HEART FAILURE

2014 UPDATE

The Canadian Cardiovascular Society

IS IT HEART FAILURE AND WHAT SHOULD I DO?

HEART FAILURE

Canadian Cardiovascular Society
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About this Pocket Guide

This pocket guide is a quick-reference tool that features diagnostic and treatment recommendations based on the CCS Heart Failure Guidelines (2006-2014).

These recommendations are intended to provide a reasonable and practical approach to care for specialists and allied health professionals. They 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 contribute 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

Peter Liu (2006), J. Malcolm O. Arnold (2006-2008), Jonathan G. Howlett (2007-2010), Robert S. McKelvie (2009-2012), Gordon W. Moe (2011-2014), Justin A. Ezekowitz (2013-Present), Eileen O'Meara (2014-Present)

Table of Contents

Standard Assessment

Suspect Heart Failure

Risk Factors	Symptoms	Signs	Key Electrocardiographic Findings	Chest X-ray (CXR)
• Hypertension • Ischemic Heart Disease (IHD) • Valvular Heart Disease • Diabetes mellitus • Heavy alcohol use • Chemotherapy • Family history of HF • Smoking • Hyperlipidemia	• Breathlessness • Fatigue • Leg swelling • Confusion* • Orthopnea • Paroxysmal Nocturnal Dyspnea **especially in the elderly*	• Lung crackles • Elevated Jugular Venous Pressure (JVP) • Positive HJR • Peripheral edema • Displaced apex • 3rd heart sound, 4th heart sound (S_3, S_4) • Heart murmur • Low Blood Pressure (BP) • Heart rate > 100	• Q Waves • Left Ventricular Hypertrophy (LVH) • Left Bundle Branch Block (LBBB) • Tachycardia	• 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, Acute decompensated - 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, Acute decompensated - 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
- Left Ventricular Hypertrophy
- Wall Motion Abnormalities and Diastolic Dysfunction
- Increased RV Size and Dysfunction
- Valve Dysfunction
- Elevated Pulmonary Arterial Pressures

How to Follow and Refer your Heart Failure Patient

How Often to Follow	What to Follow	When to Refer
• Acute change in HF symptoms - within 24-48 hrs • After HF hospitalization - within 2 weeks • After HF ER visit - within 2 weeks • After addition of HF medication or increase in dose - if unstable: within 7 days - if stable: within 2 weeks - if asymptomatic: 1 month • Stable on optimized therapy - 3-6 months • Also check electrolytes, BUN creatinine if intercurrent illness likely to affect volume status (such as flu)	• At each visit record clinical data: - HF symptoms as per New York Heart Association (NYHA) classification - New symptoms - Body weight - Heart Rate (HR), sitting and standing BP - JVP, presence of HJR - Peripheral edema - Auscultate heart & chest - Check prescription and non-prescription medications, supplements and naturopathic agents • Periodically based on above, only when there is clinical change that will change treatment: - ECG, especially if new onset chest pain or irregular heart beat (e.g. AFIB), CXR, ECHO, BNP (if uncertain if increased symptoms due to heart failure). Electrolytes/creatinine within 7-14 days during ACE-I/ARB treatment, spironolactone eplerenone or diuretic change until stable. Otherwise, within 1 to 3 months.	• New onset HF • Recent HF hospitalization • HF associated with: - ischemia/infarction - hypertension - valvular disease - syncope - renal dysfunction - multiple comorbidities • Unknown etiology • Family history of HF • Intolerance to therapies • Poor compliance with treatment regimen

Algorithm for Prevention and Treatment of Clinically Stable Heart Failure

To prevent HF: treat all cardiac RF's, if low LVEF prescribe ACE-I +/-Beta-blocker

If HF symptoms but LVEF > 40%, treat cause eg Hypertension, Ischemia, consider ACE-I/ARB, Beta-blocker

If HF symptoms and LVEF < 40%

For all symptomatic patients with systolic HF:
- *Tailored Diuretic*
- *Education on:*
  - *HF syndrome*
  - *Warning S&S*
  - *Self monitoring*
  - *Drug therapy*
  - *Prognosis*

ACE-I + Beta-blocker

Intolerance → ***Prescribe ARB***

Intolerance → ***Prescribe ARB***

Titrate to Target Doses

Consider nitrate / hydralazine if intolerant to ACE-I and ARB

If LVEF < 30%, consider ICD referral

Clinically Stable → **Continue Rx**

Persistent Symptoms
High BNP and/or recent HF hospitalization

→ ***MRA**

→ **ARB**

If EF < 35% see device referral pathway

NYHA Class II-IIIa → **Digoxin**

→ **Nitrates**

If refractory, consider mechanical circulation support, transplant or if appropriate palliation

NYHA Class IIIb-IV → **Increase or combine Diuretics**

** MRA: Mineralocorticoid Receptor Antagonist (spironolactone, eplerenone)*
Not recommended to combine ACE-I, MRA, and ARB.

Evidence Based Heart Failure Drugs and Doses* (mg) for Patients with Systolic LV Dysfunction

Drug	Start Dose	Target Dose
ACE inhibitors		
Captopril	6.25-12.5 mg TID	25-50 mg TID
Enalapril	1.25-2.5 mg BID	10 mg BID
Lisinopril	2.5-5 mg OD	20-35 mg OD
Perindopril	2-4 mg OD	4-8 mg OD
Ramipril	1.25-2.5 mg BID	5 mg BID
Trandolapril	1-2 mg OD	4 mg OD
Beta-blockers		
Bisoprolol	1.25 mg OD	10 mg OD
Carvedilol	3.125 mg BID	25 mg BID**
Metoprolol CR/XL	12.5-25 mg OD	†200 mg OD
ARBs		
Candesartan	4 mg OD	32 mg OD
Valsartan	40 mg BID	160 mg BID
Mineralocorticoid receptor antagonists		
Spironolactone	12.5 mg OD	50 mg OD
Eplerenone	25 mg OD	50 mg OD
Vasodilatators		
Hydralazine	37.5 mg TID	75 mg TID
Isorbide dinitrate	20 mg TID	40 mgTID

** Drugs and doses may vary and depend upon the clinical scenario. ** 50 mg BID if weight is > 85 kg*

† Not available in Canada

Practical Tips for Heart Failure with Preserved EF (HFpEF)

- Control volume with minimum effective diuretic dose
- Control resting heart rate to 70 bpm, especially if atrial fibrillation present
- Determine if contributing ischemia and treat if present
- Determine if valvular heart disease present and treat if necessary
- Control of hypertension is critical
- In most cases, an indication for ACE, ARB and/or BB is present
- Usually loop diuretics are needed, renal function may be very volume dependant
- Beta-blockers most commonly used, but rate limiting calcium channel blockers (diltiazem or verapamil) may be considered
- Treat cardiac ischemia according to current guidelines
- Be especially vigilant of aortic stenosis and mitral regurgitation
- Patients with atrial fibrillation should be anticoagulated unless there is a contraindication

Shortness of Breath and LVEF > 50%

Cardiac causes

- Heart Failure with Normal Ejection Fraction
- Other Cardiac Entities
  - Coronary artery disease
  - Valvular heart disease
  - Hypertrophic cardiomyopathy
  - Restrictive cardiomyopathy
  - Constrictive pericarditis
  - Intracardiac shunt

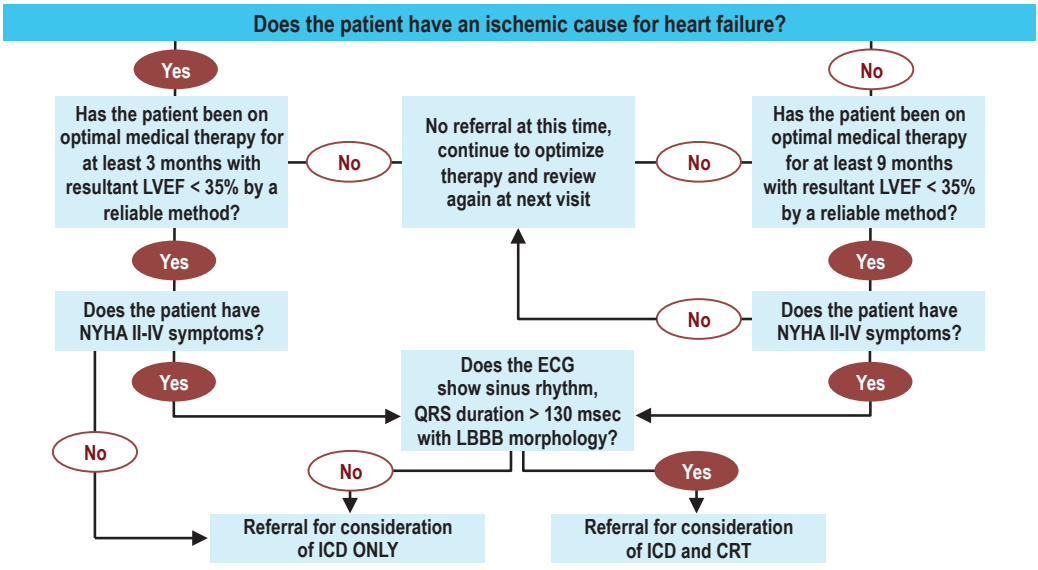
Non-cardiac causes

- Lung disease
- Obesity
- Deconditioning
- Anemia
- Hyperventilation
- Thyrotoxicosis
- Pulmonary arterial hypertension
- Extracardiac shunt

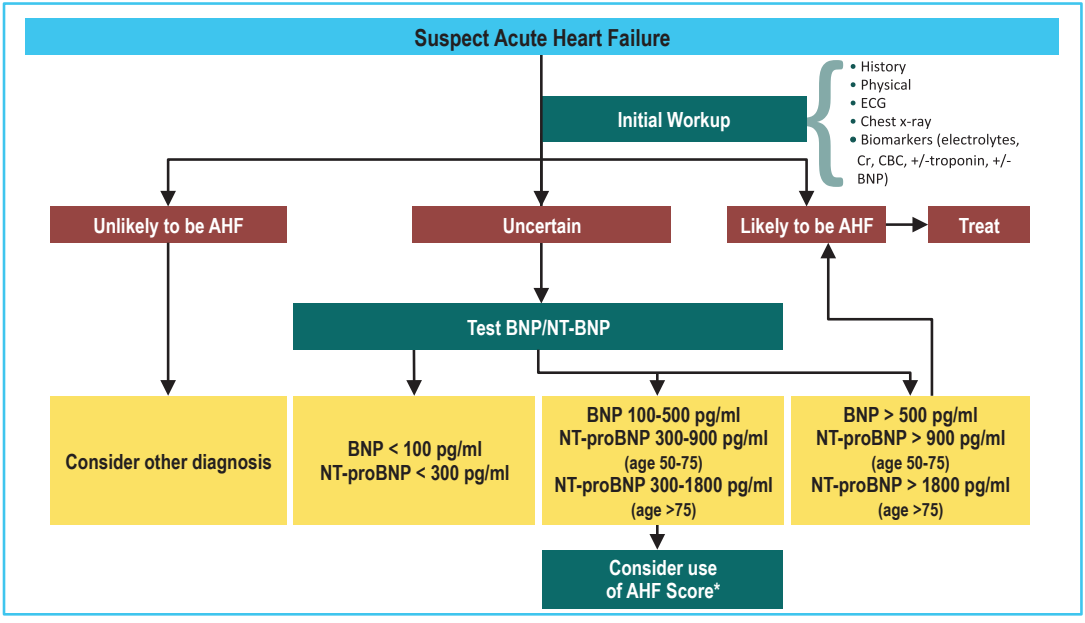
Educate Patient about Heart Failure

Warning Signs and Symptoms	Lifestyle	Drug and Device Treatment Regimen
• Dyspnea - When flat - During sleep - With less exertion • Fatigue with less exertion • Symptoms at rest • Weight gain > 2 kg in 2 days or 3 kg in 7 days • Lightheaded/faint • Prolonged palpitations • Usual angina pain	• Reduce cardiovascular risk factors - Eliminate added salt, limit to less than 2g per day (1 teaspoon) - Control hypertension - Control Diabetes Mellitus (DM) - Smoking cessation • No need to push oral fluids • Lose weight if significant obesity • Regular physical activity, as tolerated • Weigh daily if fluid retention	• Diuretics, nitrates and digoxin - Improve symptoms • Angiotensin Converting Enzyme Inhibitors /Angiotensin Receptor Blocker, Beta-blocker, spironolactone, epleronone - Improve survival in patients with low LVEF • Combination drug regimen is required • Most require dose adjustments • Most will be used long term • Understand the common side effects • Consider devices with low LVEF or wide QRS

Referral Pathway for Device Therapy in Patients with Chronic Heart Failure



Acute Heart Failure (AHF) - Diagnosis



** PRIDE or other scoring systems*

Acute Heart Failure (AHF) - Therapeutic Goals

Therapeutic Goals for Patients with AHF

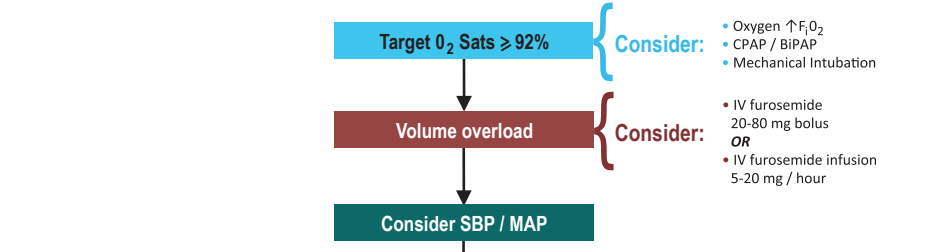
- Understanding the etiology and precipitating factors
- Alleviate presenting symptoms
- Optimize all indicated evidence-based treatment interventions
- Provide patient education
- Establish a transition of care plan and outpatient follow-up

Acute Decompensated Heart Failure Standard Of Care Therapies

Drug/ Device	First 24hour	During Hospitalization	At Hospital Discharge	Long-term F/U
IV/PO Diuretic	✓	✓	✓	✓
IV Vasodilator	*	*		
IV Inotrope	*	*		
ACE-I+	+	✓	✓	
ARB (if ACE-I intolerant)	+	+	✓	✓
MRA	+	*	*	
Beta Blocker	+	+	✓	✓
Hydralazine/Nitrate				*
Statin		+	*	*
Antiplatelet agents		+	*	*
CRT			*	
ICD			*	
Revascularization/Other				*

*✓Indicates all eligible patients; *indicates select indications; +indicates patients on therapy before hospitalization and treatment should be continued in the absence of contraindications. ACE-I, Angiotensin-converting enzyme inhibitor; F/U, follow-up; PO, oral.*

Acute Heart Failure (AHF) - Acute Management



***Consider:**

- Dopamine or other vasopressor
- Dobutamine

***Consider:**

- If low cardiac output suspected by clinical exam and confirmed with PA catheter, add dobutamine or milrinone.

***Consider:**

- If not adequately responsive to IV diuretics, consider adding nitroglycerin IV / SL, nesiritide IV, nitroprusside IV

**see table for dosing.*

Acute Heart Failure (AHF) - Diuretic Dosing

Diuretic Dosing for ADHF

Creatinine Clearance *	Patient	Initial IV Dose†	Maintenance Dose
≥ 60 mL/min/1.73m^2	New-onset HF or no maintenance diuretic therapy	Furosemide 20-40 mg 2-3 times daily	Lowest diuretic dose that allows clinical stability is the ideal dose
	Established HF or chronic oral diuretic therapy	Furosemide bolus equivalent to oral dose	
< 60 mL/min/1.73m^2	New-onset HF or no maintenance diuretic therapy	Furosemide 20-80 mg 2-3 times daily	
	Established HF or chronic oral diuretic therapy	Furosemide bolus equivalent to oral dose	

**Creatinine clearance is calculated from the Cockroft-Gault or Modification of Diet in Renal Disease formula. See text for details.*
† Intravenous continuous furosemide at doses of 5 to 20mg/h is also an option.

Practical Tips when Response to Diuretic is Suboptimal

- Reevaluate the need for additional diuresis by assessing volume status
- Restrict NA+/H2O intake (and 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 OB/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

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
02 saturation on room air	< 91%	> 92%
Systolic blood pressure	< 90 - 100 mmHg	> 100 mmHg
Heart rate	> 90 bpm	< 90 bpm
Respiratory rate	> 20 breaths/minute	< 20 breaths/minute
ECG	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

Acute Heart Failure (AHF) - Admit or Discharge (continued)

Criteria for Discharge	
• Presenting symptoms resolved	• Education initiated, understood by patient, continued education planned
• Vital signs resolved and stable for > 24 hrs, especially blood pressure & heart rate	• Discharge plan includes clear requirements for labs, office and further testing
• Returned to "dry" weight and stable for > 24 hours	• Timely communication to primary care provider and/or specialist physician and/or multi-disciplinary disease management program is essential
• Inter-current cardiac illness adequately diagnosed and treated	• Greater than 30% decrease in natriuretic peptide level from time of admission and relatively free from congestion
• Inter-current non-cardiac illness adequately diagnosed and treated	
• Chronic oral HF Therapy initiated, titrated and optimized (or plan for same)	

Acute Heart Failure (AHF) - Daily Follow-up

Question/Query	How To Assess	
Have the patients symptoms improved?	• Dyspnea • Overall well-being	• Other symptoms improved (fatigue, orthopnea, paroxysmal nocturnal dyspnea, etc.)
What are the clinical findings compared with baseline?	• Blood pressure • Respiratory rate • Oxygen saturation	• Heart rate • Physical examination findings (*especially JVP, S_3 , rales, lower extremity edema)*
What are the pertinent laboratory findings?	• Weight and net fluid balance • Creatinine • Potassium • BNP or NT-proBNP	• Hemoglobin • Blood urea nitrogen • Sodium

JVP, Jugular venous pressure. S_3 third heart sound.

Exercise Modalities According to Clinical Scenario

Exercices	Discharged with Heart Failure	NYHA I-III	NYHA IV
Flexibility Exercises	Recommended	Recommended	Recommended
Aerobic Exercises	Recommended	Recommended	Recommended
Suggested modality	• Selected population only • Supervision by an expert team needed (see text)	• Walk • Treadmill • Ergocycle • Swimming	• Selected population only • Supervision by an expert team needed (see text)
Intensity		**Continuous training:** Moderate intensity: • RPE scale 3-5, or • 65%-85% HRmax, or • 50%-75% peak VO2 Moderate intensity aerobic interval might be incorporated in selected patients • Intervals of 15-30 minutes with an RPE scale of 3-5 • Rest intervals of 15-30 minutes	
Frequency		• Starting with 2-3 days per week • Goal: 5 days per week	
Duration		• Starting with 10-15 minutes • Goal: 30 minutes	
Isometric / Resistance Exercises		Recommended	
Intensity		• 10-20 repetitions of 5- to 10-pound free weights	
Frequency		• 2-3 days per week	

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

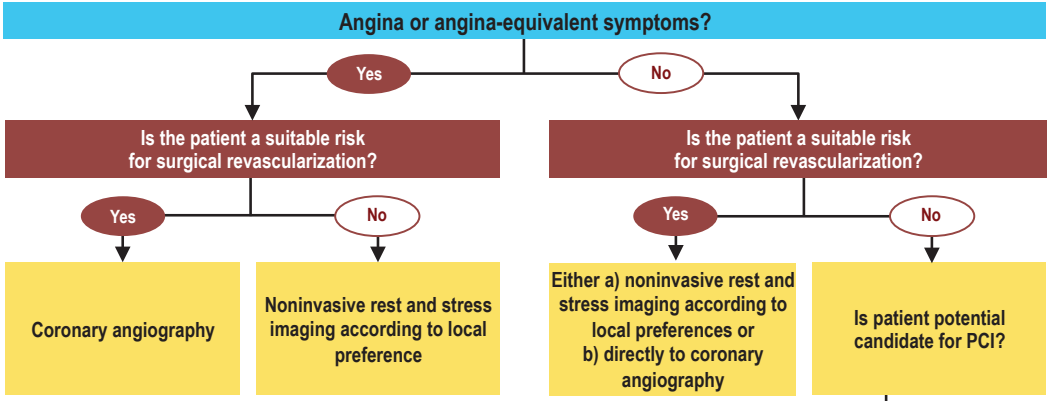


Figure 1. Approach to assessment for coronary artery disease in patients with heart failure. All patients with heart failure are expected to undergo noninvasive measurement of systolic function (not included in this algorithm). *Some centres might additionally perform noninvasive imaging, especially when coronary anatomy is not optimal.
†If imaging indicates features of high risk, progression to coronary angiography is expected.
‡Noninvasive imaging might be performed in certain centres for risk stratification or diagnosis.
PCI, percutaneous coronary intervention.

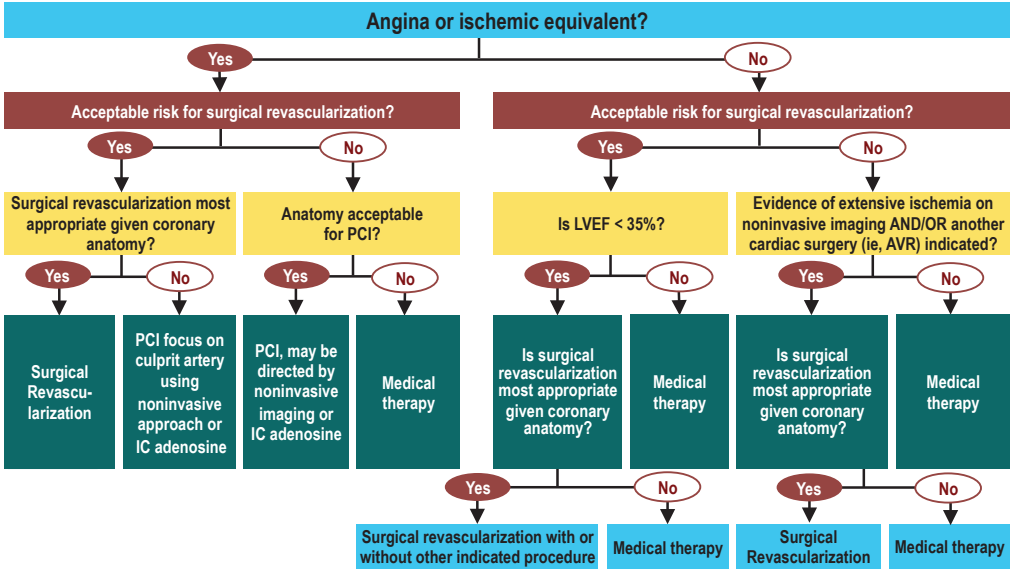


Figure 2. Decision regarding coronary revascularization in heart failure. It is recommended that surgical consultation be performed very early in this process. *Coronary anatomy suitable for CABG includes multivessel disease > 70% stenosis, left main stem stenosis > 50%, or diabetes with left anterior descending artery stenosis > 70%. In selected cases in which there is noninvasive imaging evidence of extensive cardiac ischemia, PCI might be considered. AVR, aortic valve replacement; CABG, coronary artery bypass grafting; IC, intracoronary; LVEF, left ventricular ejection fraction; PCI, percutaneous coronary intervention.

Commonly Available Tests for the Work-up of Anemia

Test	Suspected Etiologies	Remarks
Transferrin saturation, ferritin, serum iron	Iron deficiency	Ferritin may be artificially elevated in chronic inflammatory states; transferrin saturation may be low in patients with cachexia
Fecal occult blood; upper and lower endoscopy	GI-related blood loss	Referral to gastroenterology may be required
TSH	Thyroid related disorders	
Peripheral smear, reticulocyte count / index, bone marrow biopsy	Multiple	
B12 / folate	Nutritional deficiency	Uncommon in Canada
Hemoglobin electrophoresis	Thalassemia; sickle cell disease	Target testing to those in high prevalence population
Serum and urine protein electrophoresis	Multiple myeloma, amyloidosis and other protein disorders	

Algorithm for Management of Different Stages of HF using Natriuretic Peptides

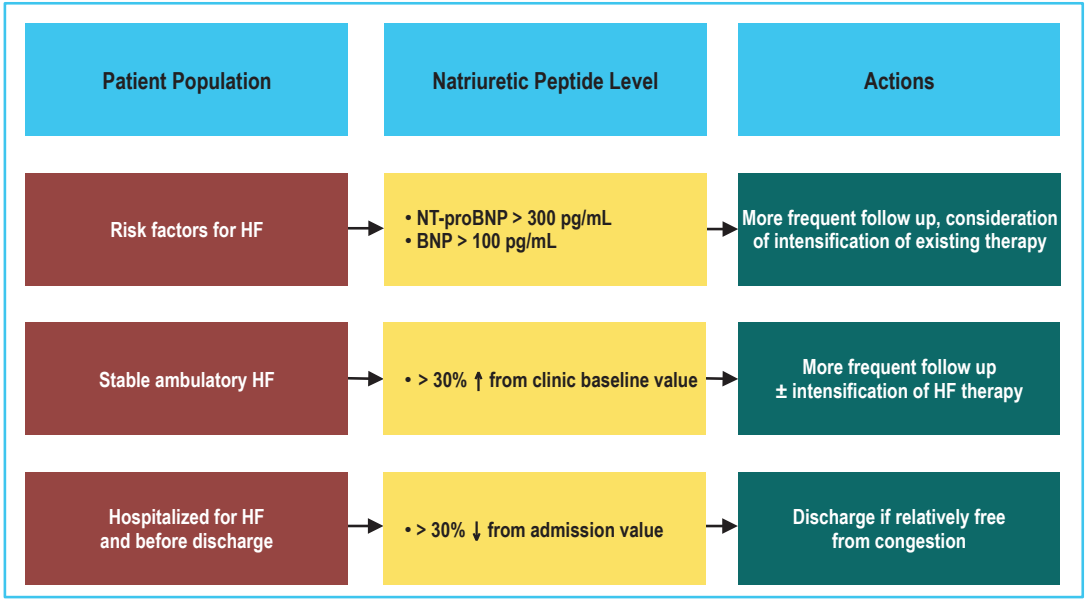


Figure 3. Algorithm of the use of natriuretic peptide in the prevention and management of ambulatory and hospitalized patients with heart failure.

Mineralocorticoid Receptor Antagonists in HFpEF

Recommendation - We suggest that in individuals with HFpEF, an increased NP level, serum potassium < 5.0 mmol/L, and an estimated glomerular filtration rate (eGFR) ≥ 30 mL/min, a mineralocorticoid receptor antagonist like spironolactone should be considered, with close surveillance of serum potassium and creatinine (Weak Recommendation, Low-Quality Evidence).

Values and Preferences - This recommendation is based on a prespecified subgroup analysis of the Treatment of Preserved Cardiac Function Heart Failure with an Aldosterone Antagonist (TOPCAT) trial, which includes analysis of the predefined outcomes according to admission NT-proBNP level, and the corroborating portion of the trial conducted within North and South America.

Practical Tip - After spironolactone is started and with a change in dose, serum potassium and creatinine should be monitored in the first week, fourth week, and then fourth month, and whenever clinically indicated. In practice, spironolactone is available in 25-mg tablets. The dose to use will therefore be 25-50 mg per day.

Combined Angiotensin/Neprilysin Inhibition in HFrEF

Recommendation - We recommend that in patients with mild to moderate HF, an EF ≤ 40%, an elevated NP level or hospitalization for HF in the past 12 months, a serum potassium < 5.2 mmol/L, and an eGFR ≥ 30 mL/min and treated with appropriate doses of guideline-directed medical therapy should be treated with LCZ696 in place of an ACE inhibitor or an angiotensin receptor blocker, with close surveillance of serum potassium and creatinine (Conditional Recommendation, High-Quality Evidence).

Values and Preferences - This recommendation places high value on medications proven in large trials to reduce mortality, HF rehospitalization, and symptoms. It also considers the health economic implications of new medications. The recommendation is conditional because the drug is not yet approved for clinical use in Canada and the price is still not known.

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