

HEART FAILURE

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The Canadian Cardiovascular Society

IS IT
HEART FAILURE
AND WHAT SHOULD I DO?



Canadian Cardiovascular Society

Leadership. Knowledge. Community.

About this Pocket Guide

This pocket guide is a quick-reference tool that features diagnostic and management recommendations based on the CCS Heart Failure Comprehensive Guidelines (2017).

These recommendations are intended to provide a reasonable and practical approach to the care of patients with HF. The intended audience is primary care physicians, specialists, nurses and allied health professionals. Recommendations are subject to change as scientific knowledge and technology advance and practice patterns evolve, and are not intended to be a substitute for clinical judgment. Adherence to these recommendations will not necessarily produce successful outcomes in every case.

Please visit www.ccs.ca for more information or additional resources.

Acknowledgements

The CCS would like to thank the many Heart Failure Guideline Panel members who have contributed countless hours to guideline development as well as our knowledge translation program. We appreciate their dedication and commitment to the CCS and to this important heart failure management resource. A complete list of guideline authors can be found at www.ccs.ca and our Heart Failure Program co-chairs are listed below:

CCS Heart Failure Guideline Co-Chairs

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Standard Assessment

Suspect Heart Failure

Risk Factors	Symptoms	Signs	Key Electrocardiographic Findings	Chest X-ray (CXR)
<ul style="list-style-type: none"> Hypertension Ischemic heart disease (IHD) Valvular heart disease Diabetes mellitus Heavy alcohol or substance use Chemotherapy or radiation therapy Family history of cardiomyopathy Smoking Hyperlipidemia 	<ul style="list-style-type: none"> Breathlessness Fatigue Leg swelling Confusion* Orthopnea Paroxysmal nocturnal dyspnea <p><i>*especially in the elderly</i></p>	<ul style="list-style-type: none"> Lung crackles Elevated Jugular Venous Pressure (JVP) Positive Abdominal jugular reflux (AJR) Peripheral edema Displaced apex 3rd heart sound, 4th heart sound (S₃, S₄) Heart murmur Low blood pressure (BP) Heart rate > 100 BPM 	<ul style="list-style-type: none"> Q Waves Left Ventricular Hypertrophy (LVH) Left Bundle Branch Block (LBBB) Tachycardia Atrial Fibrillation 	<ul style="list-style-type: none"> Cardiomegaly Pulmonary venous redistribution Pulmonary edema Pleural effusion

If Heart Failure Diagnosis Remains in Doubt

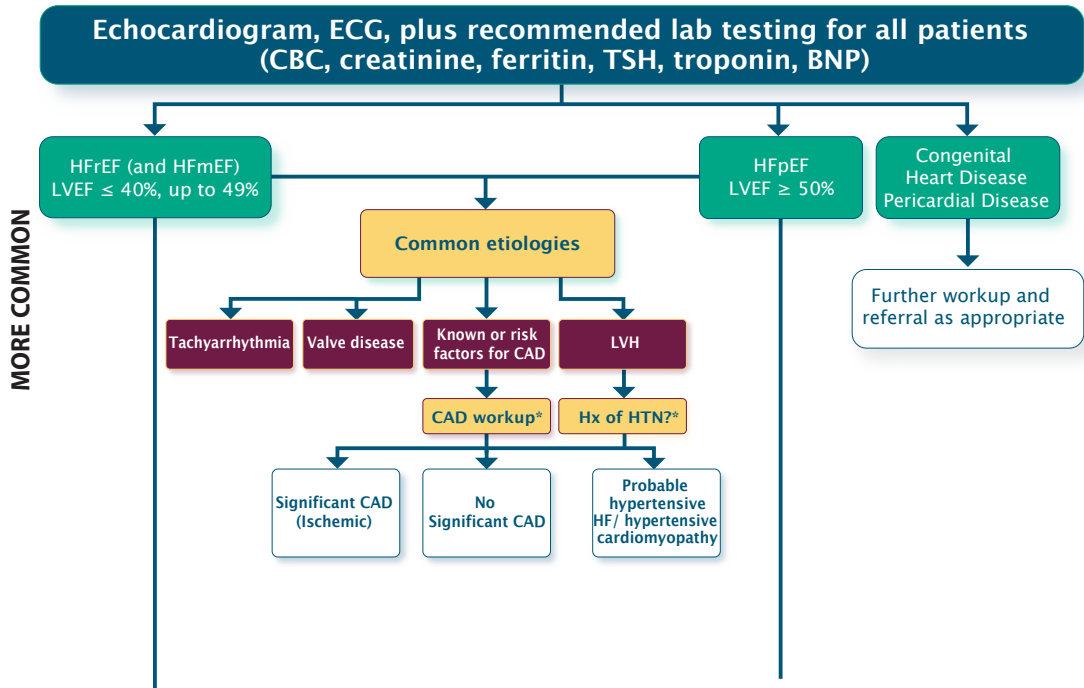
B-type Natriuretic Peptide (BNP) or NT-proBNP, if available

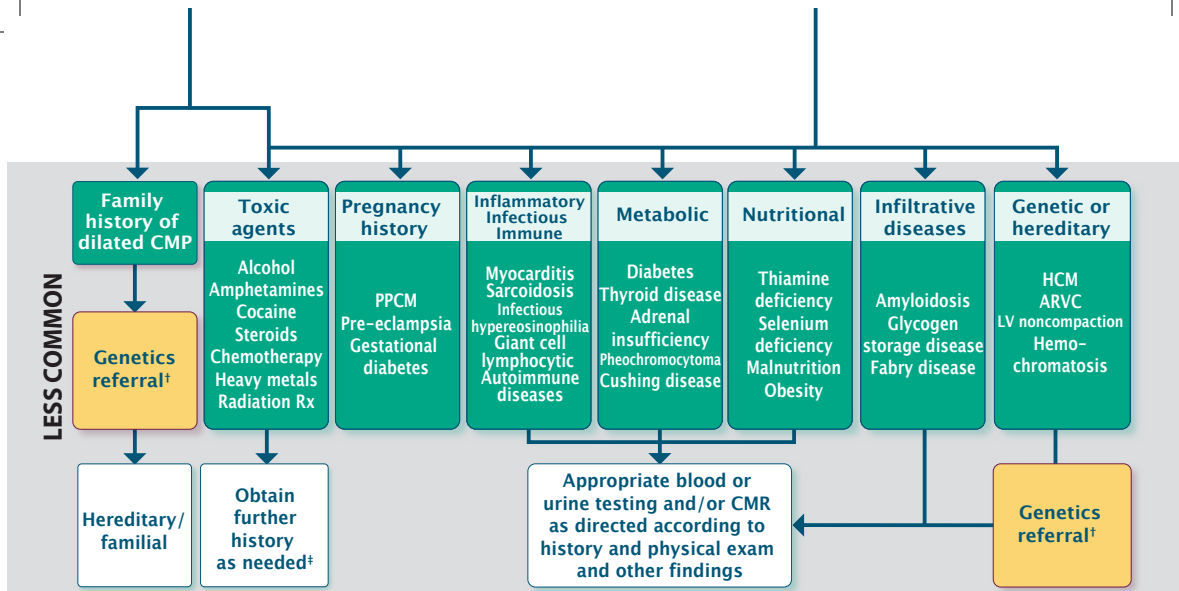
- BNP***
 - < 100 pg/ml - HF unlikely
 - = 100-500 pg/ml - HF possible but other diagnoses need to be considered
 - > 500 pg/ml - HF likely
- NT-proBNP***
 - < 300 pg/ml - HF unlikely
 - = 300-900 pg/ml - HF possible, but other diagnoses need to be considered (age 50-75)
 - = 300-1800 pg/ml - HF possible, but other diagnoses need to be considered (age > 75)
 - > 900 pg/ml - HF likely (age 50-75)
 - > 1800 pg/ml - HF likely (age > 75)

**Values correspond to decompensated heart failure and do not apply for diagnosis of stable heart failure.*

Echocardiogram (ECHO)

- Decreased left ventricular (LV) ejection fraction
- Increased LV end-systolic and end-diastolic diameter
- LVH
- Wall motion abnormalities and diastolic dysfunction
- Increased RV size and/or RV dysfunction
- Valve dysfunction
- Elevated pulmonary arterial pressures (PAP)



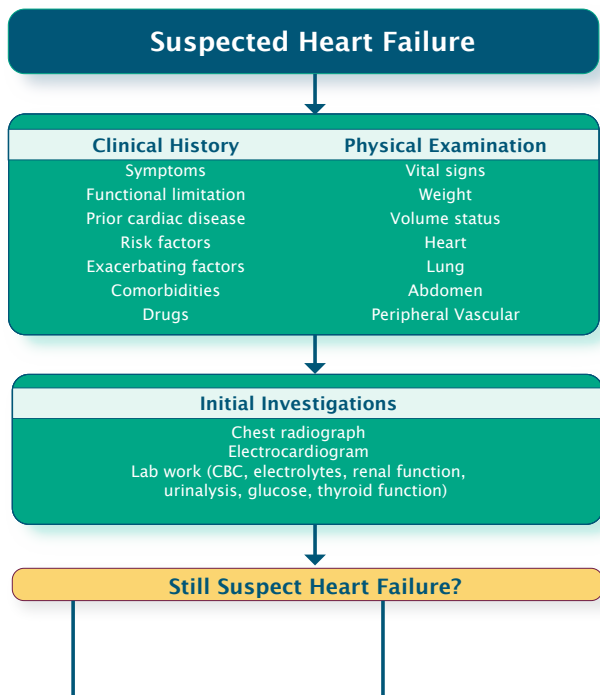


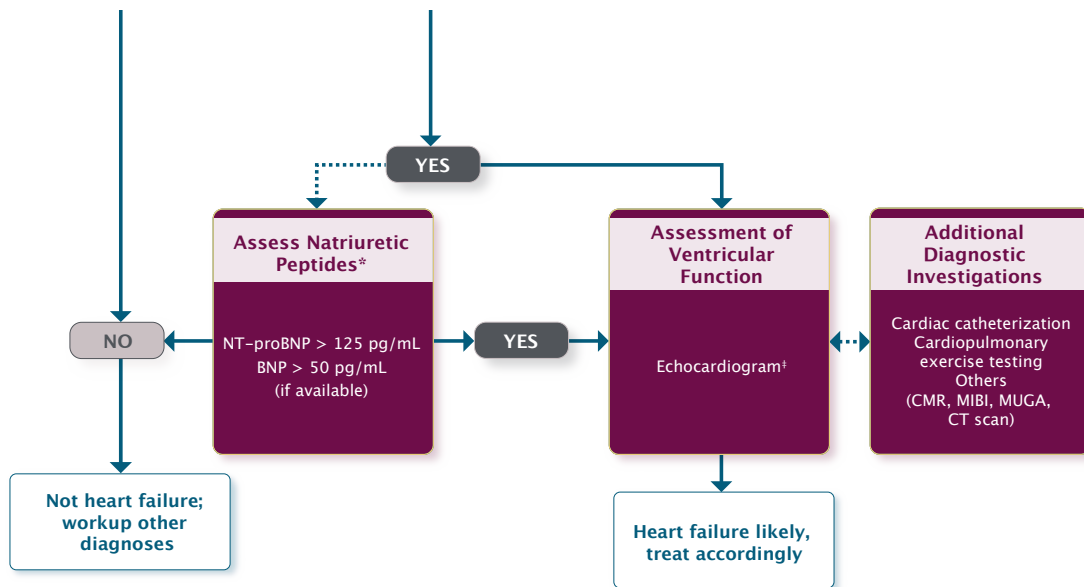
* Patients may have mixed etiology of HF

† A detailed medical and family history may guide investigations and should be completed in all patients (see recommendation 19)

‡ Direct testing based on pre-test probability, availability and expertise.

ARVC, arrhythmogenic right ventricular cardiomyopathy; CAD, coronary artery disease; CBC, complete blood count; CMP, cardiomyopathy; CMR, cardiac magnetic resonance; ECG, electrocardiogram; HCM, hypertrophic cardiomyopathy; HFmEF, HF with a mid-range ejection fraction; HFpEF, HF with preserved ejection fraction; HFREF, HF with a reduced ejection fraction; HTN, hypertension; LV, left ventricle; LVEF, left ventricular ejection fraction; LVH, left ventricular hypertrophy; NP, natriuretic peptide; PPCM, peripartum cardiomyopathy; TSH, thyroid stimulating hormone.





* Natriuretic peptides are not available in all jurisdictions in Canada

† Includes both systolic and diastolic parameters (eg, numeric left ventricular ejection fraction, transmitral and pulmonary venous flow patterns, or mitral annulus velocities); a preserved ejection fraction on a routine echocardiogram does not rule out the clinical syndrome of heart failure and therefore clinical judgment is required if other indicators point to heart failure as a diagnosis.

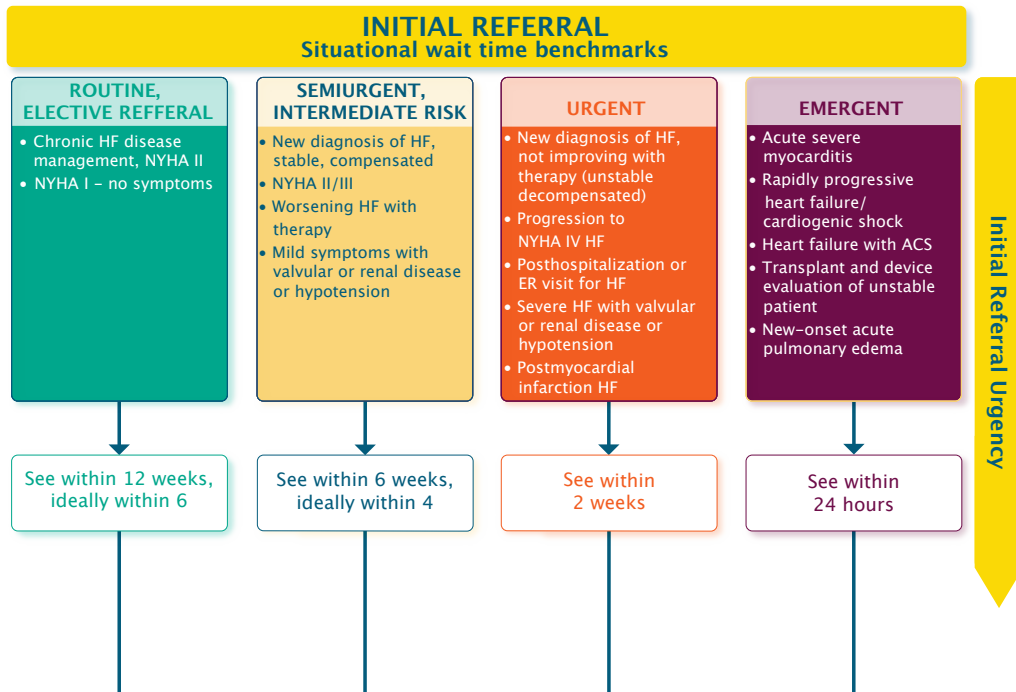
A lower BNP cutoff for suspecting HF in the ambulatory setting facilitates earlier implementation of guideline directed care.

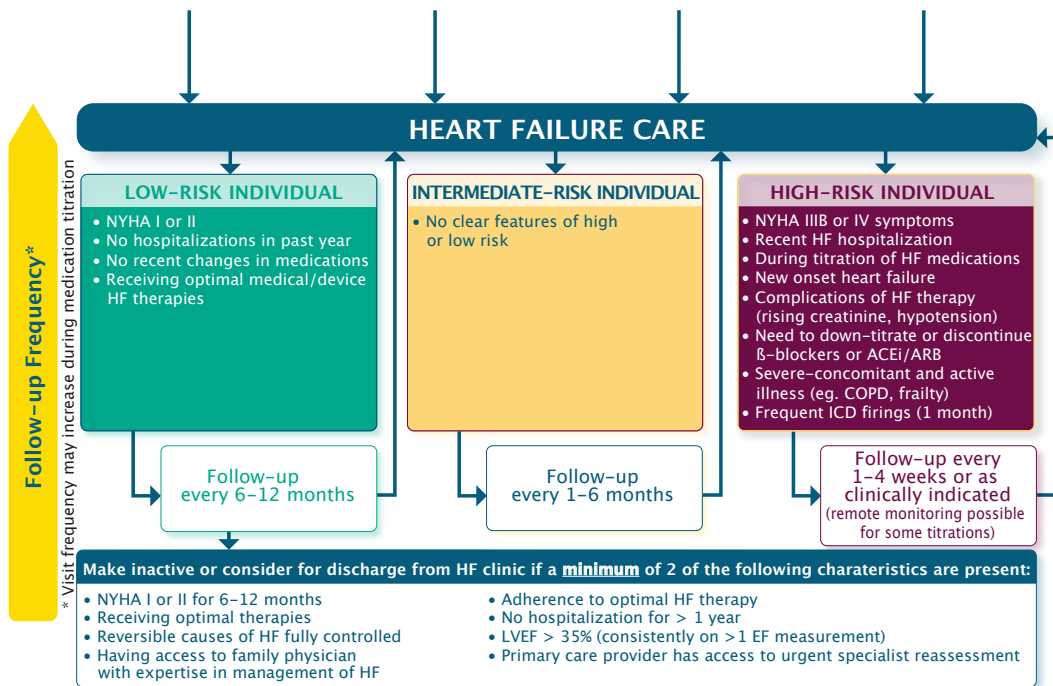
Warning Signs and Symptoms	Lifestyle and Risk Factor Management	Drug and Device Treatment Regimen
<ul style="list-style-type: none"> • Dyspnea <ul style="list-style-type: none"> - With less exertion - During sleep - When flat • Fatigue with less exertion • Increased abdominal swelling or pedal and leg edema • Dyspnea at rest • Weight gain > 2 kg in 2 days or 3 kg in 7 days • Lightheaded/faint • Prolonged palpitations • Chest pain that does not go away with rest or with medicine or is worsening • Confusion 	<ul style="list-style-type: none"> • Treat cardiovascular risk factors <ul style="list-style-type: none"> - Control hypertension - Control Diabetes Mellitus (DM) - Smoking cessation - Obesity counselling - Annual influenza vaccine and periodic pneumococcal pneumonia immunizations • No need to push oral fluids <ul style="list-style-type: none"> - Sodium restriction between 2g-3g/day is reasonable • Weigh daily if fluid retention 	<ul style="list-style-type: none"> • Medical therapy that improves survival and reduces hospitalization such as ACEi, ARB, MRA, ARNI, If inhibitors at guideline directed doses should be emphasized as targets • Combination drug regimen is required • Diuretics may need frequent adjustment targeting the lowest effective dose • Most will be used long term and generally life long • Common side effects are manageable by adjusting medication timing and may require periodic laboratory testing • Consider device therapy with reduced EF and/or wide QRS (e.g. ICD, CRT)

Evidence-based Drugs and Oral Doses as Shown in Large Clinical Trials

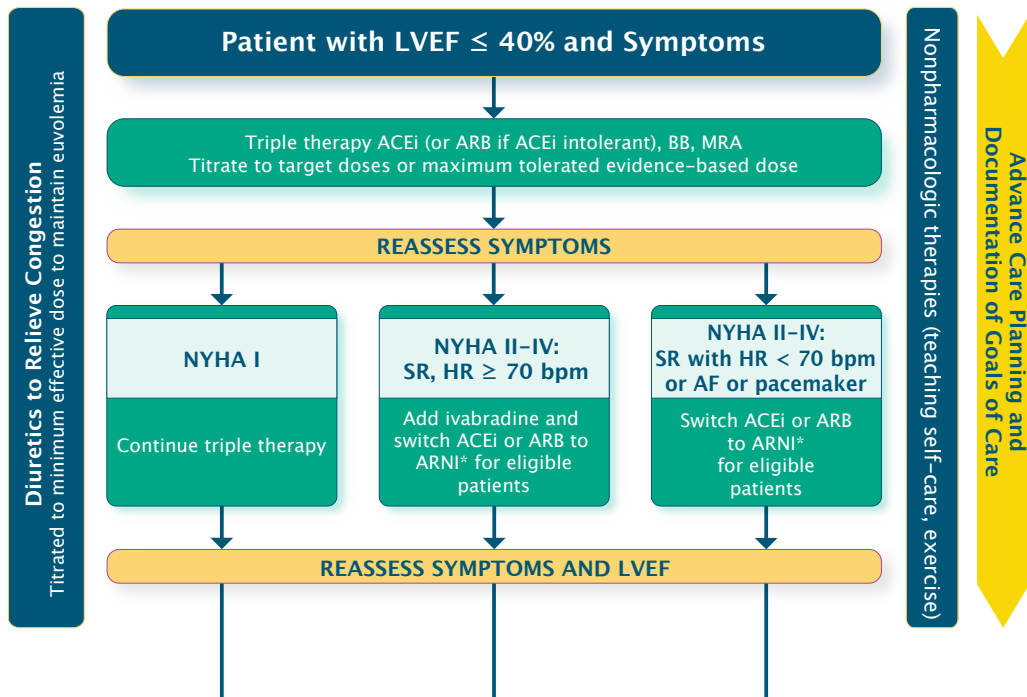
Drug	Start Dose	Target Dose
Ace-Inhibitors (ACEi)		
Enalapril	1.25-2.5 mg BID	10 mg BID/ 20 BID in NYHA class IV
Lisinopril	2.5-5 mg daily	20-35 mg daily
Perindopril	2-4 mg daily	4-8 mg daily
Ramipril	1.25-2.5 mg BID	5 mg BID
Trandolapril	1-2 mg daily	4 mg daily
Angiotensin Receptor Blocker (ARB)		
Candesartan	4-8 mg daily	32 mg daily
Valsartan	40 mg BID	160 mg BID
Beta-blockers		
Carvedilol	3.125 mg BID	25 mg BID/ 50mg BID (> 85kg)
Bisoprolol	1.25 mg daily	10 mg daily
Metoprolol CR/XL*	12.5-25 mg daily	200 mg daily
Mineralocorticoid Receptor Antagonists (MRA)		
Spironolactone	12.5 mg daily	50 mg daily
Eplerenone	25 mg daily	50 mg daily
Angiotensin receptor–neprilysin inhibitor (ARNI)		
Sacubitril/Valsartan	24/26 mg BID	97/103 mg BID
I₁ Inhibitor		
Ivabradine	2.5-5 mg BID	7.5 mg BID
Vasodilators		
Isosorbide dinitrate	20 mg TID	40 mg TID
Hydralazine	37.5 mg TID	75-100 mg TID-QID

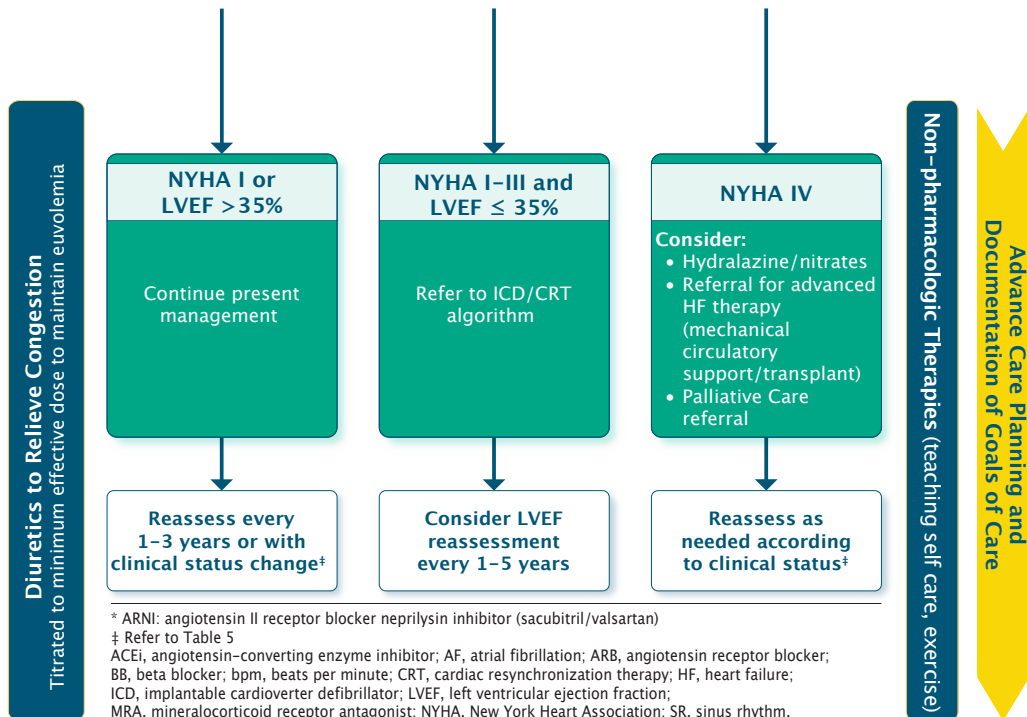
*Limited evidence of short-acting metoprolol tartrate in HF. Metoprolol CR/XL is not available in Canada





ACEi/ARB, angiotensin-converting enzyme inhibitor/angiotensin receptor blocker; ACS, acute coronary syndrome; AHA/ACC, American Heart Association/American College of Cardiology; COPD, chronic obstructive pulmonary disease; D/C, hospital discharge; ER, Emergency Department; FC, functional class; hrs, hours; ICD, implantable cardioverter defibrillator; MI, myocardial infarction; NYHA, New York Heart Association.





ACEi	ARB	Initial Dose Sacubitril/Valsartan*	Titration
Higher dose of RAAS inhibitor		100 mg PO BID	Over 3-6 weeks, increase to target 200 mg PO BID
<ul style="list-style-type: none"> • Enalapril ≥ 10mg/d • Lisinopril ≥ 10mg/d • Perindopril ≥ 4mg/d • Ramipril ≥ 5 mg/d 	<ul style="list-style-type: none"> • Candesartan ≥ 16 mg/d • Irbesartan ≥ 150 mg/d • Losartan ≥ 50 mg/d • Olmesartan ≥ 10 mg/d • Telmisartan ≥ 40 mg/d • Valsartan ≥ 160 mg/d 		
Lower dose of RAAS inhibitor		50 – 100 mg PO BID	Over 6 weeks, increase to target 200 mg PO BID
Higher risk of hypotension (eg. low baseline SBP, poor renal function)		50 – 100 mg PO BID	

*Health Canada labelled dose of 50 mg BID is 24 mg sacubitril/26 mg valsartan, 100 mg BID is 49 mg sacubitril/51 mg valsartan and 200 mg is 97 mg sacubitril/103 mg valsartan.

CONVERTING TO ARNI:

- **FROM ACEi:** Stop ACEi, **wait at least 36 h** after last dose (\uparrow risk of angioedema), then start ARNI
- **FROM ARB:** Stop ARB, no washout period necessary, start when next dose would have been due

Comparison: Ivabradine vs Sacubitril-Valsartan

Ivabradine – Add-on therapy

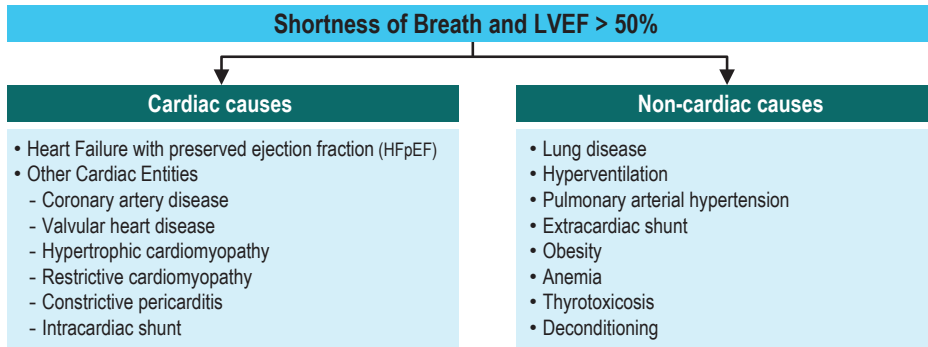
- Little evidence for de novo HF
 - Need BB titrated first
- Indicated for those in NSR and HR > 70 bpm
- Limited by bradycardia, fatigue
- Not affected by BP, creatinine
- Other side effects less common
- One titration (5, 7.5 BID) at 2 week interval

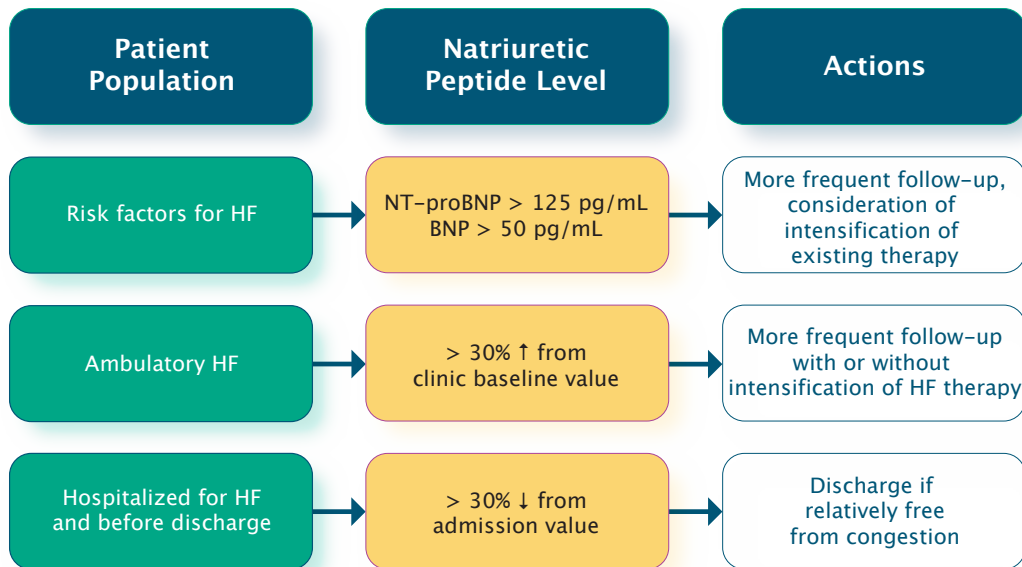
Sacubitril-Valsartan – Replacement for ACE/ARB

- Little evidence for de novo HF
 - Needs ACE/ARB first
- Limited by hypotension, creatinine, potassium
- Not affected by HR
- Other side effects not common
- Two titrations (50, 100, 200 BID) for 6-12 weeks

Practical Tips for Heart Failure with Preserved Ejection Fraction (HFpEF)

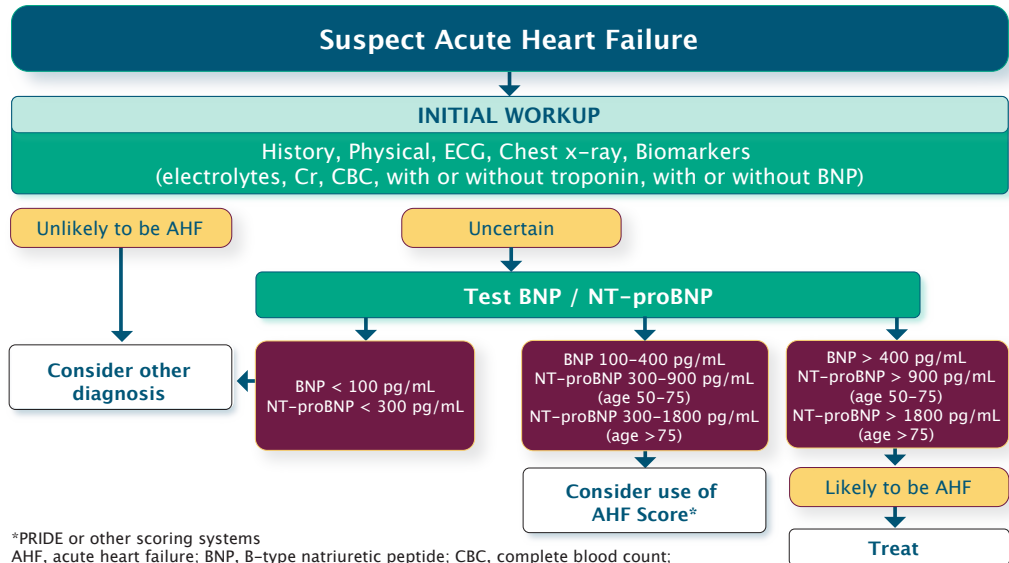
- Minimum effective diuretic dose to maintain euvoemia
- Identification and treatment of underlying factors such as ischemia and valvular disease
- Treat hypertension according to current hypertension guidelines
- Usually loop diuretics are needed, renal function may be very volume dependant
- In most cases, an indication for ACE, ARB and/or BB is present
- Patients with atrial fibrillation should be anticoagulated unless there is a contraindication
- Individuals with HFpEF, serum potassium < 5.0 mmol/L and eGFR >30mL/min, an MRA like spironolactone should be considered





BNP, B-type natriuretic peptide; HF, heart failure; NTproBNP, amino-terminal fragment propeptide B-type natriuretic peptide.

Acute Heart Failure (AHF) - Diagnosis

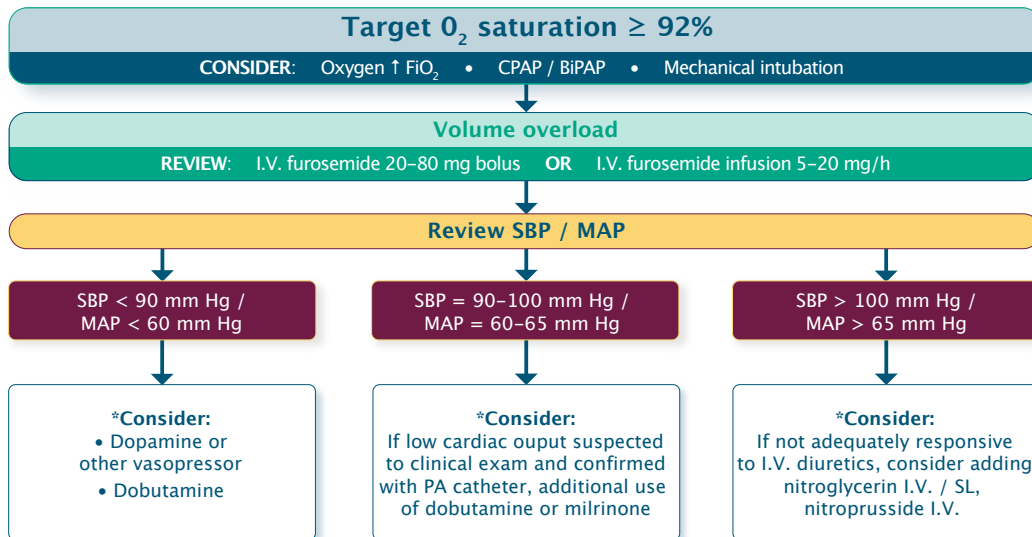


*PRIDE or other scoring systems

AHF, acute heart failure; BNP, B-type natriuretic peptide; CBC, complete blood count;

Cr, creatinine; ECG, electrocardiogram;

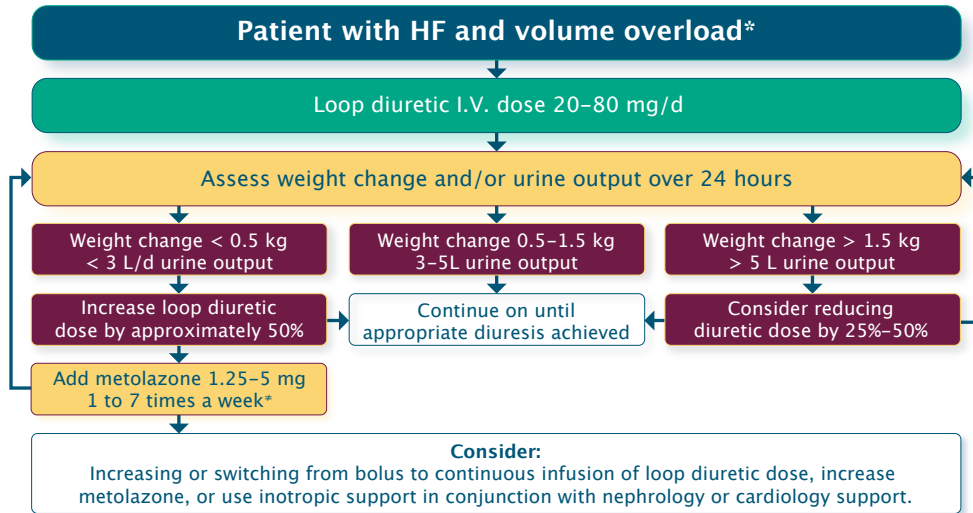
NTproBNP, amino-terminal fragment propeptide B-type natriuretic peptide.



* See table 27 for dosing (CCS 2017 Heart Failure Guidelines)

BiPAP, bilevel positive airway pressure; BP, blood pressure; CPAP, continuous positive airway pressure; I.V., intravenous; MAP, mean arterial pressure; PA, pulmonary artery; PCWP, pulmonary capillary wedge pressure; SBP, systolic blood pressure.

Acute Heart Failure (AHF) - Diuretic Dosing



* Assumes: 1) Volume assessment with each step

3) Daily weights

2) Monitoring of electrolytes, renal function, symptoms and vital signs

4) Urine output not often accurate or obtainable

≠ Titrate progressively, according to the degree of hypervolemia, furosemide doses and creatinine/kidney function

Acute Heart Failure (AHF) - Therapeutic Goals and Diuretic Dosing

Therapeutic Goals for Patients with AHF

- Understanding the etiology of patient's cardiomyopathy and precipitating factors for decompensation
- Alleviate presenting symptoms
- Optimize all indicated evidence-based treatment interventions
- Provide patient education
- Establish a transition of care plan and outpatient follow-up
- Establish euvolemia

Practical Tips when Response to Diuretic is Suboptimal

- Reevaluate the need for additional diuresis by frequent assessment of volume status
- Restrict sodium and fluid (Na⁺/H₂O) intake (exercise caution reducing oral intake below 500 ml per 24 hours)
- Review diuretic dosing. Higher bolus doses will be more effective than more frequent lower doses. Diuretic infusions (eg, furosemide 20-40 mg bolus then 5-20 mg/h) can be a useful strategy when other options are not available
- Add another type of diuretic with different site of action (thiazides, spironolactone). Thiazide diuretics (eg oral metolazone 2.5-5 mg OD/BID or hydrochlorothiazide 25-50 mg) are often given at least 30 minutes before the loop diuretic to enhance diuresis, although this is not required to have an adequate effect
- Consider hemodynamic assessment and/or positive inotropic agents if clinical evidence of poor perfusion coexists with diuretic resistance
- Refer for hemodialysis, ultrafiltration, or other renal replacement strategies if diuresis is impeded by renal insufficiency

Acute Heart Failure (AHF) - Admit or Discharge from the Emergency Department

Variable	Consider for Hospital Admission	Consider for Discharge Home with Close Follow-up
Current clinical status	NYHA III / IV	NYHA II
Amount of improvement	Minimal or modest	Significant
O ₂ saturation on room air	< 91%	≥ 92%
Systolic blood pressure	< 90 - 100 mmHg	> 100 mmHg or similar to prior
Heart rate	> 90 bpm	< 90 bpm
Respiratory rate	> 20 breaths/minute	≤ 20 breaths/minute
ECG findings	Active ischemia; ventricular arrhythmia; atrial arrhythmia not under control	Baseline
Renal function	Worsening	Stable
Comorbidity	Other comorbid condition requiring admission; syncope; pneumonia	
Other	New diagnosis of HF	Established etiology and precipitant
Follow-up	Uncertain	Established / Organized

Criteria for Discharge

- Presenting symptoms resolved
- Vital signs resolved and stable for > 24 hrs, especially blood pressure & heart rate
- Returned to “dry” weight and stable for > 24 hours on oral diuretics
- Inter-current cardiac illness adequately diagnosed and treated
- Inter-current non-cardiac illness adequately diagnosed and treated
- Chronic oral HF therapy initiated, titrated and optimized (or outpatient plan for same)
- Education initiated, understood by patient and caregivers, continued education planned
- Discharge plan includes clear requirements for follow-up labs, office appointments and further testing
- Timely communication to primary care provider and/or specialist physician and/or multi-disciplinary disease management program is essential

Acute Heart Failure (AHF) - Daily Follow-up

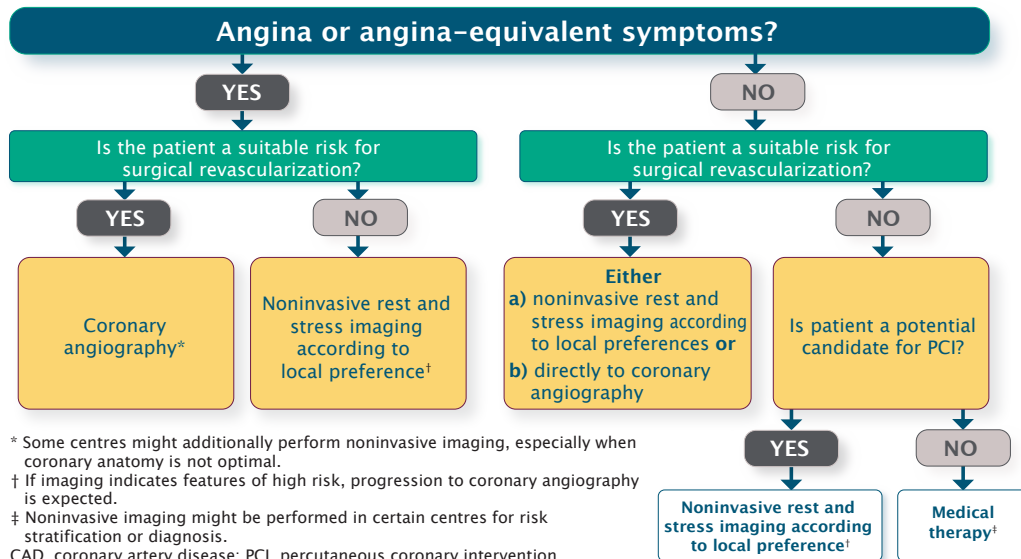
Question/Query	How To Assess	
Have the patients symptoms improved?	<ul style="list-style-type: none"> • Dyspnea • Overall well-being 	<ul style="list-style-type: none"> • Other symptoms improved (fatigue, orthopnea, paroxysmal nocturnal dyspnea, etc.)
What are the clinical findings compared with baseline?	<ul style="list-style-type: none"> • Blood pressure • Respiratory rate • Oxygen saturation 	<ul style="list-style-type: none"> • Heart rate • Physical examination findings (<i>especially JVP, S₃, rales, lower extremity edema</i>)
What are the pertinent laboratory findings?	<ul style="list-style-type: none"> • Weight and net fluid balance • Creatinine • Potassium • BNP or NT-proBNP 	<ul style="list-style-type: none"> • Hemoglobin • Blood urea nitrogen • Sodium

JVP, Jugular venous pressure. S₃ third heart sound.

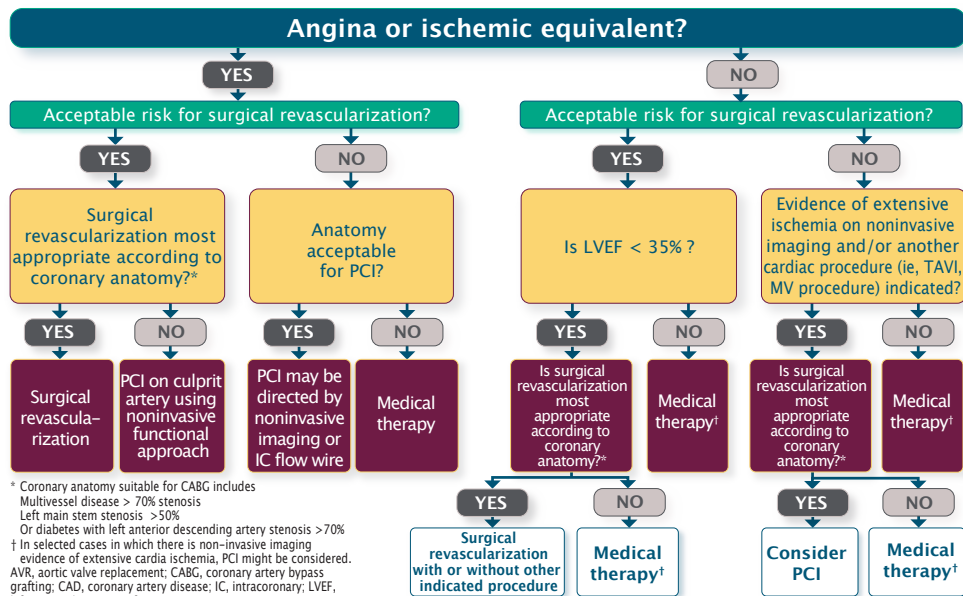
Approach to Exercise Modalities According to Clinical Scenario

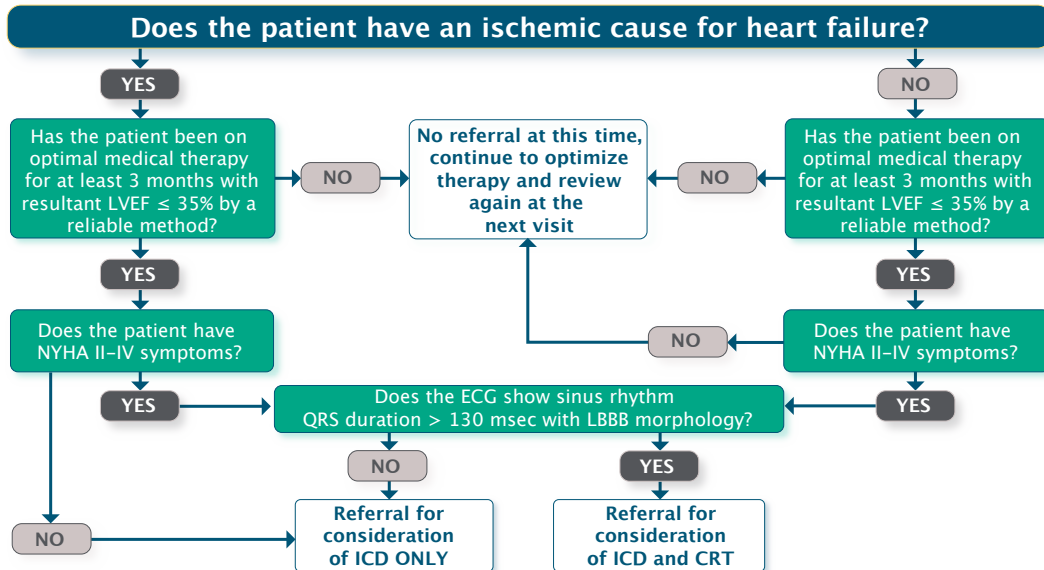
Exercises	Discharged with Heart Failure	NYHA I-III	NYHA IV
Flexibility Exercises	Recommended	Recommended	Recommended
Aerobic Exercises	Recommended	Recommended	Recommended
Suggested modality	<ul style="list-style-type: none">• Selected population only• Supervision by an expert team needed (see text)	<ul style="list-style-type: none">• Walk• Treadmill• Ergocycle• Swimming	<ul style="list-style-type: none">• Selected population only• Supervision by an expert team needed (see text)
Intensity		Continuous training: Moderate intensity: <ul style="list-style-type: none">• RPE scale 3-5, or• 65%-85% HRmax, or• 50%-75% peak VO2 Moderate intensity aerobic interval might be incorporated in selected patients <ul style="list-style-type: none">• Intervals of 15-30 minutes with an RPE scale of 3-5• Rest intervals of 15-30 minutes	
Frequency		<ul style="list-style-type: none">• Starting with 2-3 days per week• Goal: 5 days per week	
Duration		<ul style="list-style-type: none">• Starting with 10-15 minutes• Goal: 30 minutes	
Isometric / Resistance Exercises			
Intensity		<ul style="list-style-type: none">• 10-20 repetitions of 5 to 10-pound free weights	
Frequency		<ul style="list-style-type: none">• 2-3 days per week	

HRmax, maximal heart rate; NYHA, New York Heart Association; RPE, rating perceived exertion; VO2, peak oxygen uptake.



Decision Regarding Coronary Revascularization in Heart Failure (HF)





CRT, cardiac resynchronization therapy; ECG, electrocardiogram; ICD, implantable cardioverter-defibrillator; LBBB, left bundle branch block; LVEF, left ventricular ejection fraction; NYHA, New York Heart Association.

Classifying Advanced Heart Failure

To be considered for advanced HF management strategies (cardiac transplantation, MCS, palliative care, etc.) patients with advance HF must, despite optimal treatment, continue to exhibit progressive/persistent NYHA III or IV HF symptoms and accompanied by more than one of the following:

- LVEF < 25% and, if measured, peak exercise oxygen consumption < 14 mL/kg/min (or < 50% predicted)
- Evidence of progressive end organ dysfunction due to reduced perfusion and not to inadequate ventricular filling pressures
- Recurrent HF hospitalizations (≥ 2 in 12 months) not due to a clearly reversible cause
- Need to progressively reduce or eliminate evidence based HF therapies such as ACEis, MRAs, or B-blockers, because of circulatory-renal limitations such as renal insufficiency or symptomatic hypotension.
- Diuretic refractoriness associated with worsening renal function
- Requirement for inotropic support for symptomatic relief or to maintain end organ function
- Worsening right HF (RHF) and secondary pulmonary hypertension
- Six-minute walk distance < 300 m
- Increased 1-year mortality (eg, > 20%-25%) predicted by HF risk scores
- Progressive renal or hepatic end organ dysfunction
- Persistent hyponatremia (serum sodium < 134 mmol/L)
- Cardiac cachexia
- Inability to perform activities of daily living

Note: most patients will have a number of the listed criteria and there is no single criterion that determines candidacy for cardiac transplantation, MCS, or palliative care. Patient preferences should be incorporated into the decision process when assessing further choices.

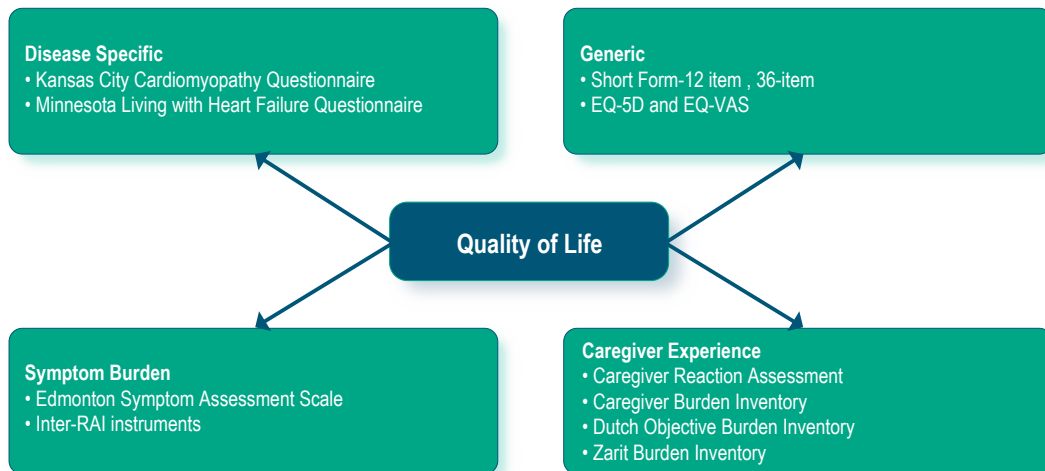
Advance Care Planning

Practical Tips

- Although the course of HF in individual patients can be unpredictable, a high symptom burden and high mortality rates should be anticipated, and advance care planning discussions should be initiated early in the course of illness.
- Triggers for discussion:
 - After important clinical events such as hospitalization
 - When considering invasive therapies
 - When requested by the patient/family
- Discussions should focus on the values and goals of the individual patient what they find valuable and important in their lives and what they hope for in the future (eg, attending an important upcoming family event).
- Discussions are dynamic and evolve over time; ongoing and repeated discussions are often necessary.

Visit <http://www.advancecareplanning.ca/> for tools and resources to help patients and families with advance care planning.

Validated Tools in HF



The above is not intended to be an exhaustive list of such instruments, but identifies those most used and evaluated in the context of heart failure. There is no clear evidence to recommend one tool over another.

EQ-5D, Euro QOL 5 dimensions; EQ-VAS, Euro QOL-Visual Analogue Scale

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