OPTIMAL HEART FAILURE MANAGEMENT FOR THE HOSPITALIST

Erwin Argueta MD
Assistant Professor TTUHSC
Advanced Heart Failure and Transplant Cardiology

Objectives

DEFINE THE CLINICAL PRESENTATION OF HEART FAILURE

IDENTIFY HEART FAILURE MEDICATIONS COMMONLY USED

CREATE MANAGEMENT GOALS FOR THE HEART FAILURE PATIENT

CHF: Epidemiology

Leading cause of Hospitalized Medicare beneficiaries.

Estimated 5 year mortality is 50%.

Prevalence is expected to increase due to:

- Population aging.
- Improved survival with other cardiovascular conditions.
- Impact of current therapy.
- Increased prevalence of obesity, DM, metabolic syndrome.
- Better recognition of heart failure

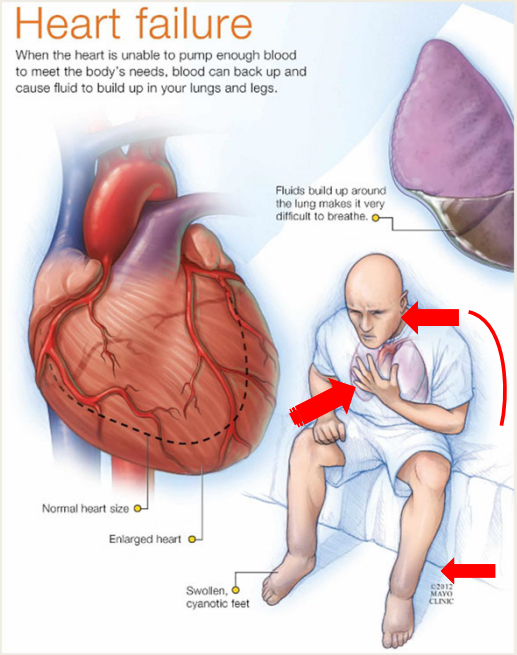
Major Clinical Risk Factors for Developing Heart Failure

- Age, Male Sex
- Hypertension
- Myocardial infarction (tobacco use, hyperlipidemia)
- Diabetes Mellitus
- Valvular Heart Disease
- Obesity

- These are targets for prevention.

Clinical presentations of heart failure

- The heart is unable to keep up with the metabolic demands of the body.
  - *Congestive symptoms (CHF)*
    - Most common presentation seen
    - Due to acute on chronic disease
  - *New onset heart failure due to a direct cardiac insult*
    - Myocardial infarction, myocarditis, trauma, psychological stress (Takotsubo CMP)
  - *Cardiogenic shock*
  - *Sudden cardiac death*
- (It is important to consider lung pathology in the differential for dyspnea and or edema on initial assessment i.e. PAH)



Distinction in CHF subtypes

- EDV (ml) - ESV (ml)/ EDV (ml) X 100 = LV EF (%)
  - *Estimated by echocardiography, nuclear scans, invasive angiography, cardiac MRI.*

What type (phenotype) of heart failure?

- HFpEF/HFrEF (50/50)
  - *Caution with pulmonary arterial hypertension*

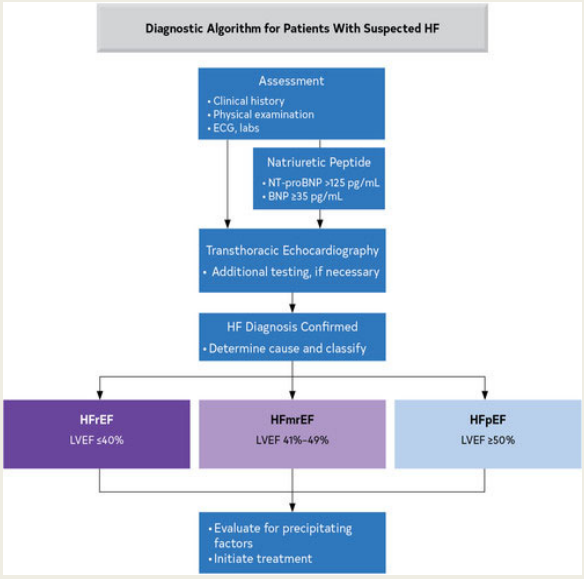
Distinction in CHF subtypes

Table 4. Classification of HF by LVEF (Table view)

Type of HF According to LVEF	Criteria
HFrEF (HF with reduced EF)	LVEF ≤40%
HFimpEF (HF with improved EF)	Previous LVEF ≤40% and a follow-up measurement of LVEF >40%
HFmrEF (HF with mildly reduced EF)	LVEF 41%–49% Evidence of spontaneous or provokable increased LV filling pressures (eg, elevated natriuretic peptide, noninvasive and invasive hemodynamic measurement)
HFpEF (HF with preserved EF)	LVEF ≥50% Evidence of spontaneous or provokable increased LV filling pressures (eg, elevated natriuretic peptide, noninvasive and invasive hemodynamic measurement)

2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Circulation. 2022;145:e1033



Paul A. Heidenreich. Circulation. 2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines, Volume: 145, Issue: 18, Pages: e895-e1032, DOI: (10.1161/CIR.0000000000001063)

Identifying Stages of Heart Failure (ACC/AHA)

- Stage A – At risk of heart failure, but without structural heart disease
- Stage B – Structural heart disease but without signs or symptoms of heart failure
- Stage C – Structural heart disease with prior or current heart failure symptoms
- Stage D – Refractory heart failure, requiring specialized intervention.

- These will help in identifying appropriate strategies for management.

Stage C

- Identify triggers
  - *Arrhythmias.*
  - *Avoid NSAIDs*
  - *Avoid CCB (amlodipine is neutral)*
  - *Medication adherence*

Recommendations for Assessment of Patients Hospitalized With Decompensated HF

COR	LOE	Recommendations
1	C-LD	1. In patients hospitalized with HF, severity of congestion and adequacy of perfusion should be assessed to guide triage and initial therapy.[1–5]
1	C-LD	2. In patients hospitalized with HF, the common precipitating factors and the overall patient trajectory should be assessed to guide appropriate therapy.[5,6]
Goals for Optimization and Continuation of GDMT		
1	C-LD	3. For patients admitted with HF, treatment should address reversible factors, establish optimal volume status, and advance GDMT toward targets for outpatient therapy.[6]

2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Circulation. 2022;145:e1033

HEART FAILURE WITH REDUCED EJECTION FRACTION

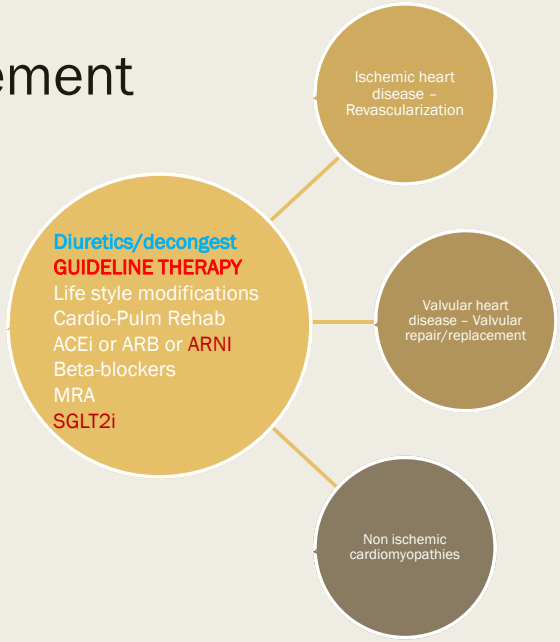
Why is the heart so weak?

- Causes of systolic heart failure (HFrEF) are important to identify for treatment/management:
  - *Ischemic heart disease*
    - CAD associated to risk factors: Tobacco, HTN, Age, gender
  - *Non ischemic cardiomyopathy*
    - HTN
    - Valvular heart disease
    - Cardiotoxins (cocaine, methamphetamines, chemotherapy)
    - Endocrine/Metabolic (thyroid disorders, pheochromocytoma)
    - Infiltrative cardiomyopathy
    - Peripartum cardiomyopathy
    - Myocarditis
    - Familial or inherited disease
    - Rhythm related cardiomyopathy (frequent RV pacing, tachycardia mediated)

Toxic Risk Precipitants

- Chemotherapy
  - *Anthracyclines, cyclophosphamide, 5 FU, trastazumab*
- Cocaine, NSAIDS
- Thiazolidinediones
- Doxazosin
- Alcohol

Management



Recommendations for Diuretics and Decongestion Strategies in Patients With HF

Referenced studies that support the recommendations are summarized in the Online Data Supplements.

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]

2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Circulation. 2022;145:e1033

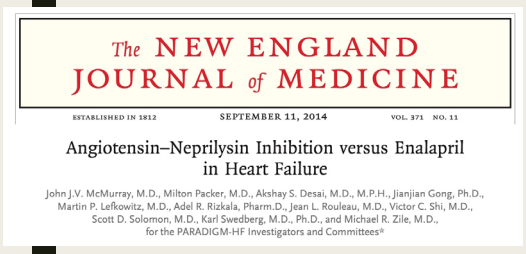
Table 12. Commonly Used Oral Diuretics in Treatment of Congestion for Chronic HF

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

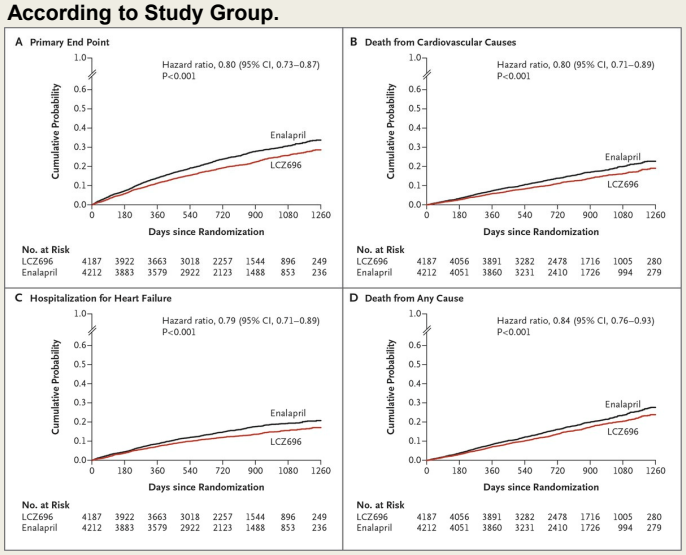
HF indicates heart failure.

2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Circulation. 2022;145:e1033



Kaplan–Meier Curves for Key Study Outcomes, According to Study Group.



McMurray JJ et al. N Engl J Med 2014;371:993-1004.A

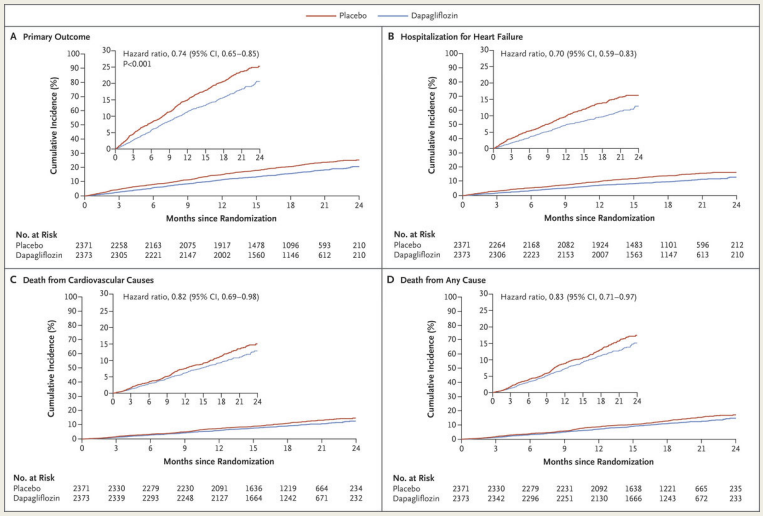
Cardiovascular Outcomes.

The NEW ENGLAND JOURNAL of MEDICINE

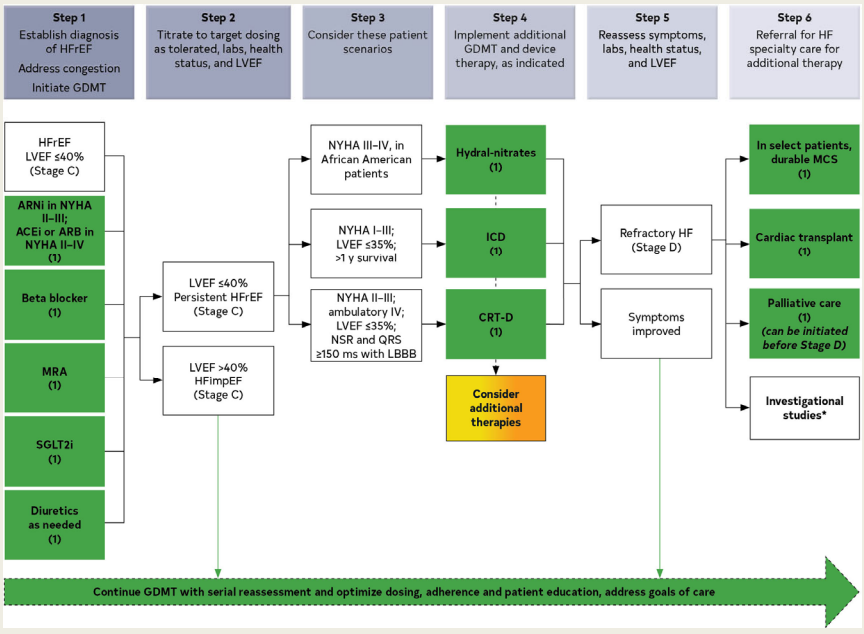
ESTABLISHED IN 1812 NOVEMBER 21, 2019 VOL. 381 NO. 21

Dapagliflozin in Patients with Heart Failure and Reduced Ejection Fraction

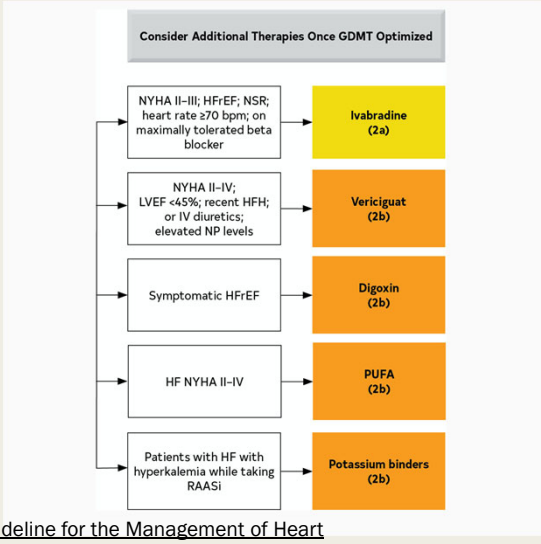
J.J.V. McMurray, S.D. Solomon, S.E. Inzucchi, L. Køber, M.N. Kosiborod, F.A. Martinez, P. Ponikowski, M.S. Sabatine, I.S. Anand, J. Bělohlávek, M. Böhm, C.-E. Chiang, V.K. Chopra, R.A. de Boer, A.S. Desai, M. Diez, J. Drozdz, A. Dukát, J. Ge, J.G. Howlett, T. Katova, M. Kitakaze, C.E.A. Ljungman, B. Merkely, J.C. Nicolau, E. O'Meara, M.C. Petrie, P.N. Vinh, M. Schou, S. Tereshchenko, S. Verma, C. Held, D.L. DeMets, K.F. Docherty, P.S. Jhund, O. Bengtsson, M. Sjöstrand, and A.-M. Langkilde, for the DAPA-HF Trial Committees and Investigators*



JJ McMurray et al. N Engl J Med 2019;381:1995-2008.



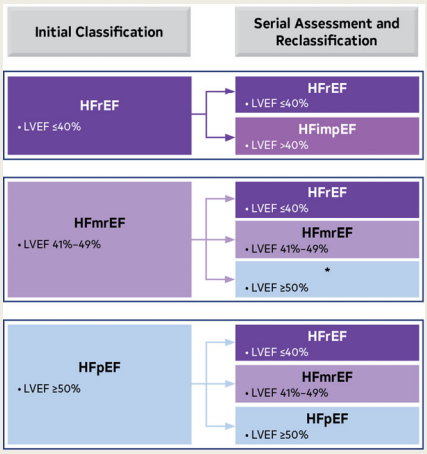
2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. Circulation. 2022;145:e1033



2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Circulation. 2022;145:e1033

CHF subtypes with serial assessment



2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Circulation. 2022;145:e1033

Recommendations for Drugs of Unproven Value or Drugs That May Worsen HF

Referenced studies that support the recommendations are summarized in the Online Data Supplements.

COR	LOE	Recommendations
3: No Benefit	A	1. In patients with HFrEF, dihydropyridine calcium channel-blocking drugs are not recommended treatment for HF.[1,2]
3: No Benefit	B-R	2. In patients with HFrEF, vitamins, nutritional supplements, and hormonal therapy are not recommended other than to correct specific deficiencies.[3–9]
3: Harm	A	3. In patients with HFrEF, nondihydropyridine calcium channel-blocking drugs are not recommended.[10–13]
3: Harm	A	4. In patients with HFrEF, class IC antiarrhythmic medications and dronedarone may increase the risk of mortality.[14–16]
3: Harm	A	5. In patients with HFrEF, thiazolidinediones increase the risk of worsening HF symptoms and hospitalizations.[17–21]
3: Harm	B-R	6. In patients with type 2 diabetes and high cardiovascular risk, the dipeptidyl peptidase-4 (DPP-4) inhibitors saxagliptin and alogliptin increase the risk of HF hospitalization and should be avoided in patients with HF.[22–24]
3: Harm	B-NR	7. In patients with HFrEF, NSAIDs worsen HF symptoms and should be avoided or withdrawn whenever possible.[25–28]

2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Circulation. 2022;145:e1033

Implantable defibrillator (ICD)

Primary prevention of sudden death					
MADIT	1996	196	Prior MI+LVEF ≤35%+NSVT+inducible nonsuppressible sustained VT/VF on electrophysiological (EP) testing Timing: >3 wk post-MI >2 mo post-CABG >3 mo post-PTCA	Defibrillator vs conventional medical therapy	0.46 (*P*=0.009)
MUSTT	1999	704	CAD+LVEF ≤40%+Asymptomatic NSVT+Inducible sustained ventricular tachyarrhythmia Timing: 34 days post-MI or revascularization	EP-guided therapy with AADs or defibrillator or no AA therapy	0.40 (*P*<0.001)
MADIT II	2002	1232	Prior MI+LVEF ≤30% Timing: >1 mo post-MI >3 mo postrevascularization	Defibrillator vs conventional medical therapy	0.69 (*P*=0.02)
DEFINITE	2004	458	Nonischemic cardiomyopathy LVEF< 36%+PVC or NSVT	Defibrillator+standard medical therapy vs medical therapy alone	0.65 (*P*=0.08)
SCDHeFT	2005	2521	NYHA FC II-III+LVEF ≤35% Timing: >3 mo heart failure	Defibrillator vs amiodarone vs Placebo	0.77 (*P*=0.007)
DANISH	2016	1116	Nonischemic cardiomyopathy LVEF ≤35%+NYHA class II or III, or NYHA class IV if CRT was planned+NT-pro BNP>200 pg/ml Timing: After reaching target doses of optimal medical therapy	Defibrillator vs standard care CRT received in 58% in both groups	0.87 (*P*=0.28)

Hussein AA et al. Circ Res. 2019;124:1584-1597

Recommendations for Maintenance or Optimization of GDMT During Hospitalization

Referenced studies that support the recommendations are summarized in the Online Data Supplements.

COR	LOE	Recommendations
1	B-NR	1. In patients with HFrEF requiring hospitalization, preexisting GDMT should be continued and optimized to improve outcomes, unless contraindicated.[1–5]
1	B-NR	2. In patients experiencing mild decrease of renal function or asymptomatic reduction of blood pressure during HF hospitalization, diuresis and other GDMT should not routinely be discontinued.[6–11]
1	B-NR	3. In patients with HFrEF, GDMT should be initiated during hospitalization after clinical stability is achieved.[2,3,5,12–18]
1	B-NR	4. In patients with HFrEF, if discontinuation of GDMT is necessary during hospitalization, it should be reinitiated and further optimized as soon as possible.[19–22]

2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Circulation. 2022;145:e1033

Refractory HF Requiring Specialized Interventions (Stage D)/Advanced Heart Failure

- When no additional therapy can be added.
  - *Low blood pressure*
  - *End organ disfunction*
    - Congestive hepatopathy
    - Cardiorenal syndrome
  - *Cachexia*
  - *Frequent hospitalizations*
- Inotropic medications
  - *In evidence of shock (IIB)*
- Mechanical circulatory support
  - *Temporary (IABP, ECMO)*
  - *LVAD (DT, Bridge to OHT)*
- Orthotopic heart transplantation
- If the patient is not a candidate for the above, hospice should be considered.

I NEED HELP

- I, Intravenous inotropes
- N, New York Heart Association (NYHA) class IIIB to IV or persistently elevated natriuretic peptides
- E, End-organ dysfunction
- E, EF ≤35%
- D, Defibrillator shocks
- H, Hospitalizations >1
- E, Edema despite escalating diuretics
- L, Low systolic BP ≤90, high heart rate
- P, Prognostic medication; progressive intolerance or down-titration of GDMT

Recommendations for Inotropic Support

Referenced studies that support the recommendations are summarized in the Online Data Supplements.

COR	LOE	Recommendations
2a	B-NR	1. In patients with advanced (stage D) HF refractory to GDMT and device therapy who are eligible for and awaiting MCS or cardiac transplantation, continuous intravenous inotropic support is reasonable as "bridge therapy."[1-4]
2b	B-NR	2. In select patients with stage D HF, despite optimal GDMT and device therapy who are ineligible for either MCS or cardiac transplantation, continuous intravenous inotropic support may be considered as palliative therapy for symptom control and improvement in functional status.[5-7]
3: Harm	B-R	3. In patients with HF, long-term use of either continuous or intermittent intravenous inotropic agents, for reasons other than palliative care or as a bridge to advanced therapies, is potentially harmful.[5,6,8-11]

2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Circulation. 2022;145:e1033

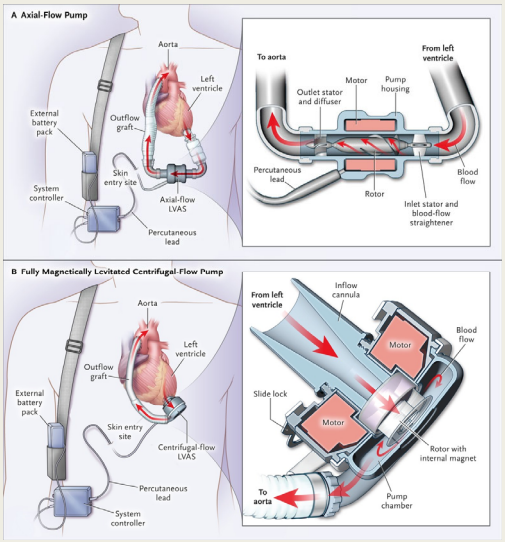
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

A Fully Magnetically Levitated Circulatory Pump for Advanced Heart Failure

Mandeep R. Mehra, M.D., Yoshifumi Naka, M.D., Nir Uriel, M.D., Daniel J. Goldstein, M.D., Joseph C. Cleveland, Jr., M.D., Paolo C. Colombo, M.D., Mary N. Walsh, M.D., Carmelo A. Milano, M.D., Chetan B. Patel, M.D., Ulrich P. Jorde, M.D., Francis D. Pagani, M.D., Keith D. Aaronson, M.D., David A. Dean, M.D., Kelly McCants, M.D., Akinobu Itoh, M.D., Gregory A. Ewald, M.D., Douglas Horstmanshof, M.D., James W. Long, M.D., and Christopher Salerno, M.D., for the MOMENTUM 3 Investigators*

Diagrams of the Axial-Flow Pump and the Centrifugal-Flow Pump.



Mehra MR et al. N Engl J Med 2017;376:440-450.

The NEW ENGLAND JOURNAL of MEDICINE

HEART FAILURE WITH PRESERVED EJECTION FRACTION

HFpEF

- In the setting of a normal LV EF and heart failure symptoms consider the following conditions:
  - *Myocardial infarction*
  - *Pulmonary arterial hypertension*
  - *Pulmonary embolism*
  - *Infiltrative cardiomyopathies*
  - *Valvular heart disease*
  - *Constrictive pericarditis*
  - *Hypertrophic cardiomyopathy*

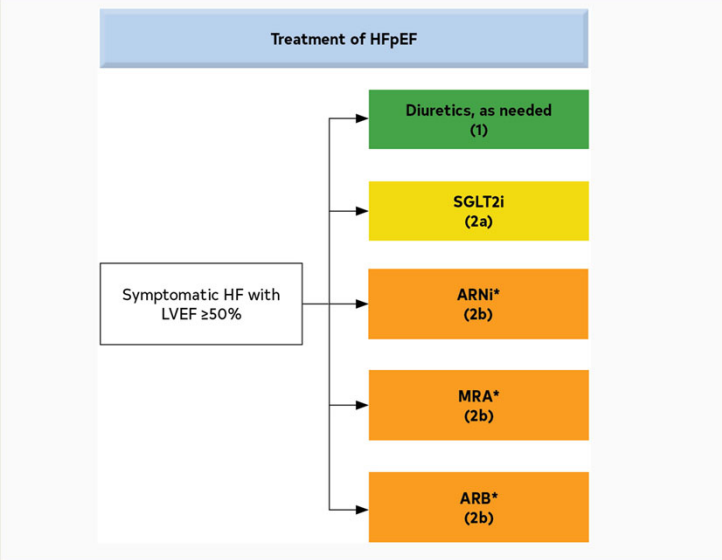
Recommendations for HF With Preserved Ejection Fraction*Referenced studies that support the recommendations are summarized in the Online Data Supplements.

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]

*See Section 7.2, "Diuretics and Decongestion Strategies in Patients with HF," and Section 10.2, "Management of Atrial Fibrillation (AF) in HF" for recommendations for use of diuretics and management of AF in HF.

2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Circulation. 2022;145:e1033



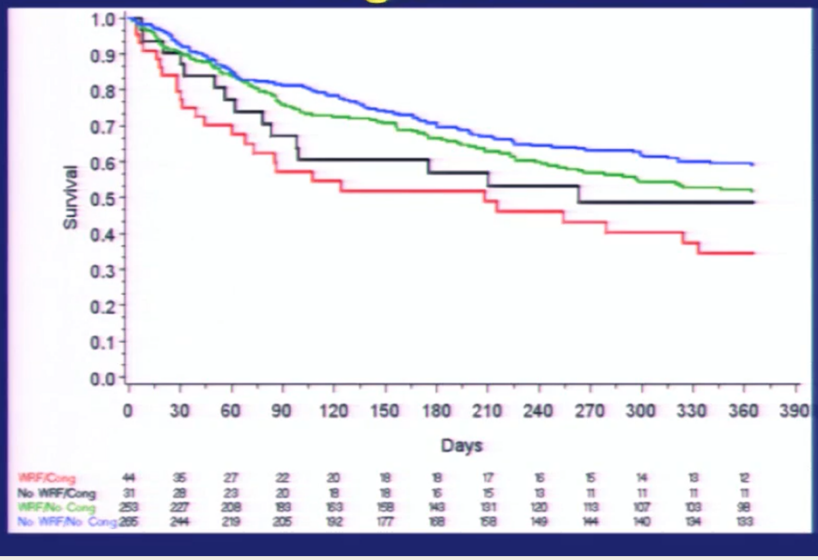
2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Circulation. 2022;145:e1033

Biomarkers

- Natriuretic peptides
  - *Diagnosis*
    - NT-proBNP can be used when there is uncertainty in the diagnosis.
  - *Monitoring of therapy*
    - Surrogate for "PCWP"
      - *BNP does not always correlate with PCWP in chronic heart failure.*
      - *Baseline BNP levels never decrease regardless of treatment.*
    - Discharge monitoring
      - *BNP <250 pg/ml lower readmissions*
- Troponin
  - *Positive troponin in the setting of ADHF has no clear role in management strategies.*
  - *Represents a higher risk population.*

Trade Offs: WRF vs Persistent Congestion?



Metra M et al. Circ Heart Fail 2012;5:54-62

Implantable PA monitoring

Wireless pulmonary artery haemodynamic monitoring in chronic heart failure: a randomised controlled trial

*William T Abraham, Philip B Adamson, Robert C Bourge, Mark F Aaron, Maria Rosa Costanzo, Lynne W Stevenson, Warren Strickland, Suresh Neelagaru, Nirav Raval, Steven Krueger, Stanislav Weiner, David Shavelle, Bradley Jeffries, Joy S Yadav, for the CHAMPION Trial Study Group**

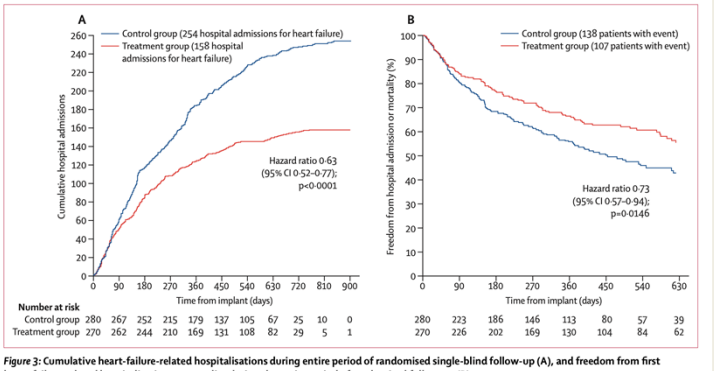
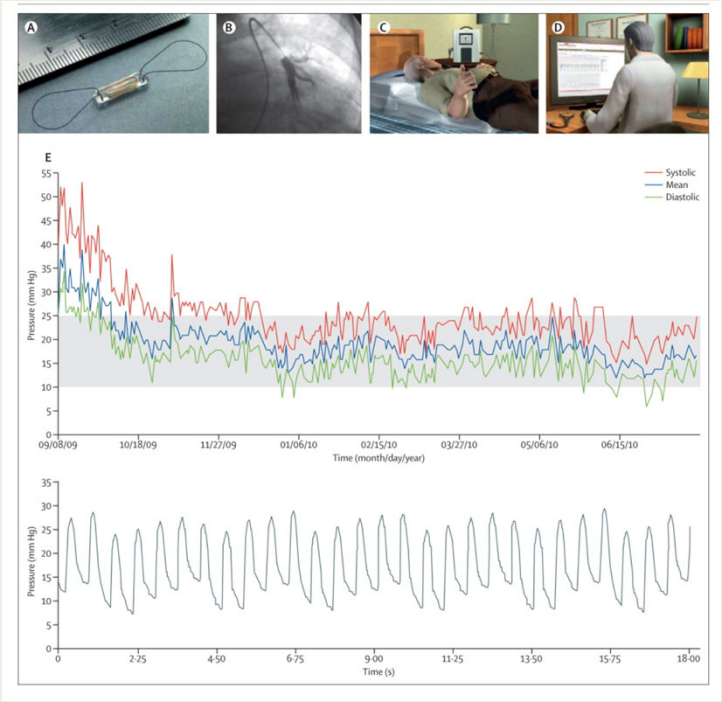
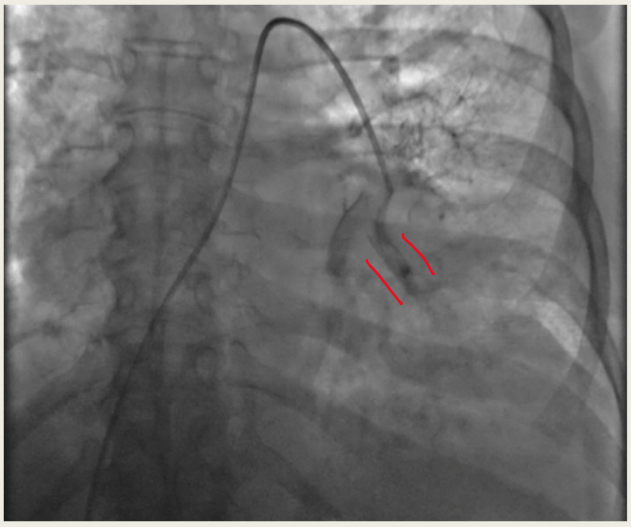


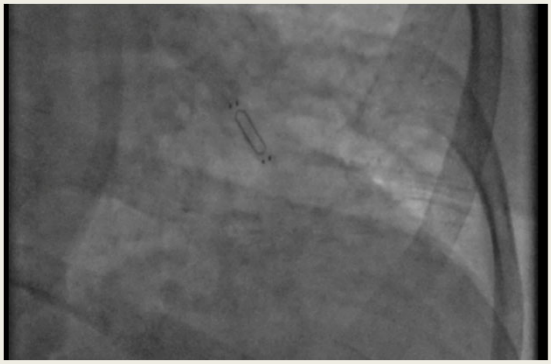
Figure 3: **Cumulative heart-failure-related hospitalisations during entire period of randomised single-blind follow-up (A), and freedom from first heart-failure-related hospitalisation or mortality during the entire period of randomised follow-up (B)**

Lancet 2011; 377: 658–66



Lancet 2011; 377: 658–66





Recommendations for Integration of Care: Transitions and Team-Based Approaches

Referenced studies that support the recommendations are summarized in the Online Data Supplements.

COR	LOE	Recommendations
1	B-R	1. In patients with high-risk HF, particularly those with recurrent hospitalizations for HFrEF, referral to multidisciplinary HF disease management programs is recommended to reduce the risk of hospitalization.[1–4]
1	B-NR	2. In patients hospitalized with worsening HF, patient-centered discharge instructions with a clear plan for transitional care should be provided before hospital discharge.[5,6]
2a	B-NR	3. In patients hospitalized with worsening HF, participation in systems that allow benchmarking to performance measures is reasonable to increase use of evidence-based therapy, and to improve quality of care.[7–10]
2a	B-NR	4. In patients being discharged after hospitalization for worsening HF, an early follow-up, generally within 7 days of hospital discharge, is reasonable to optimize care and reduce rehospitalization.[11,12]

2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

Circulation. 2022;145:e1033

Questions?