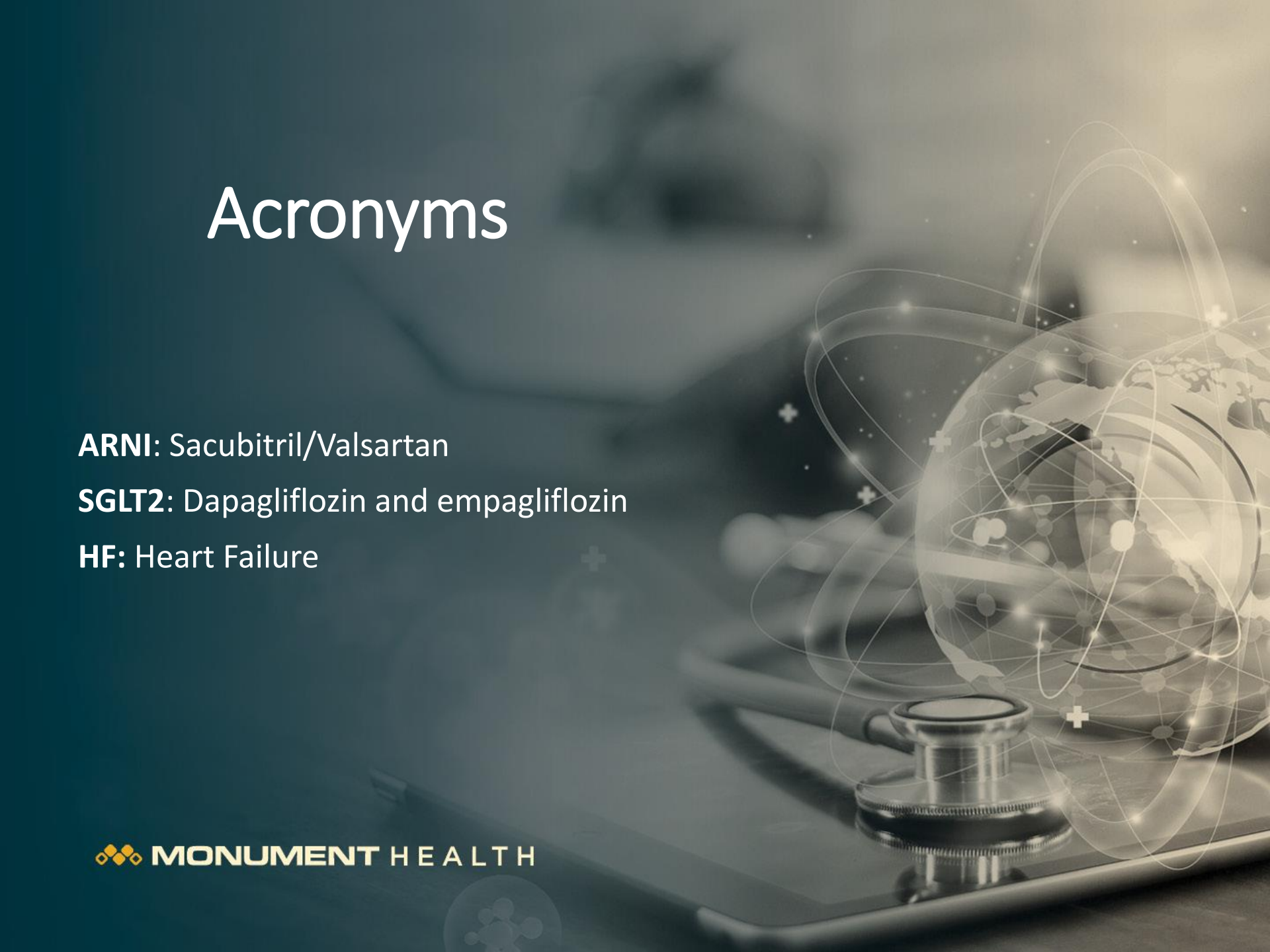
MONUMENT HEALTH

Acronyms

ARNI: Sacubitril/Valsartan

SGLT2: Dapagliflozin and empagliflozin

HF: Heart Failure



MONUMENT HEALTH

Evaluation of Ambulatory Patient

- Physical examination and a detailed history

- Evaluation of the patient's functional status and symptom burden: **New York Heart Association (NYHA)**

- Screening for comorbidities that may contribute to HF

- Examination of the patient's current medications, including both cardiovascular and noncardiovascular medications

NEW YORK HEART ASSOCIATION (NYHA) HEART FAILURE CLASSIFICATION

CLASS I

NO LIMITATION OF PHYSICAL ACTIVITY; ORDINARY PHYSICAL ACTIVITY DOES NOT CAUSE SYMPTOMS

CLASS II

SLIGHT LIMITATION OF PHYSICAL ACTIVITY; COMFORTABLE AT REST; ORDINARY PHYSICAL ACTIVITY CAUSES SYMPTOMS

CLASS III

MARKED LIMITATION OF PHYSICAL ACTIVITY; COMFORTABLE AT REST, BUT LESS THAN ORDINARY ACTIVITY CAUSES SYMPTOMS

CLASS IV

SEVERE LIMITATION AND DISCOMFORT WITH ANY PHYSICAL ACTIVITY; SYMPTOMS PRESENT EVEN AT REST

WWW.MEDCOMIC.COM

HF evaluation studies

- Initial studies that may be considered include:
- **Complete blood count (CBC), basic metabolic panel, liver function testing, iron studies, thyroid studies, CK levels and HbA1c level**
- **NT pro BNP/BNP**
- **Echocardiogram**
- Chest X-ray
- **Holter monitor**
- Coronary angiogram, cardiac MRI, biopsy, or other imaging if appropriate
- Sleep study/referral to sleep specialist for appropriate patients
- Genetic testing

Initiating and Titrating Medications

•Evidence-based medications should be introduced and **titrated to reach target or best-tolerated dose**.

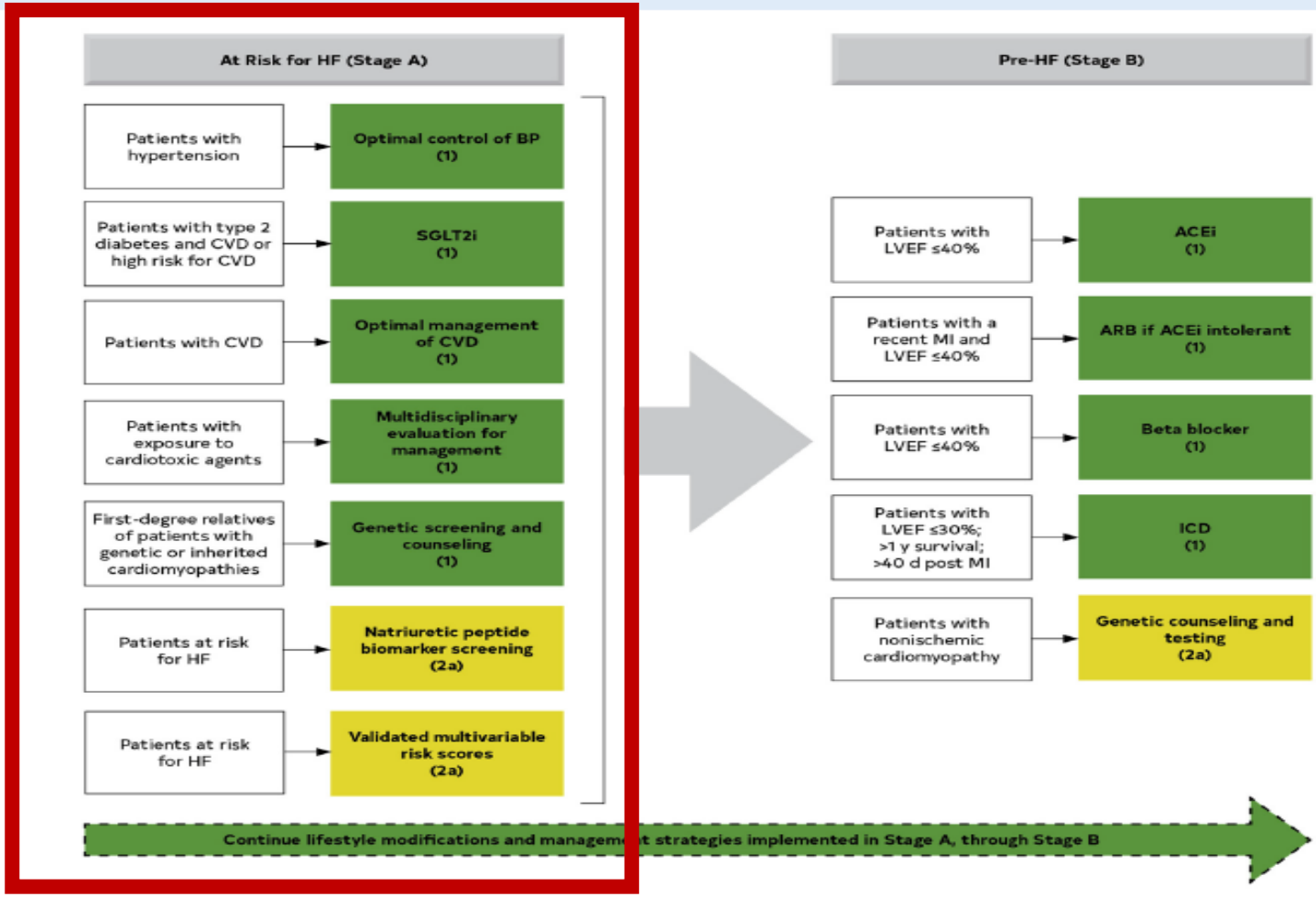
•Ideally, the patient should be **euvolemic** and the diuretic dosage adjusted if needed prior to GDMT with a RAS inhibitor, evidence-based beta-blocker, and an MRA.

•Follow-up should occur at 1 to 2 weeks and labs should be repeated.

•Further adjustments to the patient's regimen may be required until the patient is receiving **maximally tolerated doses** of all evidence-based treatments.

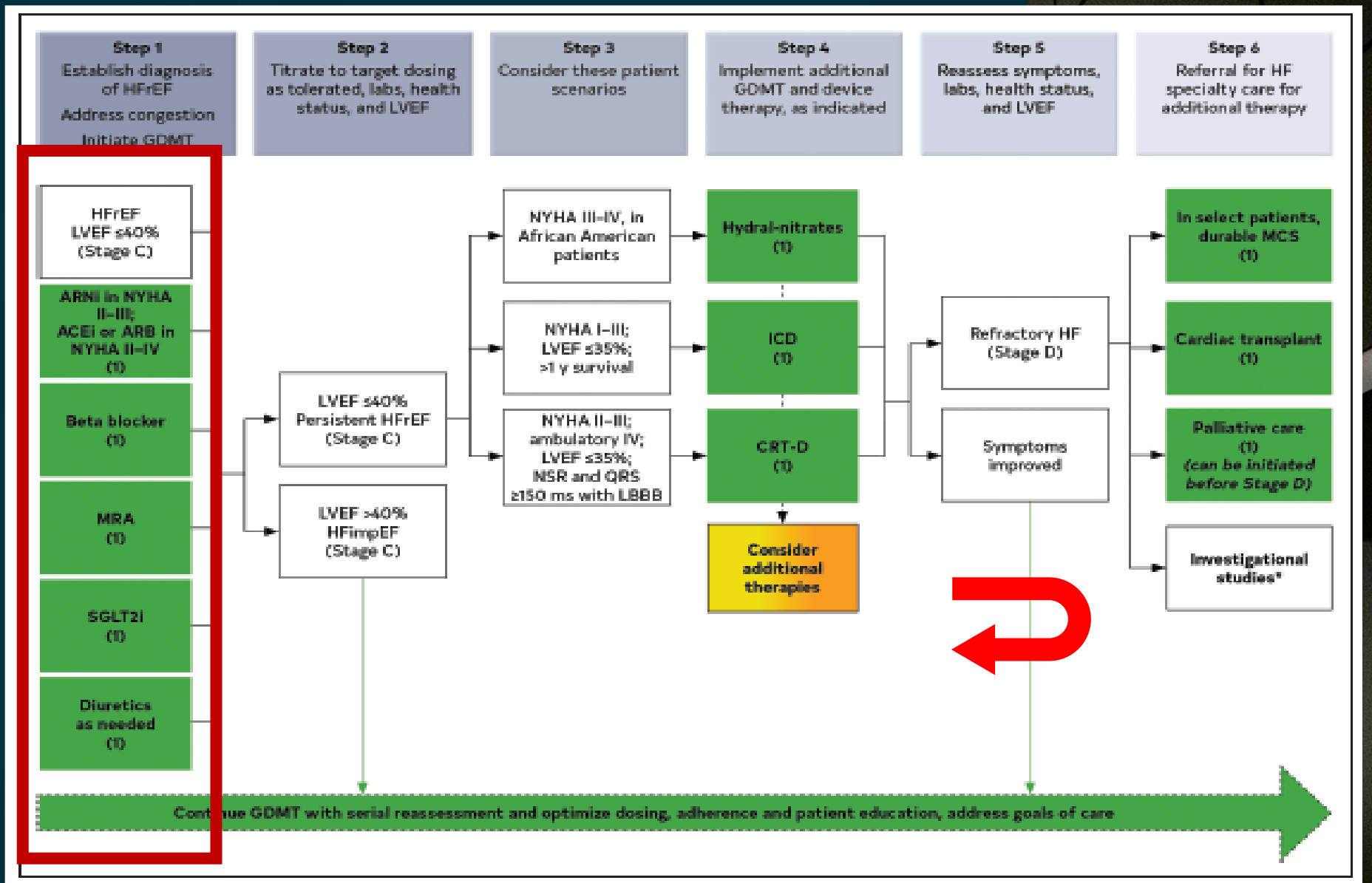
HF Stage A (Prevention) and Stage B

FIGURE 5 Recommendations (Class 1 and 2a) for Patients at Risk of HF (Stage A) and Those With Pre-HF (Stage B)

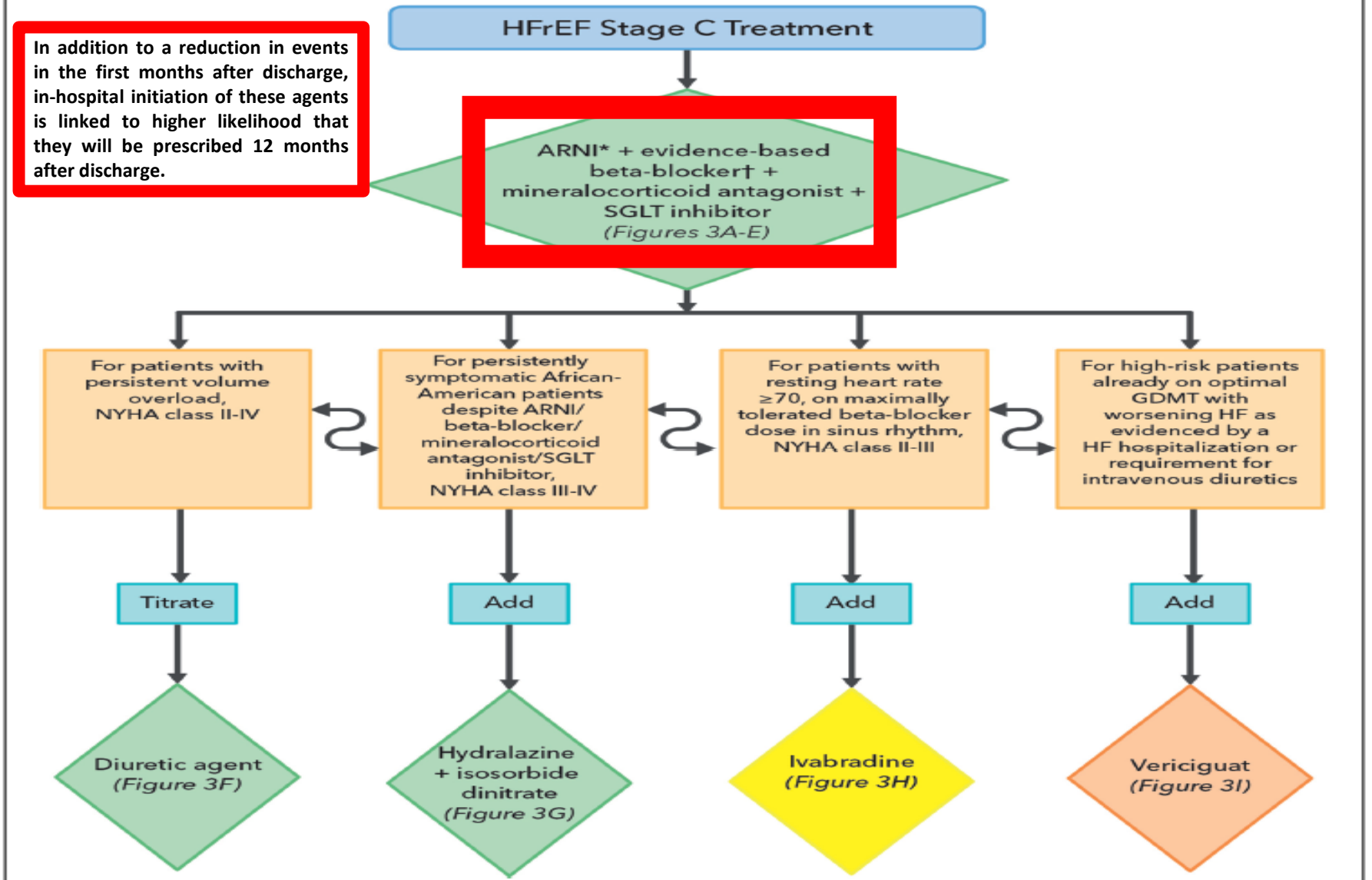


Colors correspond to COR in Table 2. COR 1 and COR 2a for patients at risk for HF (stage A) and those with pre-HF (stage B) are shown. Management strategies implemented in patients at risk for HF (stage A) should be continued though stage B. ACEi indicates angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; BP, blood pressure; COR, Class of Recommendation; CVD, cardiovascular disease; HF, heart failure; ICD, implantable cardioverter-defibrillator; LVEF, left ventricular ejection fraction; MI, myocardial infarction; and SGLT2i, sodium glucose cotransporter 2 inhibitor.

HF Stage C

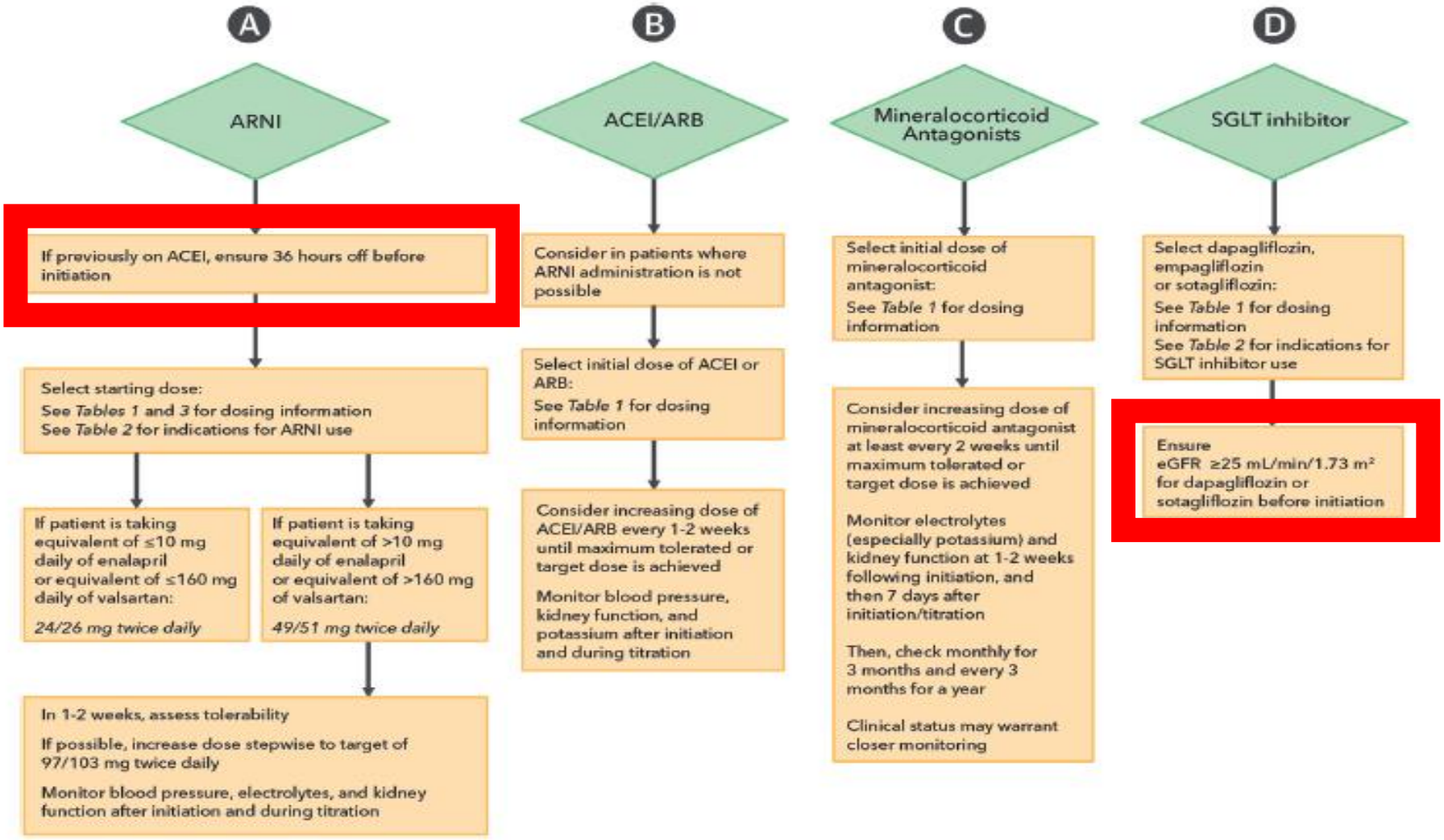

Step 1
Establish diagnosis of HFrEF
Address congestion
Initiate GDMT
Step 2
Titrate to target dosing as tolerated, labs, health status, and LVEF
Step 3
Consider these patient scenarios
Step 4
Implement additional GDMT and device therapy, as indicated
Step 5
Reassess symptoms, labs, health status, and LVEF
Step 6
Referral for HF specialty care for additional therapy
HFrEF LVEF ≤40% (Stage C)
ARNI in NYHA II–III; ACEi or ARB in NYHA II–IV (1)
Beta blocker (1)
MRA (1)
SGLT2i (1)
Diuretics as needed (1)
LVEF ≤40% Persistent HFrEF (Stage C)
LVEF >40% HFimpEF (Stage C)
NYHA III–IV, in African American patients
NYHA I–III; LVEF ≤35%; >1 y survival
NYHA II–III; ambulatory IV; LVEF ≤35%; NSR and QRS ≥150 ms with LBBB
Hydral-nitrates (1)
ICD (1)
CRT-D (1)
Consider additional therapies
Refractory HF (Stage D)
Symptoms improved
In select patients, durable MCS (1)
Cardiac transplant (1)
Palliative care (1) (can be initiated before Stage D)
Investigational studies[a]
Continue GDMT with serial reassessment and optimize dosing, adherence and patient education, address goals of care

In addition to a reduction in events in the first months after discharge, in-hospital initiation of these agents is linked to higher likelihood that they will be prescribed 12 months after discharge.



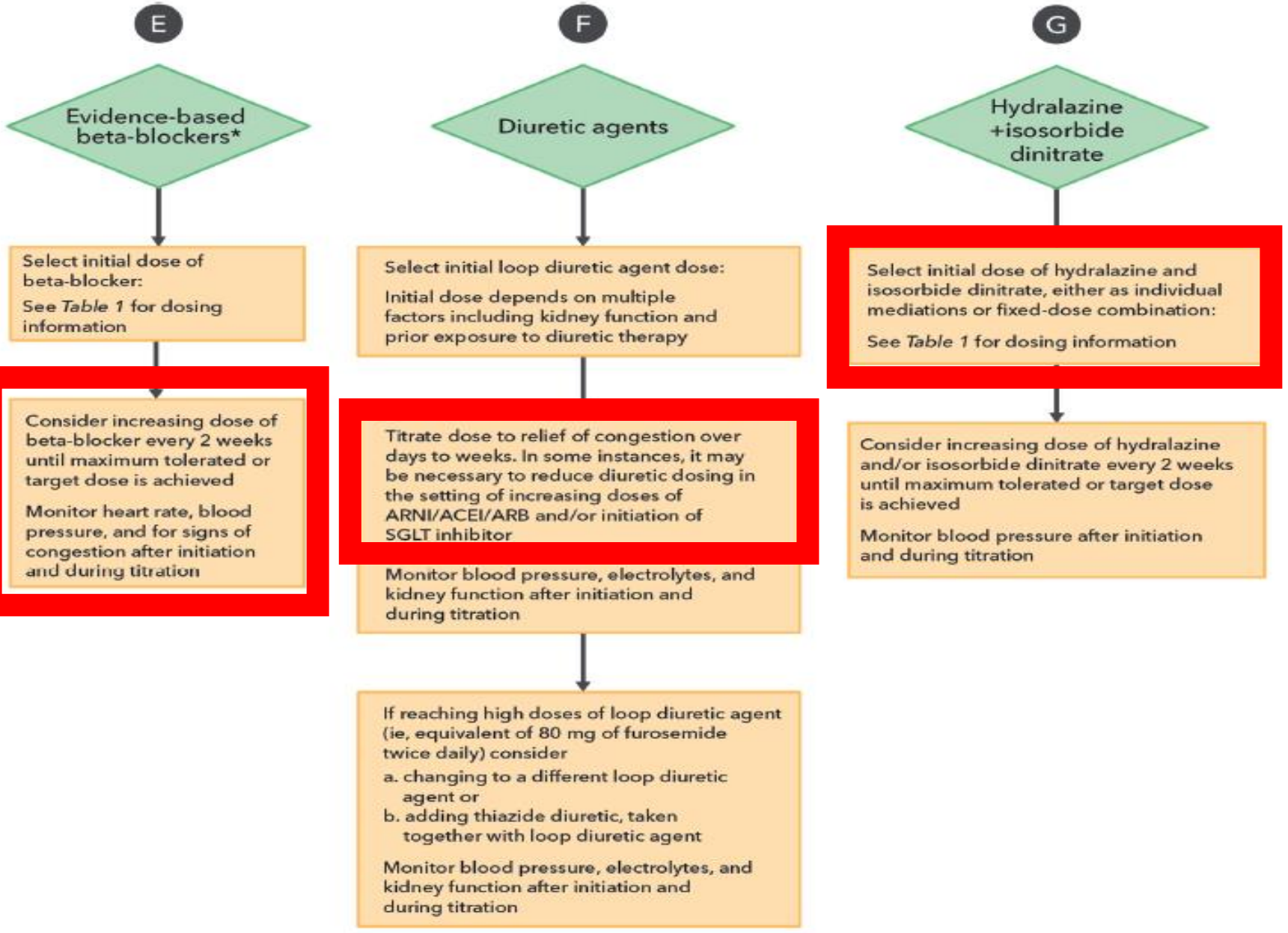
*ACE inhibitors/ARBs should only be considered in patients with contraindications, intolerance, or inaccessibility to ARNI. In those instances, please consult Figure 3 and the text for guidance on initiation. †Carvedilol, metoprolol succinate, or bisoprolol. Colors correspond to ACC/AHA Class of Recommendation. Green = Class 1 (strong); Yellow = Class 2a (moderate); Orange = Class 2b (weak). ARNI = angiotensin receptor/neprilysin inhibitors; ACC = American College of Cardiology; AHA = American Heart Association; HF = heart failure; HFrEF = heart failure with reduced ejection fraction; NYHA = New York Heart Association; SGLT = sodium-glucose cotransporter.

FIGURE 3 GDMT, Including Newer Therapies, in the ECDP for Chronic HF



ARNIs are the preferred renin-angiotensin system inhibitor and should be used as first-line therapy whenever possible. For patients in whom ARNI administration is not possible, an ACE inhibitor/ARB is recommended. *Carvedilol, metoprolol succinate, or bisoprolol. ACEI = angiotensin-converting enzyme inhibitor; ARB = angiotensin receptor blocker; ARNI = angiotensin receptor/neprilysin inhibitors; CBC = complete blood count; eGFR = estimated glomerular filtration rate; SGLT = sodium-glucose cotransporter.

FIGURE 3 Continued



Diuretics?

Table 1

Pharmacologic properties of loop diuretics

Property	Furosemide	Torsemide	Bumetanide
Relative potency	1x	2x	40x
Bioavailability (%)	10 – 100	80 – 100	80 – 100
Oral:Intravenous dosing	2:1	1:1	1:1
Time to onset (min)	60	60	30 – 60
Oral peak serum concentration (hr)	1	1	1 – 2
Absorption affected by food	Yes	No	Yes
Average half-life (hr)	2	3.5	1 – 1.5
Duration of effect (hr)	6 – 8	6 – 16	4 – 6
Decreased kaliuresis	No	Yes	No

Abbreviations: *hr: hour; min: minute*

Table 12. Commonly Used Oral Diuretics in Treatment of Congestion for Chronic HF

Drug	Initial Daily Dose	Maximum Total Daily Dose	Duration of Action
Loop diuretics			
Bumetanide	0.5–1.0 mg once or twice	10 mg	4–6 h
Furosemide	20–40 mg once or twice	600 mg	6–8 h
Torsemide	10–20 mg once	200 mg	12–16 h
Thiazide diuretics			
Chlorthiazide	250–500 mg once or twice	1000 mg	6–12 h
Chlorthalidone	12.5–25 mg once	100 mg	24–72 h
Hydrochlorothiazide	25 mg once or twice	200 mg	6–12 h
Indapamide	2.5 mg once	5 mg	36 h
Metolazone	2.5 mg once	20 mg	12–24 h

HF indicates heart failure.

FIGURE 3 Continued

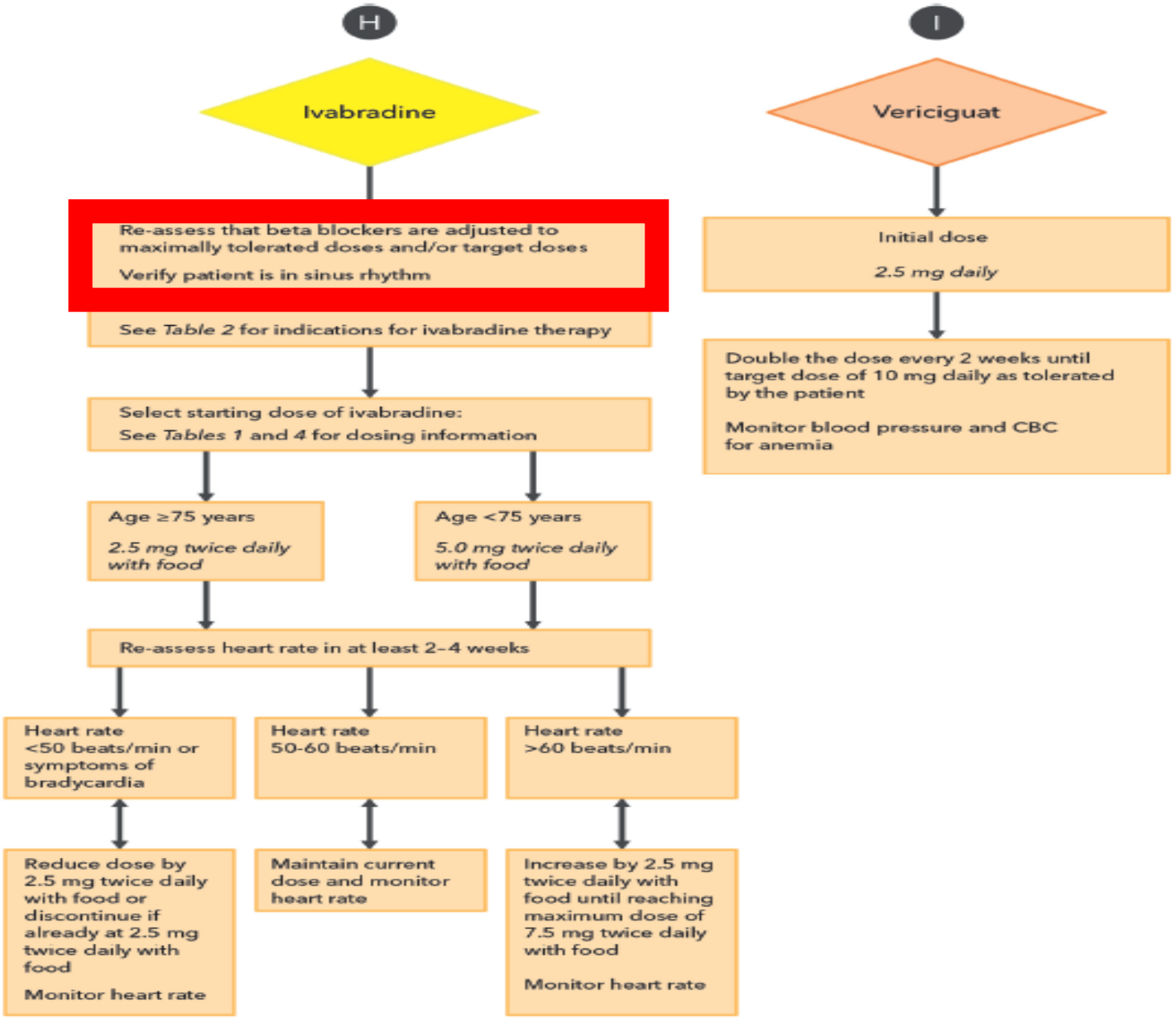
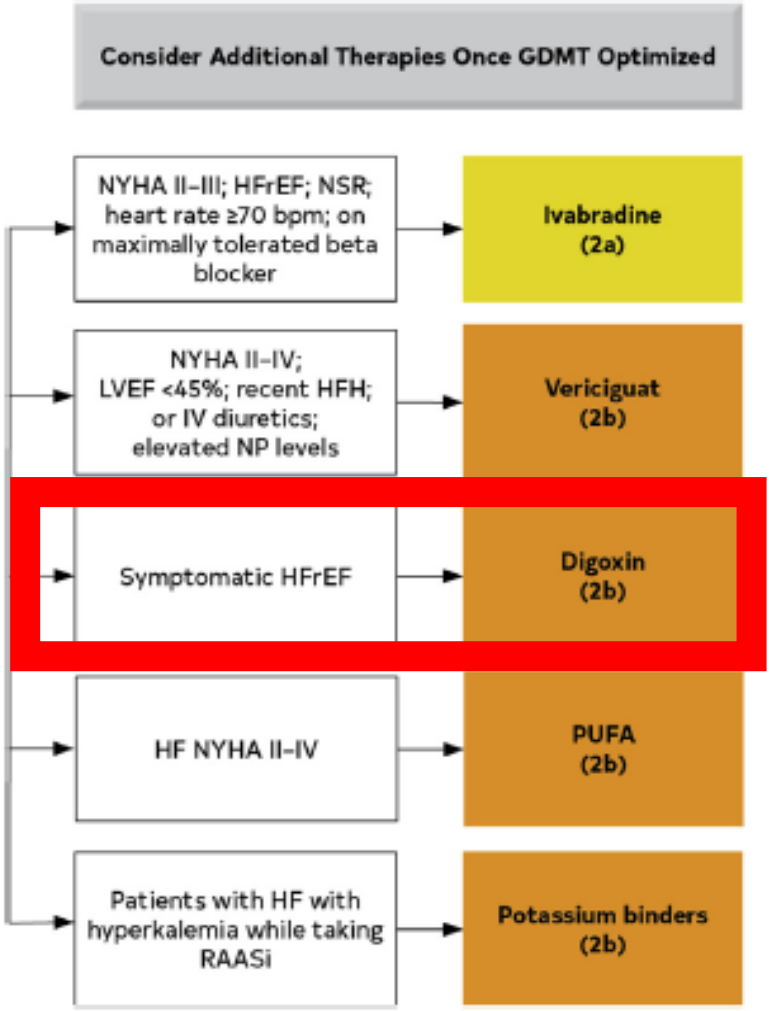


FIGURE 7 **Additional Medical Therapies for Patients With HFrEF**



Colors correspond to COR in Table 2. Recommendations for additional medical therapies that may be considered for patients with HF are shown. GDMT indicates guideline-directed medical therapy; HF, heart failure; HFH, heart failure hospitalization; HFrEF, heart failure with reduced ejection fraction; IV, intravenous; LVEF, left ventricular ejection fraction; LVESD, left ventricular end systolic dimension; MV, mitral valve; MR, mitral regurgitation; NP, natriuretic peptide; NSR, normal sinus rhythm; and NYHA, New York Heart Association; RAASi, renin-angiotensin-aldosterone system inhibitors.

Medications that can exacerbate HF

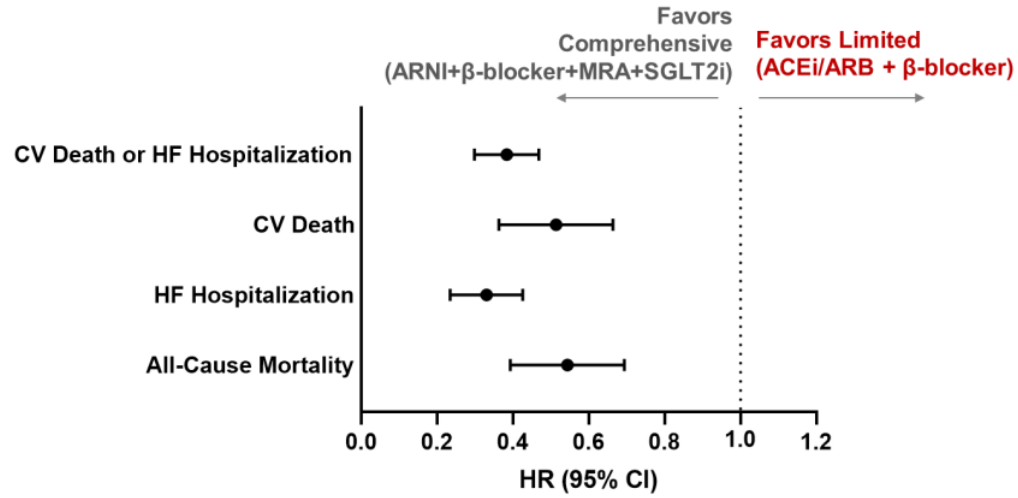
Table 13. Selected Prescription Medications That May Cause or Exacerbate HF

Drug or Therapeutic Class	Associated With HF		Magnitude of HF Induction or Precipitation	LOE for HF Induction or Precipitation	Possible Mechanism(s)	Onset
	Causes Direct Myocardial Toxicity	Exacerbates Underlying Myocardial Dysfunction				
COX, nonselective inhibitors (NSAIDs)		X	Major	B	Prostaglandin inhibition leading to sodium and water retention, increased systemic vascular resistance, and blunted response to diuretics	Immediate
COX, selective inhibitors (COX-2 inhibitors)		X	Major	B		
Thiazolidinediones		X	Major	A	Possible calcium channel blockade	Intermediate
Saxagliptin		X	Major	A	Unknown	Intermediate to delayed
Alogliptin		X	Major	A		
Flecainide		X	Major	A	Negative inotrope, proarrhythmic effects	Immediate to intermediate
Disopyramide		X	Major	B		
Sotalol		X	Major	A	Proarrhythmic properties, beta blockade	Immediate to intermediate
Dronedarone		X	Major	A	Negative inotrope	
Alpha-1 blockers						
Doxazosin		X	Moderate	B	Beta-1-receptor stimulation with increases in renin and aldosterone	Intermediate to delayed
Diltiazem		X	Major	B	Negative inotrope	Immediate to intermediate
Verapamil		X	Major	B		
Nifedipine		X	Moderate	C		

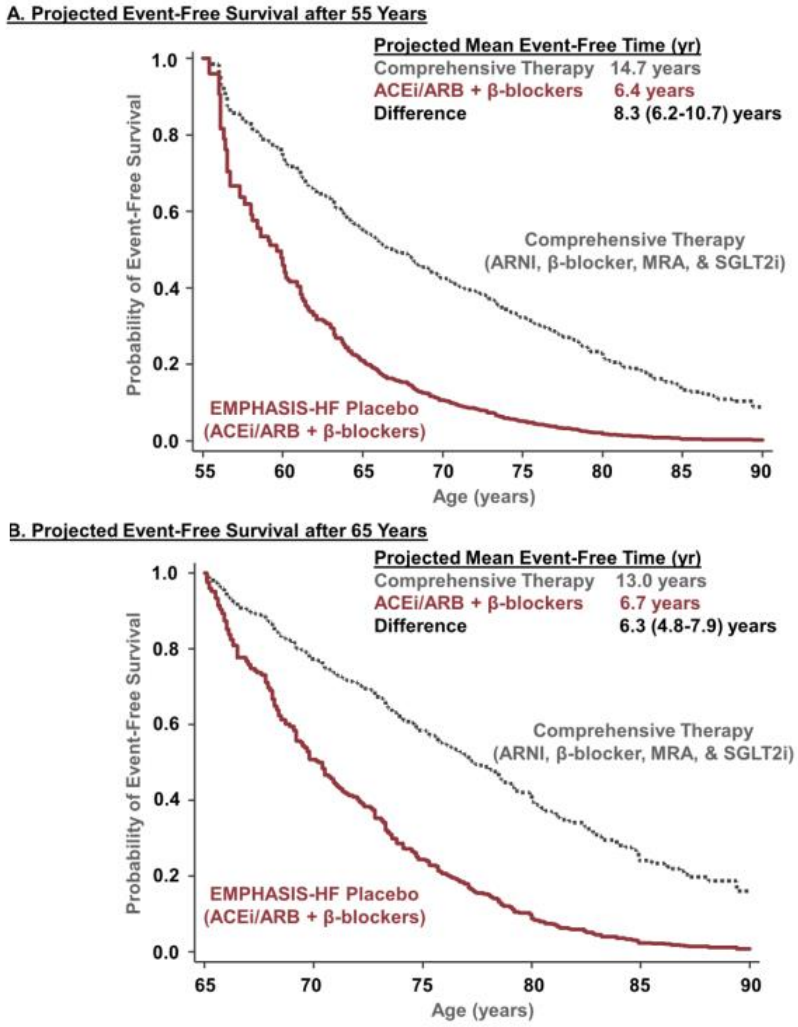
COX indicates cyclo-oxygenase; HF, heart failure; LOE, Level of Evidence; and NSAID, nonsteroidal anti-inflammatory drug.
Adapted from Page RL 2nd et al.[57]

Quadruple Therapy?

Figure 1.



Estimating lifetime benefits of comprehensive disease-modifying pharmacological therapies in patients with heart failure with reduced ejection fraction: a comparative analysis of three randomised controlled trials. Muthiah Vaduganathan



Benefits of Quadruple Therapy

Benefits of Simultaneous or Rapid Initiation of ARNi, BB, MRA, and SGLT2i for HFrEF Are Multifaceted

Benefits of Initiating ARNi+BB+MRA+SGLT2i as First-line Treatment for HFrEF Versus Drawn-out Historical Sequencing

- **Rapid improvement** in health status (within 1 to 8 weeks)[1]
- **Rapid improvement** in LVEF (within 12 weeks)[2]
- **Rapid reduction** in HF hospitalizations (within 2 to 4 weeks)
- **Rapid reduction** in HF rehospitalizations (within 2 to 4 weeks)[3]
- **Rapid reduction** in mortality (within 2 to 4 weeks)
- **Improved use**, adherence, persistence, overcoming inertia[4]

ARNi, angiotensin receptor-neprilysin inhibitor; BB, beta blocker; HF, heart failure; HFrEF, heart failure with reduced ejection fraction; LVEF, left ventricular ejection fraction; MRA, mineralocorticoid receptor antagonist; SGLT2i, sodium-glucose cotransporter-2 inhibitor.

1. Khariton Y, et al. *JACC Heart Fail*. 2019;7:933-944; 2. Desai AS, et al. *JAMA*. 2019;322(11):1077-1084; 3. Morrow DA, et al. *Circulation*. 2019;139:2285-2288; 4. Bhatt AS, et al. *Eur J Heart Fail*. 2020;22:313-314.

After Stabilization

After the patient has been **receiving OMT for ≥3 months**, the patient's response to therapy and its effects on cardiac remodeling should be evaluated by **repeating laboratory** (eg, BNP/NT-proBNP and basic metabolic panel) and **repeat echocardiogram** or other similar imaging modality for cardiac structure and function

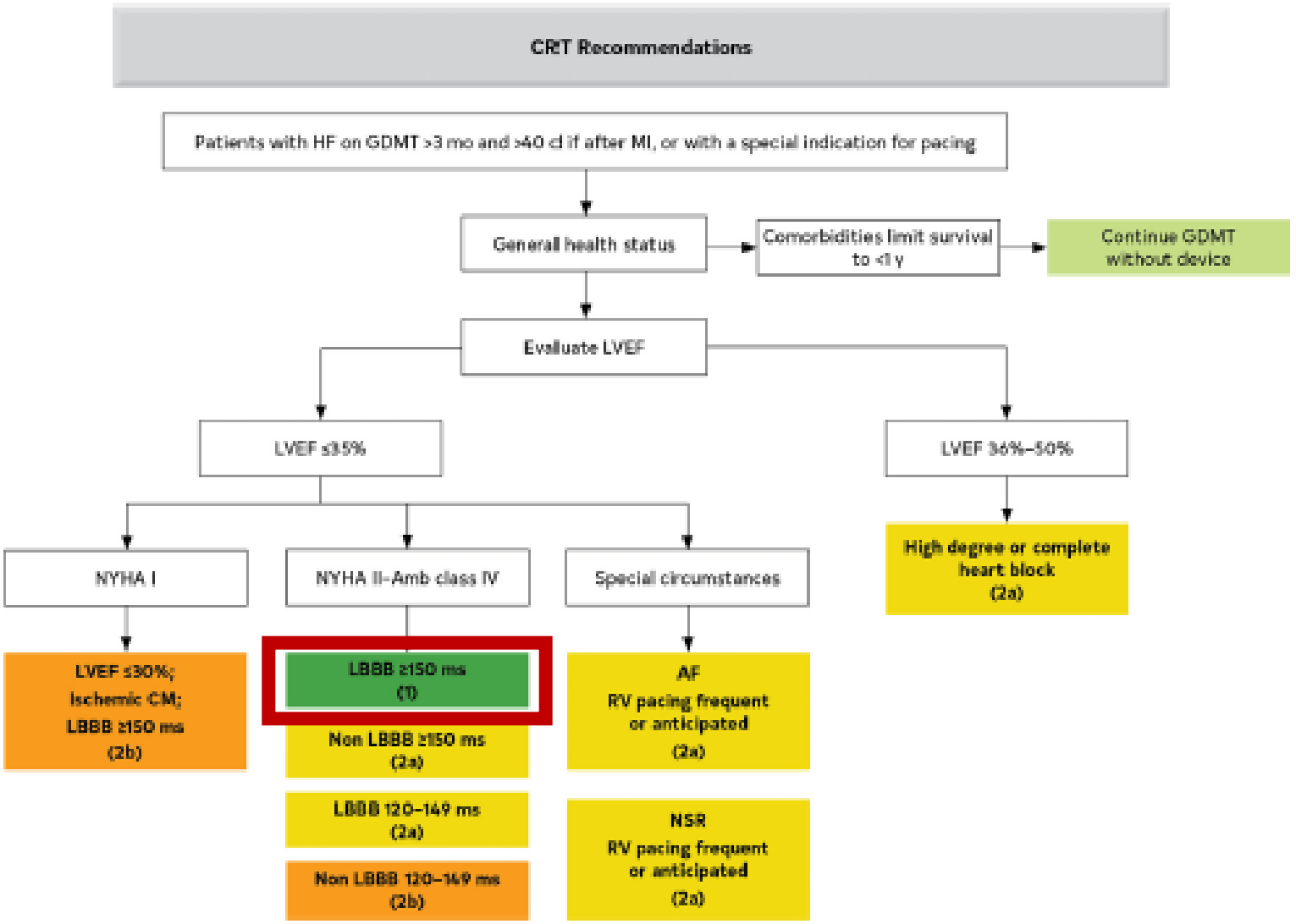
•Appropriate patients should be referred to an electrophysiologist for CRT or ICD therapy.

Devices Therapy

Indications for Device Therapy in Heart Failure

Implantable Cardioverter-Defibrillator (for primary prevention)
NYHA class II or III while taking guideline-directed medical therapy[a] *and*
Expectation of survival >1 year *and*
Either of the following:
Ischemic cardiomyopathy ≥40 days post MI or nonischemic cardiomyopathy with ejection fraction ≤35% (primary prevention)
History of hemodynamically significant ventricular arrhythmia or cardiac arrest (secondary prevention)
Biventricular Pacemaker (cardiac resynchronization therapy)
All of the following:
NYHA class II to IV
Ejection fraction ≤35%
On guideline-directed medical therapy
Ventricular dyssynchrony (LBBB with a QRS duration ≥150 msec)

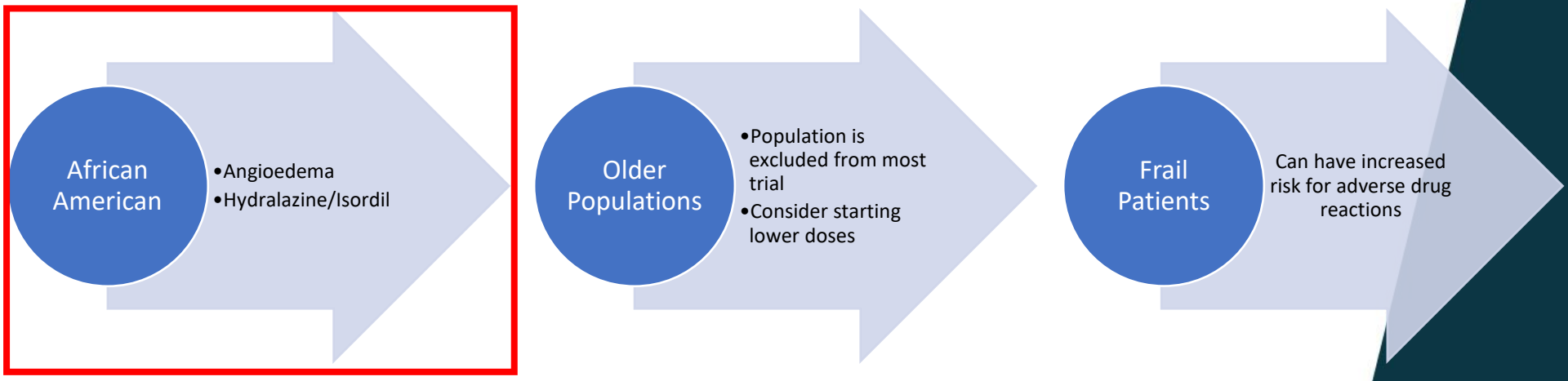
Cardiac Resynchronization Therapy (CRT) Recommended?



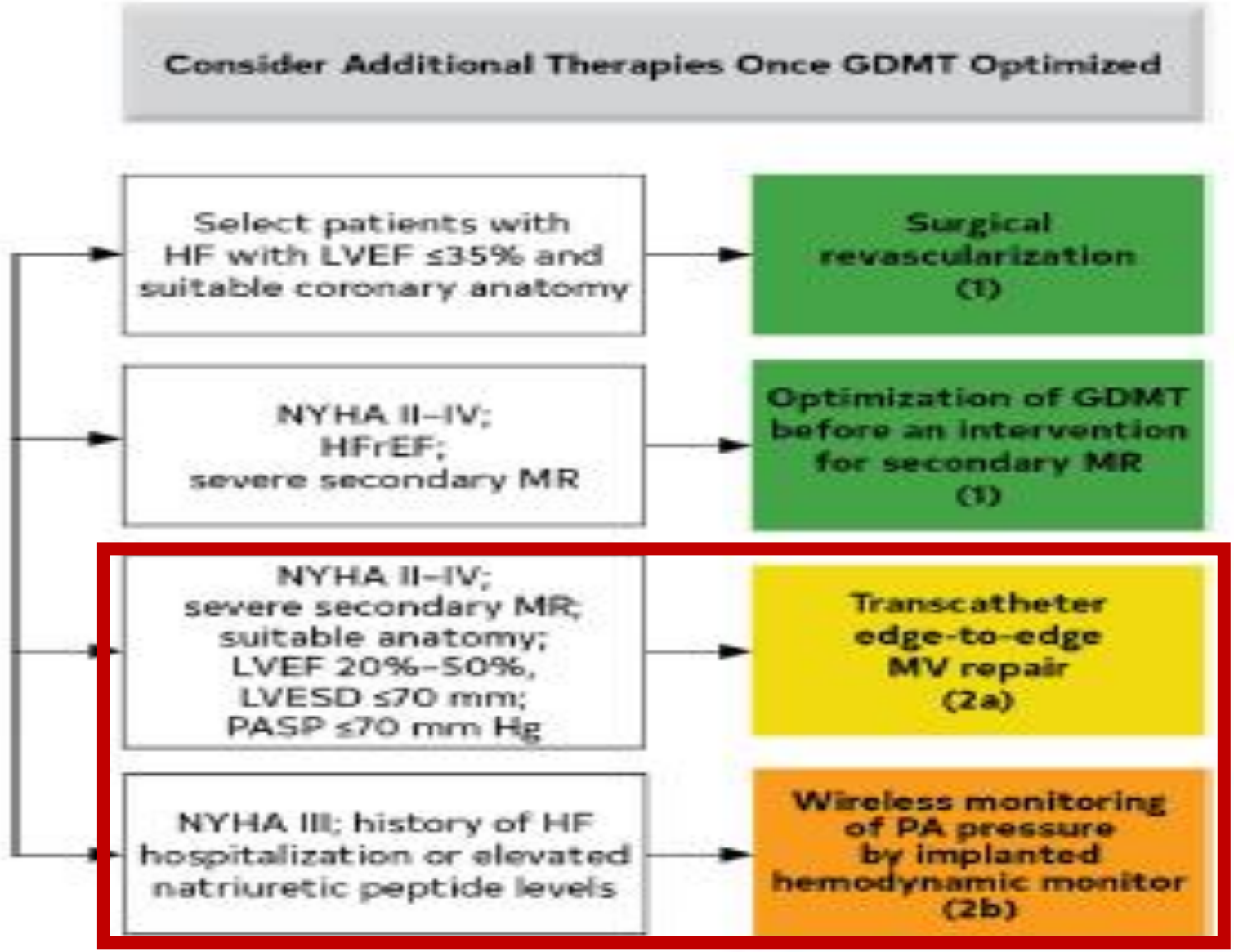
Challenges in Heart Failure Treatment

- Multiple Organs involvement
- High risk of hyperkalemia
- Lower systolic blood pressure
- High risk of medications side effects/intolerance
- Lower GFR
- Higher risk of worsening renal function

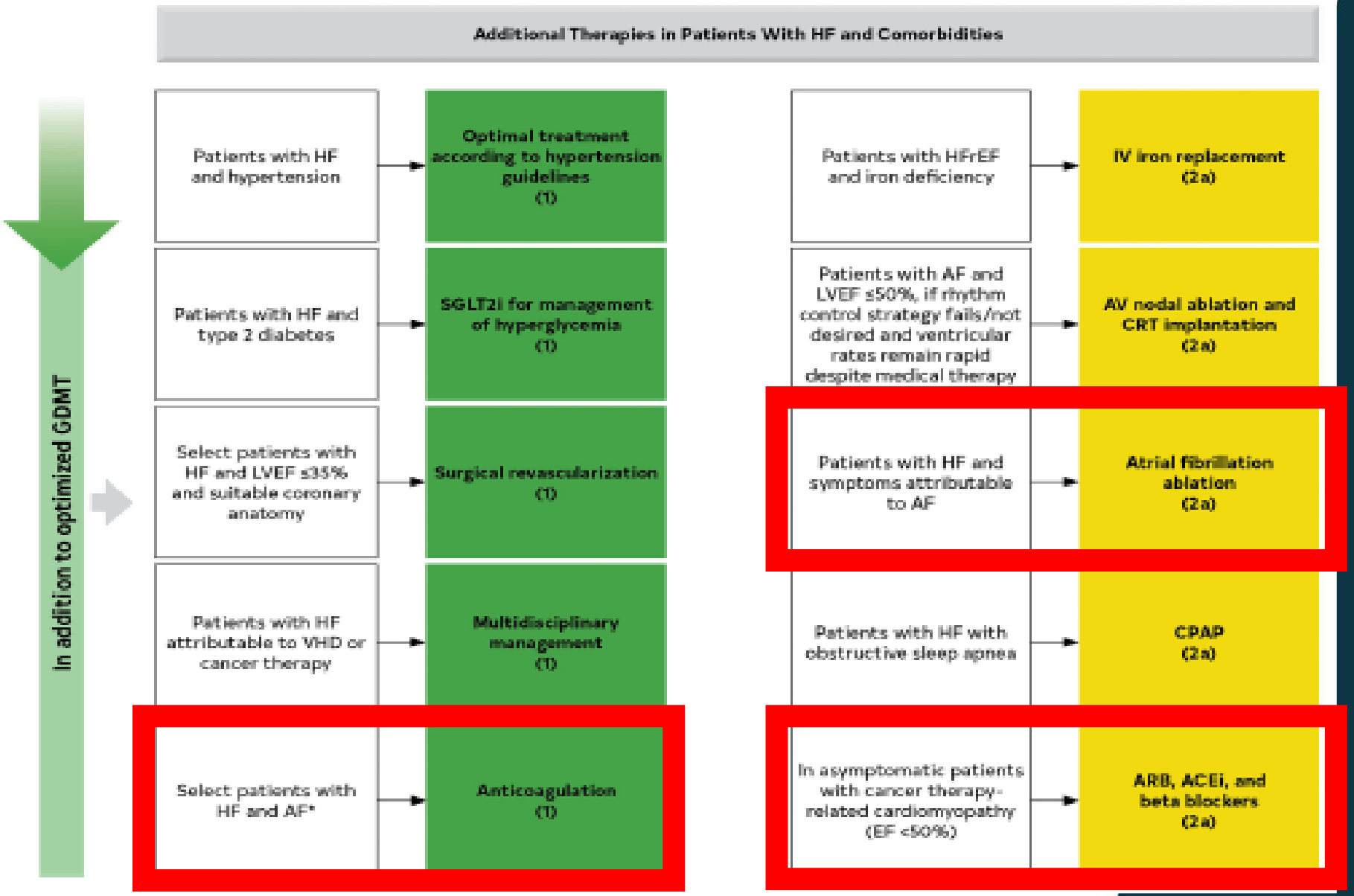
Specific Patients in HF care



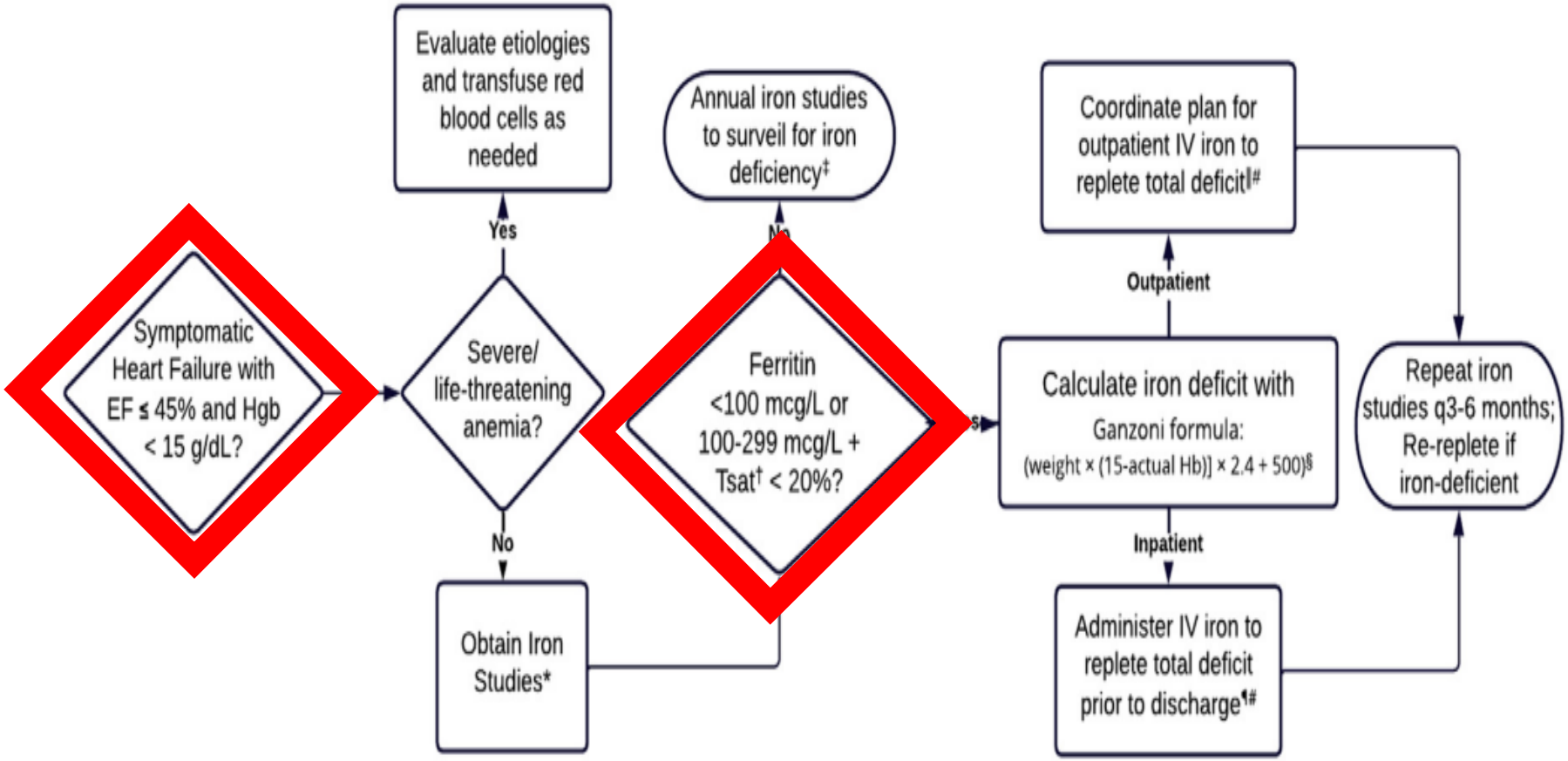
Additional Therapies



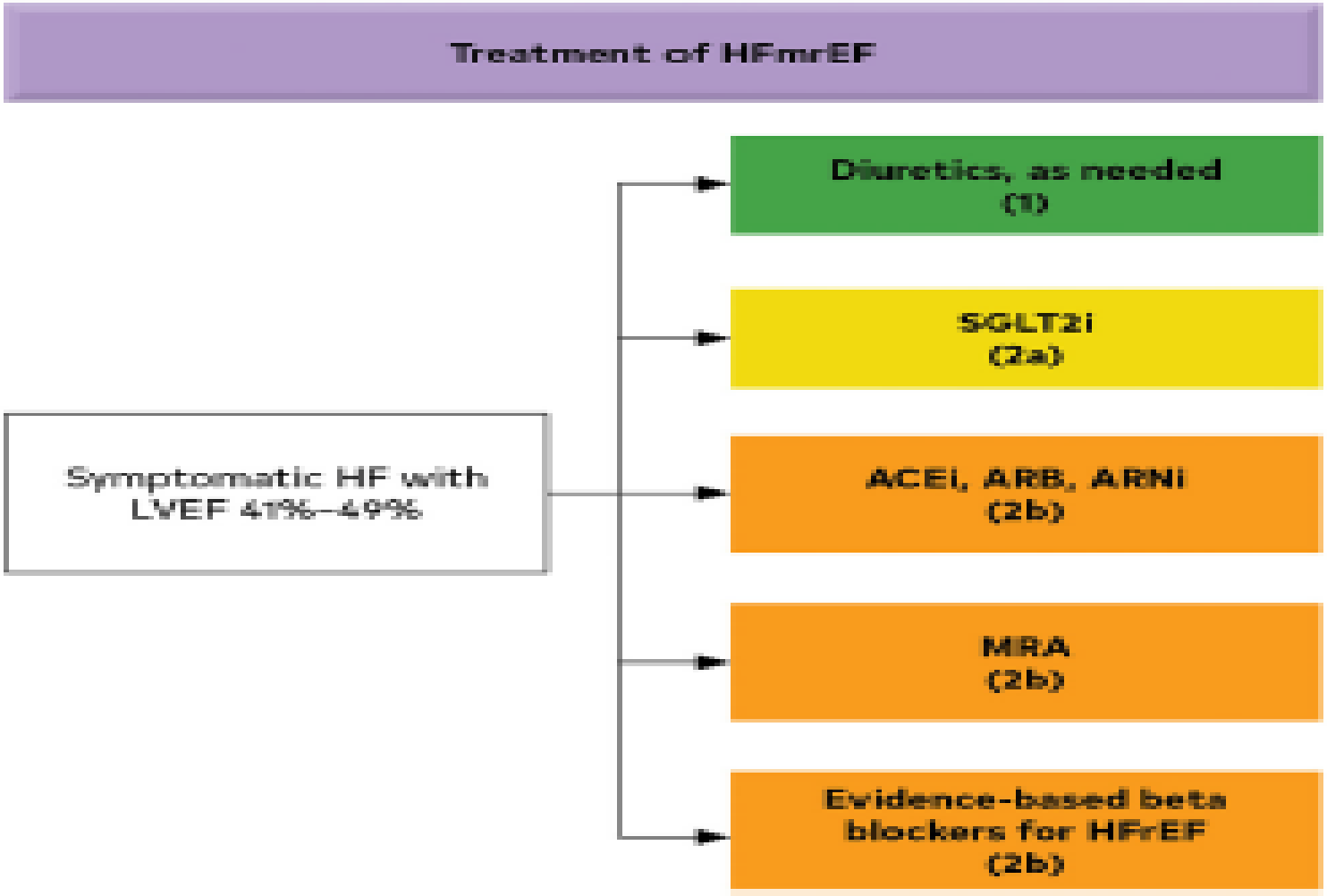
Comorbidities



Iron Deficiency Anemia in HF



HF with Mild Reduced Ejection Fraction Treatment



HF with Preserved Ejection Fraction Treatment

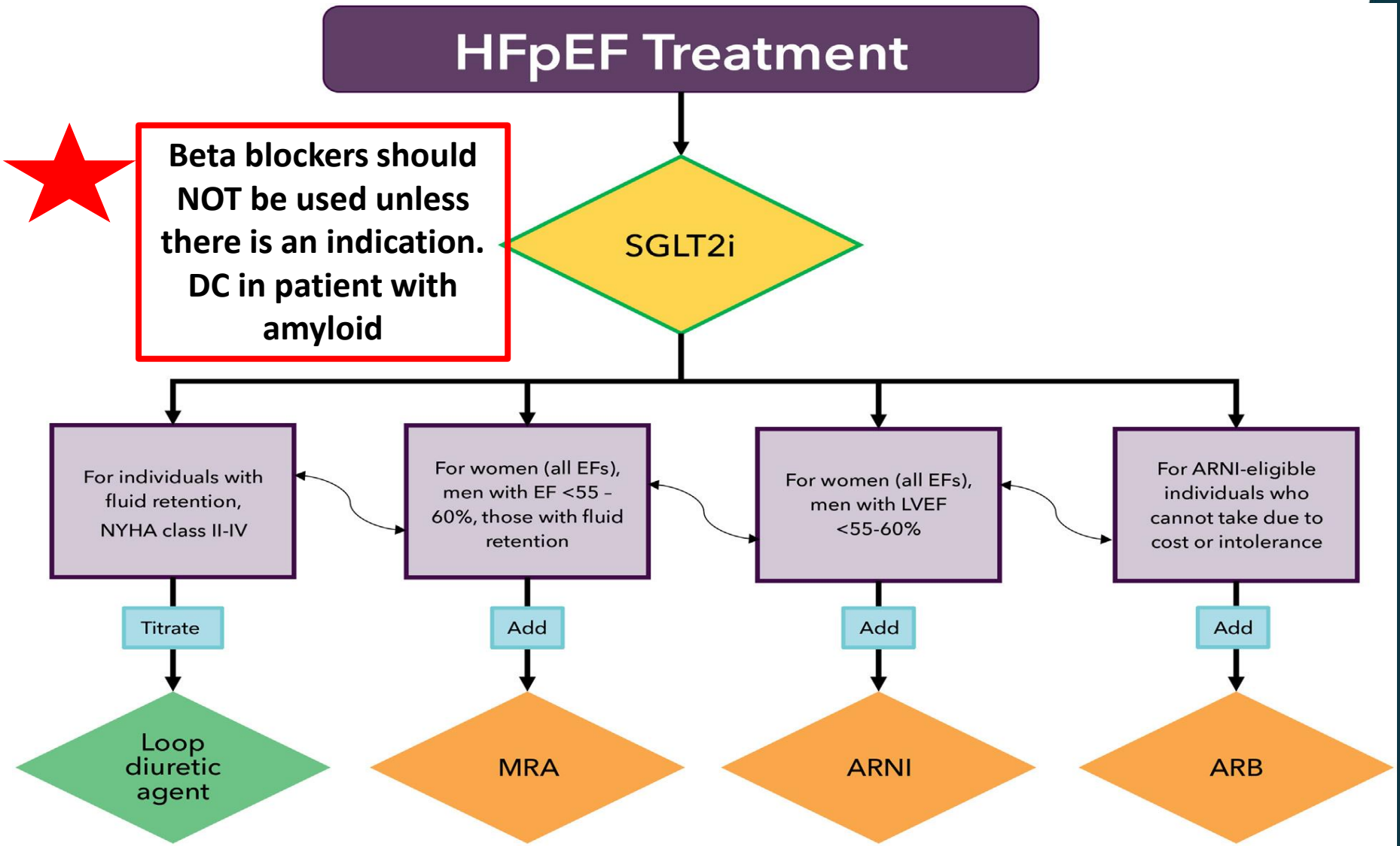
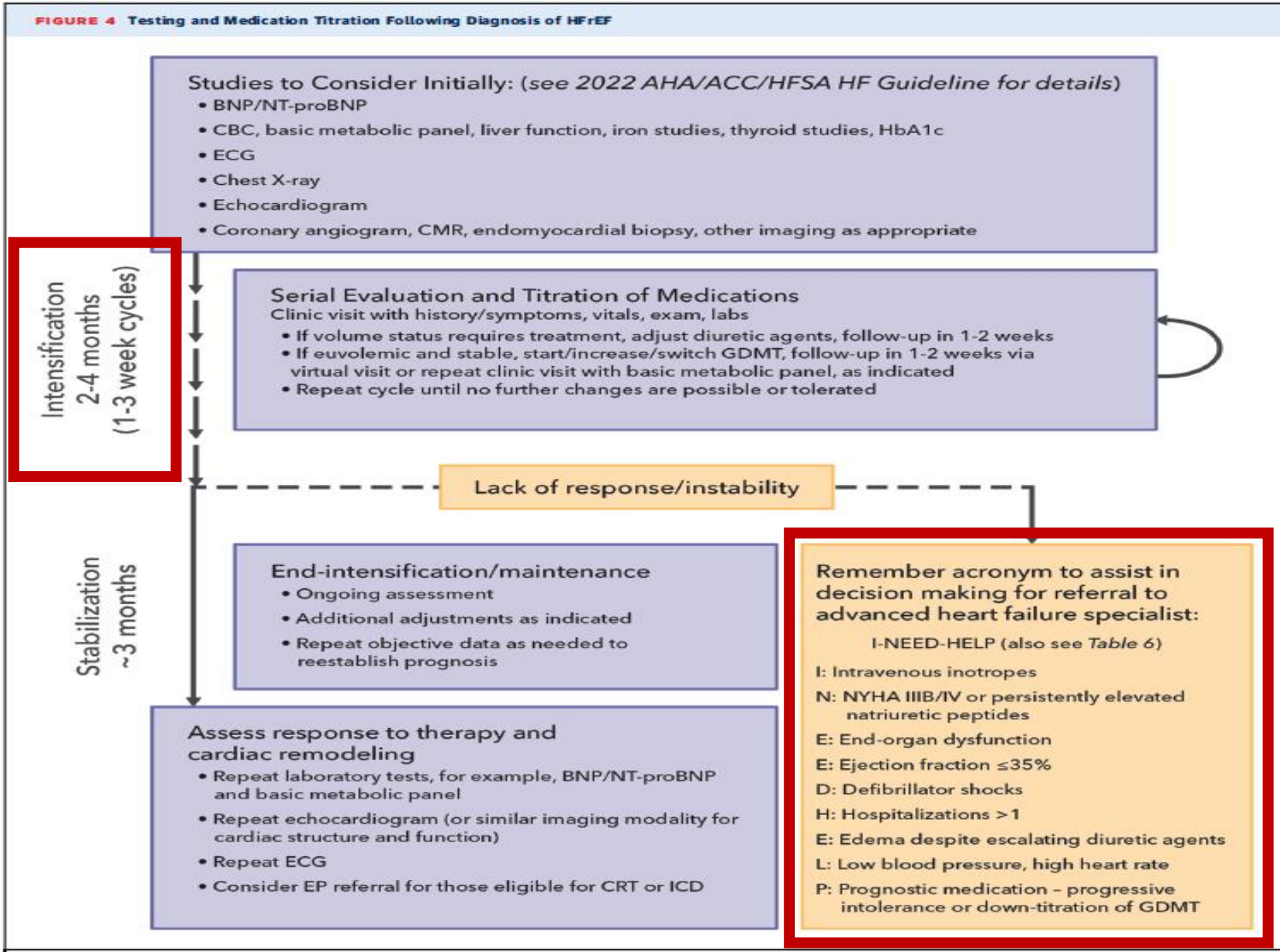


FIGURE 4 Testing and Medication Titration Following Diagnosis of HFrEF



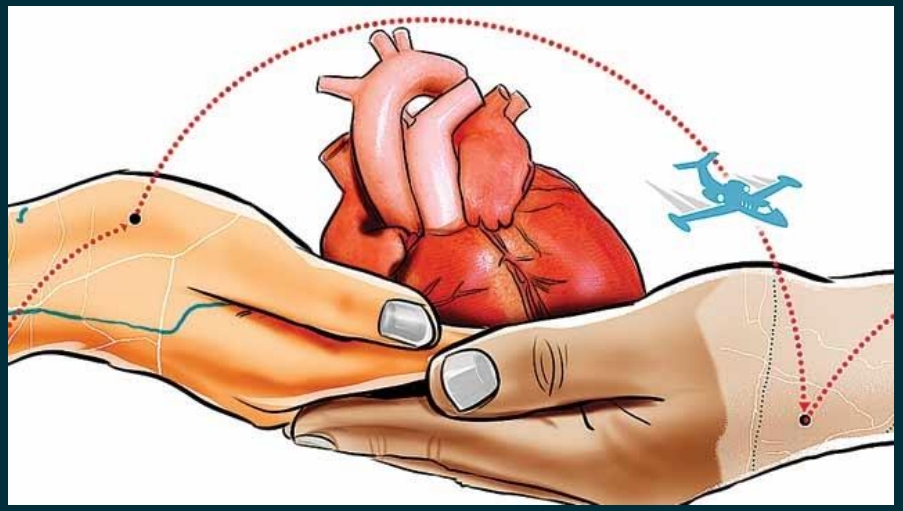
Advanced Refractory Heart Failure Therapies

Once patients have progressed to advanced heart failure, the therapeutic options are limited to **inotropic therapy, heart transplantation, mechanical circulatory support, and palliative care**.

Inotropic therapy does not decrease mortality and may actually increase it. The survival of inotropic-dependent patients is less than 10% at 1 year.

Left Assisted Ventricular Devices (LVADs)

Heart Transplant



Heart transplantation is the best option for patients with end-stage heart failure, with 50% survival rates approaching 13 years, but is limited by donor availability .

MONUMENT HEALTH

Palliative Care/Hospice Care

MONUMENT HEALTH

KEY POINTS

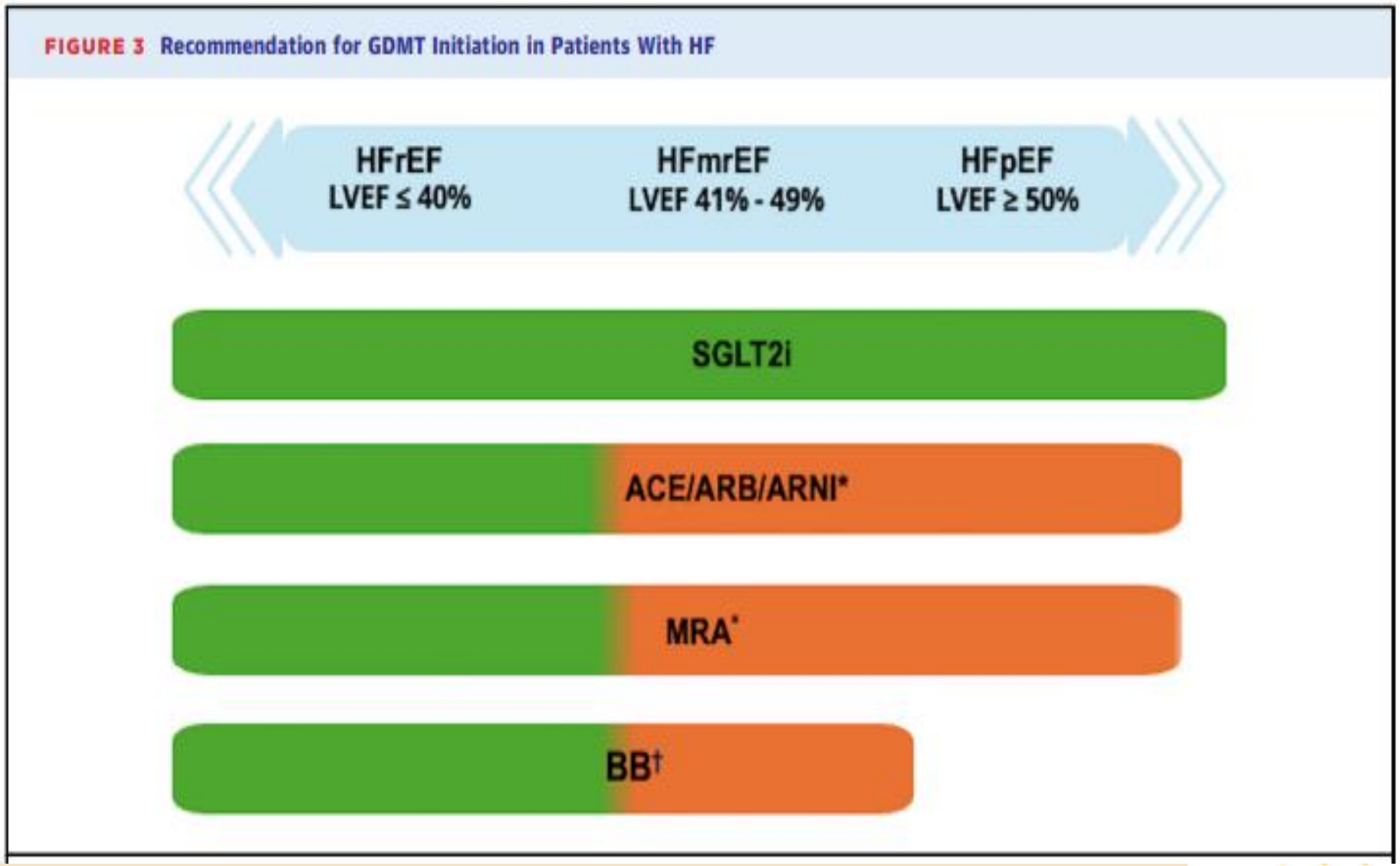


FIGURE 3 Recommendation for GDMT Initiation in Patients With HF
HFrEF
LVEF ≤ 40%
HFmrEF
LVEF 41% - 49%
HFpEF
LVEF ≥ 50%
SGLT2i
ACE/ARB/ARNI*
MRA*
BB†

Case # 1

64-year-old male with PMH of diabetes mellitus type 2 on insulin, HTN, hyperlipidemia, obesity, left bundle branch block, recently diagnosed systolic heart failure, NYHA III, Stage C. He was started on heart failure medical therapy on the first clinic visit (Sacubitril/valsartan 24/26 mg p.o. twice daily, empagliflozin 10 mg daily, Bumex 1 mg p.o. daily, spironolactone 25 mg p.o. daily and metoprolol XL 25 mg p.o. daily). He came back for blood work a week later and he reported that he was feeling very sick complaining of lightheadedness, dizziness, and he can barely ambulate. BP 98/60mmHg What is the next step?

A. Discontinue medications but keep bumetanide
B. Reassure patient that these side effects are normal, and he will have to continue with this the rest of his life
C. Review medications and decrease doses appropriately.
D. Increase all his medication to the next dose.

Case # 2

70-year-old female with PMH of obesity, left bundle branch block, presented to clinic with a new diagnosis of acute on chronic systolic heart failure and recent Covid infection 2 months ago. Her previous EF was 65% -> 37%. Symptoms: SOB associated with bilateral leg edema and weight gain. Current medical therapy is furosemide 40 mg p.o. twice a day which apparently has improved her symptoms.

A. No changes on her medications since she is doing better
B. Start patient on metoprolol and losartan
C. Start patient on losartan only
D. Start patient on metoprolol, SGLT-2, ARNI and aldactone

Case # 3

68F with PMH of hypertension, hyperlipidemia, pre-diabetes (HbA1c 6.3%), obesity, ex-smoker of 20 years that quit 10 years ago, drinks alcohol 5-10 drinks/week. Recent stress test last year was normal. She presents with dyspnea on exertion the last 6 months, ankle edema, 5-10# weight gain, and mild orthopnea. No recent hospitalizations. BP 131/74, HR 72, RR 18, O2 sat 95% RA, weight: 204 lbs. CBC, iron studies, CMP, TSH, PFTs, lipids are unremarkable. CXR does show mild cardiomegaly with small pleural effusions. EKG SR with LVH. Echo show EF of 52%, grade II diastolic dysfunction with elevated LV filling pressures. On Lisinopril 10 mg daily, Lasix 80 mg po daily and rosuvastatin 20 mg daily.

According to the AHA/ACC/HFSA guidelines, which GDMT could be considered for this patient? Select all that apply?

A. Beta blockers

B. ACE/ARB/ARNI

C. MRA

D. SGLT2i

E. Add more diuretics

Case # 4

83 yo male with PMH central sleep apnea, grade 2 diastolic abnormality, bradycardia requiring pacemaker, bilateral carpal tunnel, knee surgery, back surgery. Present with history of sudden onset DOE not improved following cardioversion. Currently treated with lasix for possible congestion on CXR at time of cardioversion. BNP 670. Empagliflozin added per clinical pharmacist. BP 112/64, HR 52, Sat 93%, Wt 242 lb, volume overloaded. Amyloid evaluation ordered, diuretic increased, Spironolactone added, continue metoprolol. Results: AL amyloid test negative, PYP scan positive for cardiac amyloid. Genetic testing: negative for hereditary amyloidosis

What is the recommended treatment?

A. Refer to oncology for further evaluation and management
B. Continue current GDMT optimization
C. Start Tafamidis and continue current GDMT
D. Start Tafamidis, continue empagliflozin and spironolactone but discontinue Metoprolol succinate

MONUMENT HEALTH

HEART AND VASCULAR INSTITUTE

Heart Failure Extinguisher TEAM!

American Heart Association. Get With The Guidelines. Heart Failure

2025 HOSPITAL RECOGNITION CRITERIA

(based on 2024 data)

American Heart Association. Target: HF™

BRONZE

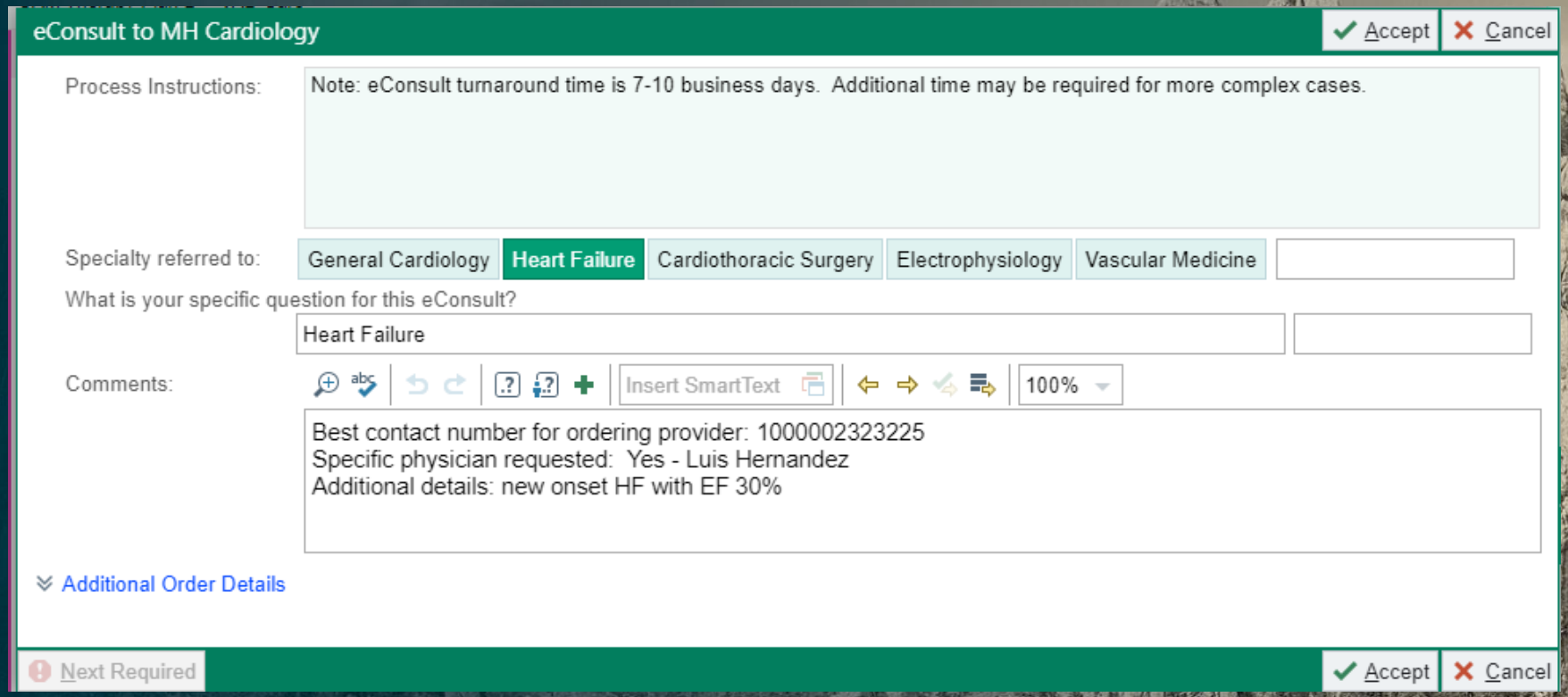
HFSA HEART FAILURE SOCIETY OF AMERICA

OMT-HF Optimal Medical Therapy in Heart Failure Certificate Program

Setting the standard in heart failure care.

Increasing Access!

Order: E-Consult to MH Cardiology



MONUMENT HEALTH


That's all Folks!