Canadian Journal of Cardiology 32 (2016) 296–310

Special Article

The Canadian Cardiovascular Society Heart Failure Companion: Bridging Guidelines to Your Practice

Jonathan G. Howlett, MD, FRCPC,[a] Michael Chan, MBBS, FRCPC, FACC,[b] Justin A. Ezekowitz, MBBCh, MSc, FRCPC,[c] Karen Harkness, RN, PhD,[d] George A. Heckman, MD, FRCPC,[e] Simon Kouz, MD, FRCPC,[f] Marie-Hélène Leblanc, MD, FRCPC,[g] Gordon W. Moe, MD, FRCPC,[h] Eileen O'Meara, MD, FRCPC,[i] Howard Abrams, MD, FRCPC,[j] Anique Ducharme, MD, FRCPC,[i] Adam Grzeslo, MD, CCFP,[d] Peter G. Hamilton, MBBCh, FRCPC,[c] Sheri L. Koshman, PharmD, ACRP,[c] Serge Lepage, MD, FRCPC,[k] Michael McDonald, MD, FRCPC,[l] Robert McKelvie, MD, PhD, FRCPC,[d] Miroslaw Rajda, MD, FRCPC,[m] Elizabeth Swiggum, MD, FRCPC,[n] Sean Virani, MD, FRCPC,[o] and Shelley Zieroth, MD, FRCPC;[p]

for the Canadian Cardiovascular Society Heart Failure Guidelines Panels

[a] *University of Calgary and Libin Cardiovascular Institute, Calgary, Alberta, Canada;* [b] *Royal Alexandra Hospital, Edmonton, Alberta, Canada;* [c] *University of Alberta, Edmonton, Alberta, Canada;* [d] *Hamilton Health Sciences, McMaster University, Hamilton, Ontario, Canada;* [e] *University of Waterloo, Waterloo, Ontario, Canada;* [f] *Centre Hospitalier Régional de Lanaudière and Université Laval, Quebec, Quebec, Canada;* [g] *Institut Universitaire de Cardiologie et de Pneumologie de Québec, Quebec, Quebec, Canada;* [h] *St Michael's Hospital, University of Toronto, Toronto, Ontario, Canada;* [i] *Institut de Cardiologie de Montréal, Montreal, Quebec, Canada;* [j] *University of Toronto, Toronto, Ontario, Canada;* [k] *Centre Hospitalier Universitaire de Sherbrooke, Fleurimont, Quebec, Canada;* [l] *University Health Network, University of Toronto, Toronto, Ontario, Canada;* [m] *QE II Health Sciences Centre, Dalhousie University, Halifax, Nova Scotia, Canada;* [n] *Royal Jubilee Hospital, Victoria, British Columbia, Canada;* [o] *University of British Columbia, Vancouver, British Columbia, Canada;* [p] *St Boniface General Hospital, Winnipeg, Manitoba, Canada*

ABSTRACT

The Canadian Cardiovascular Society Heart Failure (HF) Guidelines Program has generated annual HF updates, including formal recommendations and supporting Practical Tips since 2006. Many clinicians indicate they routinely use the Canadian Cardiovascular Society HF Guidelines in their daily practice. However, many questions surrounding the actual implementation of the Guidelines into their daily prac-

RÉSUMÉ

Le programme des lignes directrices de la Société canadienne de cardiologie en matière d'insuffisance cardiaque (IC) a généré des mises à jour annuelles sur l'IC, y compris des recommandations formelles et des conseils pratiques depuis 2006. De nombreux cliniciens indiquent qu'ils utilisent régulièrement les lignes directrices de la Société canadienne de cardiologie en matière d'IC dans leur pratique

The Canadian Cardiovascular Society (CCS) Heart Failure (HF) Guidelines Program has generated annual HF updates, including formal recommendations and supporting practical tips for the past 9 years.[1-9] Many clinicians indicate they routinely use the CCS HF Guidelines in their daily practice or as a reference for optimal care.[10] Feedback from family physicians, internists, cardiologists, nurses, pharmacists, and others attending Guidelines Workshops held across Canada have indicated that the Guidelines provide great value.[11] They also indicated the need to address issues surrounding

Received for publication May 12, 2015. Accepted June 15, 2015.

Corresponding author: Dr Jonathan G. Howlett, Room C838, 1403-29th St NW, Calgary, Alberta T2T 2X2, Canada. Tel.: +1-403-944-3232; fax: +1-403-944-3262.

E-mail: howlettjonathan@gmail.com

The disclosure information of the authors and reviewers is available from the CCS on their guidelines library at www.ccs.ca.

http://dx.doi.org/10.1016/j.cjca.2015.06.019

tice remain. A consensus-based approach was used, including feedback from the Primary and Secondary HF Panels. This companion is intended to answer several key questions brought forth by HF practitioners such as appropriate timelines for initial assessments and subsequent reassessments of patients, the order in which medications should be added, how newer medications should be included in treatment algorithms, and when left ventricular function should be reassessed. A new treatment algorithm for HF with reduced ejection fraction is included. Several other practical issues are addressed such as an approach to management of hyperkalemia/hypokalemia, treatment of gout, when medications can be stopped, and whether a target blood pressure or heart rate is suggested. Finally, elements and teaching of self-care are described. This tool will hopefully function to allow better integration of the HF Guidelines into clinical practice.

quotidienne. Cependant, de nombreuses questions entourant la mise en œuvre effective de ces lignes directrices dans leur pratique quotidienne demeurent. Une approche fondée sur le consensus a été utilisée, y compris les rétroactions des Panels d'IC primaire et secondaire. Ce vade-mecum est destiné à répondre à plusieurs questions clés élaborées par les praticiens spécialistes de l'IC tels que les délais appropriés pour les évaluations initiales des patients et les réévaluations subséquentes, l'ordre dans lequel les médicaments doivent être ajoutés, comment les nouveaux médicaments devraient être inclus dans les algorithmes de traitement, et quand la fonction ventriculaire gauche doit de nouveau être évaluée. Un nouvel algorithme de traitement de l'IC avec une fraction d'éjection réduite est inclus. Plusieurs autres questions pratiques sont abordées telles une approche de gestion de l'hyperkaliémie hypokaliémie, le traitement de la goutte, le moment où les médicaments peuvent être arrêtés, et si une cible de pression artérielle ou d'un rythme cardiaque est suggérée. Enfin, un enseignement et des éléments de l'autosoins sont décrits. Cet outil devrait permettre une meilleure intégration des lignes directrices en matière d'IC dans la pratique clinique.

the implementation of the Guidelines into everyday practice. Efforts are under way to implement Canadian benchmarking of key performance indicators for HF care. Although there is published information regarding hospital discharge medication use in patients admitted with HF, Canadian outpatient data are limited to abstract publications from the Canadian HF Network.[12,13] These data show relatively modest use of evidence-based therapies that increases in the HF clinic setting. Because use of evidence-based therapies for HF is closely related to best outcomes, the current Companion is focused on providing a pathway to achieving optimal treatment.

Who Is This Document Primarily Intended to Reach? What Is the Format?

This document addresses the most commonly asked practical questions that arise from those (in primary and secondary care) who use these HF Guidelines and is written with the main HF care provider in mind. Many of the suggestions and comments made in this article might also be of interest to those who treat a large volume of HF patients or who practice in a HF clinic setting. We have adopted a question and answer approach to the structure of this document and have indicated where published evidence has informed the responses. Otherwise, we have relied on procedures described in large randomized trials, or, where no evidence exists, we have used expert consensus obtained by polling all members of the primary and secondary HF panels and have collated the responses (response rate 29 of 34 [85%]) to the questionnaire.[14] We have also attempted to use graphics, tables, and lists in a user-friendly manner that is accessible via multiple formats so that the busy clinician might conveniently use this tool.

In this report, we provide suggested answers to the following questions:

(1) How soon should I see a newly referred HF patient; how often should my HF patient be seen, and when can a patient be discharged from a HF clinic?
(2) How quickly and in what order should standard HF therapy be titrated for most patients?
(3) When should I measure electrolytes, serum creatinine, and blood urea nitrogen (BUN), and how should I manage abnormal potassium or increasing creatinine levels?
(4) Should I treat my HF patients to a specific heart rate (HR) or blood pressure (BP) and how often should I measure left ventricular (LV) ejection fraction (EF)?
(5) Can I ever stop HF medications?
(6) When should I refer my patient to a heart surgeon?
(7) How should I manage gout in my patient?
(8) In what ways do I care differently for frail older patients with HF?
(9) How do I teach self-care to my patients?

How Soon Should I See a Newly Referred HF Patient?

Table 1 shows situational wait time benchmarks for HF referrals to a specialist.[15] More than 86% of survey respondents agreed that routine referrals should be seen within 4 weeks and 16% suggested this ideally be < 14 days.[14]

How Often Should My HF Patient Be Seen?

There are few published data regarding the optimal frequency of outpatient visits for patients with HF. Most clinical trials that involved stable HF patients scheduled visits every 3-4 months, with the assumption that primary and specialist care was in place. Patients who are not stable or are in the process of medical optimization should be seen more frequently. Table 2 shows the time frames for which $> 70\%$ of our respondents believe patients should be seen for HF care (by whomever provides their HF care), based on their risk.[14] Patients often move from one risk group to another after a sentinel event such as an emergency department visit or hospitalization. A suggested pathway for initial and ongoing assessments for patients with HF is shown in Figure 1.

Table 1. Situational wait time benchmarks for initial assessment of patients with HF

Triage category/ access target	Clinical scenario
Emergent < 24 hours	• Acute severe myocarditis • Cardiogenic shock • Transplant and device evaluation of unstable patients • New-onset acute pulmonary edema • HF in the setting of acute coronary syndrome
Urgent < 2 weeks	• Progressive HF and/or decompensated HF • New diagnosis of HF, unstable, decompensated • New progression to NYHA IV, AHA/ACC stage D • Postmyocardial infarction HF • Posthospitalization or ER visit for HF • HF with severe valvular heart disease
Semiurgent < 4 weeks	• New diagnosis of HF, stable, compensated • HF with mild to moderate or NYHA II/III symptoms • Worsening HF with therapy • Mild symptoms with valvular or renal disease or hypotension
Scheduled/routine < 6 weeks	• Chronic HF disease management, NYHA II
< 12 weeks	• NYHA FC I symptoms, structural heart disease without symptoms of HF (AHA/ACC stage B)

AHA/ACC, American Heart Association/American College of Cardiology; HF, heart failure; NYHA, New York Heart Association; ER, emergency room; FC, functional class.

Who Can I Discharge From My HF Clinic?

Panelists were split on this issue, with nearly 30% questioning whether those in the low-risk category required ongoing follow-up in HF clinics.[14] However, all agreed that they should not be discharged without establishment of coordinated follow-up involving primary and specialist care. Many of our panelists also believe that stable patients could be followed in satellite clinics attended by a combination of nurses and experienced internists or family doctors. All of our respondents listed a minimum of at least 2 of the following patient characteristics should be present to justify discharge from a HF clinic:

- Stable New York Heart Association (NYHA) I or II for 6-12 months.
- Using optimal devices and pharmacological therapies.
- Stable adherence to optimal HF therapy.
- No hospitalizations for > 1 year.
- LVEF > 35% (consistently shown if > 1 recent EF measurement).
- Reversible causes of HF controlled.
- Follow-up by general practitioner interested in management of HF.

How Quickly and in What Order Should Standard HF Therapy Be Titrated for Most Patients?

Standard treatment of HF due to LV systolic dysfunction (LVEF < 40%) now consists of triple therapy with an angiotensin-converting enzyme inhibitor (ACEi) (or an angiotensin receptor blocker [ARB] if ACEi not tolerated), β-blockers and, mineralocorticoid receptor antagonists (MRA).[8] However, many practitioners prefer specific aids, which might be used to help perform the mechanics of titration. The CCS has developed online aids for the titration of these medications that may be used by the individual practitioner or as a supporting document for an approved local protocol for physician extender/prescribers (such as nurse practitioners or clinical assistants), in areas in which this activity is allowed. These tools exist as a .pdf document, PowerPoint slide set or iTunes app—which is available and freely downloaded from the CCS HF Web site.[16] In Figure 2,

Table 2. Recommended frequency of follow-up for patients with HF, by risk

Risk group	Features defining risk of group	Suggested frequency of follow-up*
Low risk	NYHA class I or II No hospitalizations in past year No recent changes in medications Receiving optimal medical/device HF therapies	At least yearly (90% suggested within 12 months, 50% within 6 months) In certain cases might consider discharge of patient from clinic to specialist office (in addition to primary care)
Intermediate	No clear features of high or low risk	1-6 months
High risk	NYHA IIIb or IV symptoms Frequent symptomatic hypotension More than 1 HF admission (or need for outpatient intravenous therapy) in past year Recent HF hospitalization especially in past month Increasing creatinine level, especially GFR < 30 mL/min Nonadherence to therapy for any reason During titration of HF medications (ACEi/BB/ARB/MRA) New-onset HF Complication of HF therapy Need to downtitrate or discontinue BB or ACEi/ARB Concomitant and active illness (eg, high-grade angina, severe COPD, frailty) Frequent ICD firings (1 month)	Minimum 1-2 visits per month In some cases might be weekly assessments or even more frequent—especially if patient willing to undergo multiple visits to potentially avoid a hospitalization

ACEi, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; BB, β-blocker; COPD, chronic obstructive pulmonary disease; GFR, glomerular filtration rate; HF, heart failure; ICD, implantable converter defibrillator; MRA, mineralocorticoid receptor antagonist; NYHA, New York Heart Association.

* Many of these visits might be performed by telehealth or with allied health professionals supported in a multidisciplinary environment. The exact composition will vary according to local resources, personnel, and practice standards.

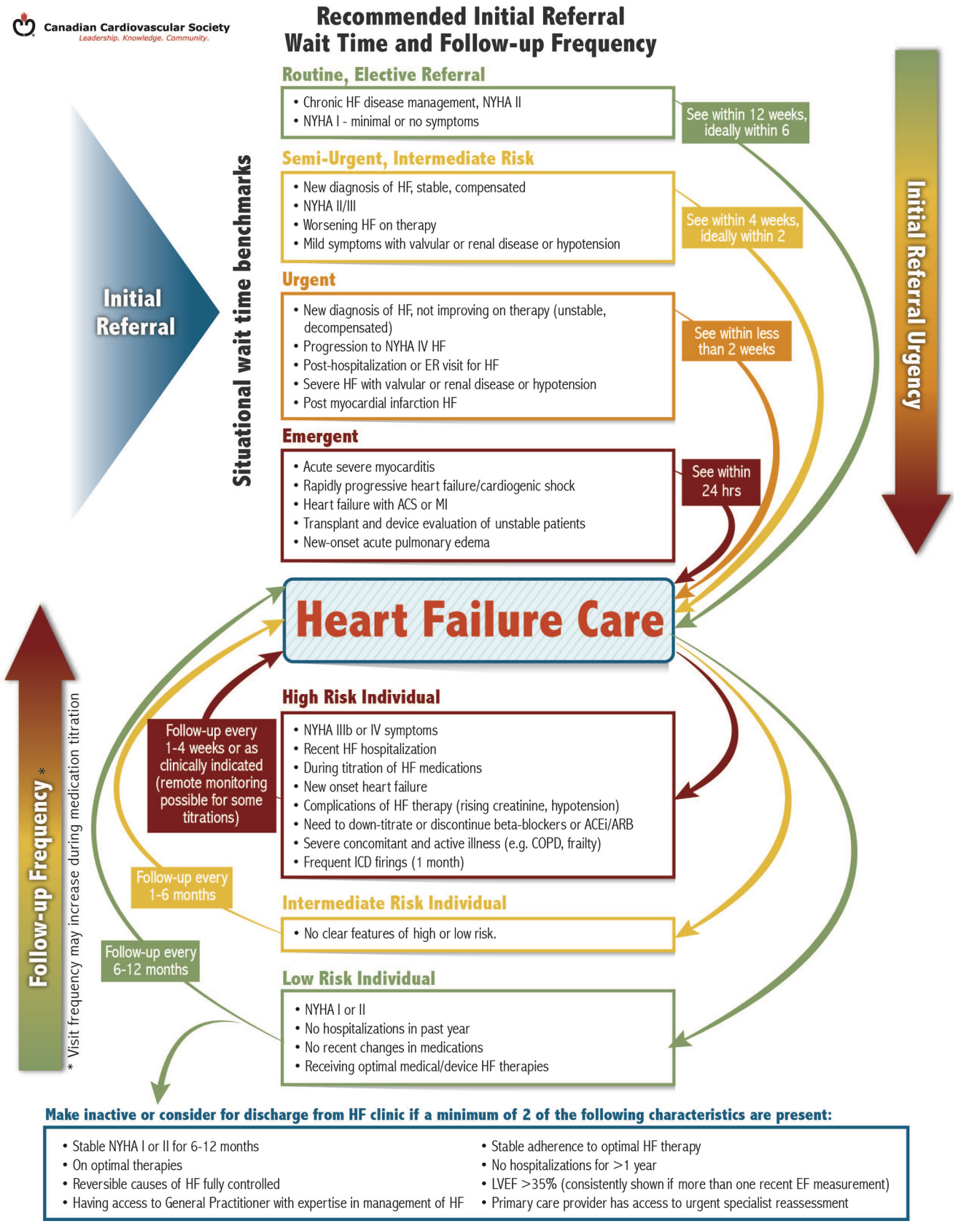

Figure 1. Recommended initial referral wait time and follow-up frequency. ACEi/ARB, angiotensin-converting enzyme inhibitor/angiotensin receptor blocker; ACS, acute coronary syndrome; AHA/ACC, American Heart Association/American College of Cardiology; COPD, chronic obstructive pulmonary disease; D/C, hospital discharge; ER, Emergency Department; FC, functional class; HF, heart failure; hrs, hours; ICD, implantable cardioverter defibrillator; MI, myocardial infarction; NYHA, New York Heart Association.

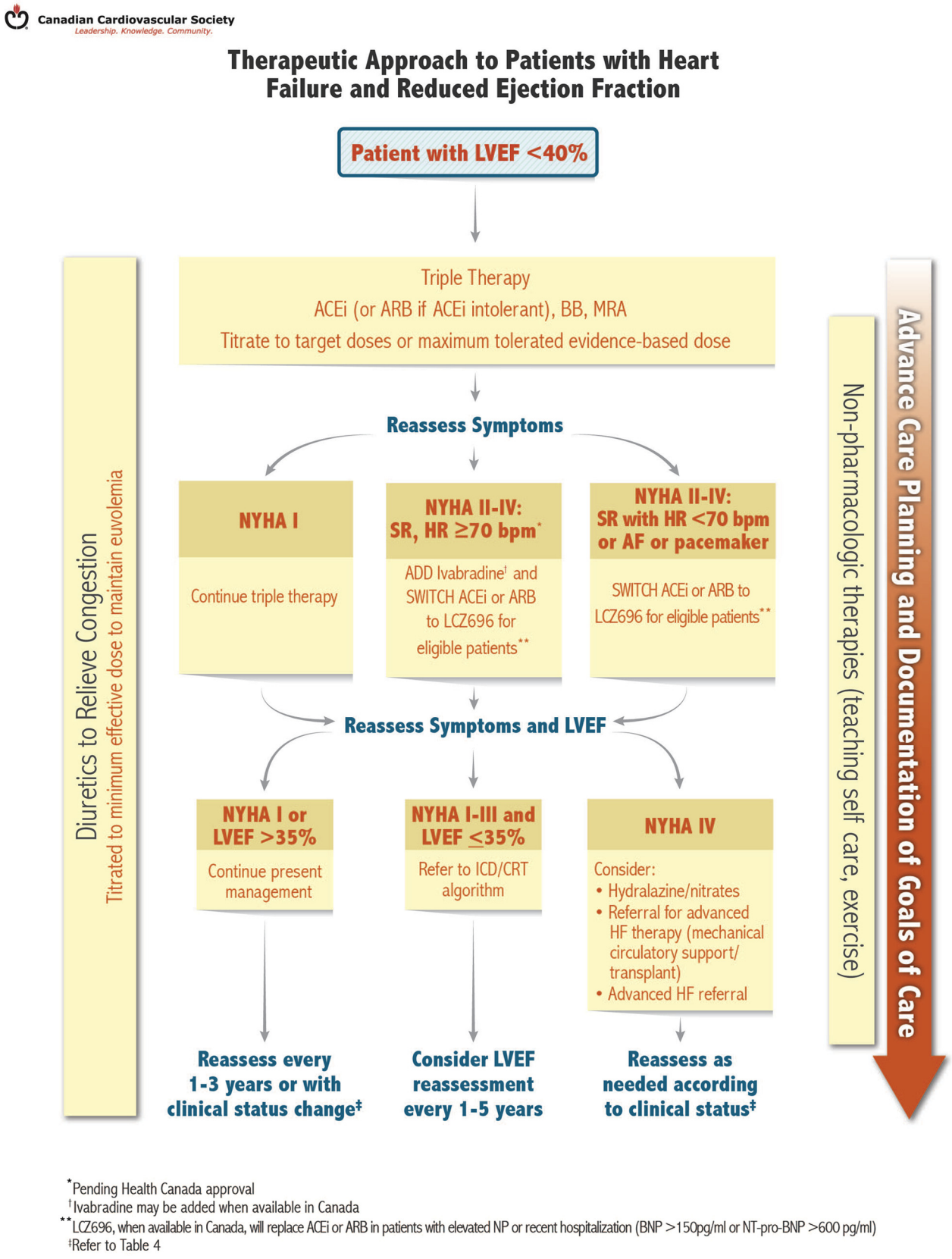

Figure 2. Therapeutic approach to patients with HF and reduced ejection fraction. ACE, angiotensin-converting enzyme inhibitor; AF, atrial fibrillation; ARB, angiotensin receptor blocker; bpm, beats per minute; CRT, cardiac resynchronization therapy; HF, heart failure; ICD, implantable cardioverter defibrillator; LVEF, left ventricular ejection fraction; MRA, mineralocorticoid receptor antagonist; NYHA, New York Heart Association; SR, sinus rhythm.

we have modified the treatment algorithm for institution of evidence-based therapies, including reassessments on treatment, for patients with HF due to LV systolic dysfunction. In this algorithm, we have referenced therapies that are at present under review by Health Canada and are expected to become available in the near future.

β-Blocker and ACEi (or ARB) titrations should be accomplished first (supported by > 80% of respondents), although this does not have to occur in any specific order as long as there is not undue delay in titration of the other.[17,18] Typically, in patients with continuing HF symptoms, an MRA is introduced when the ACEi titration is finished, because both drugs can exert additive effects on serum potassium and creatinine. Consistent with the Guidelines, the MRA should not be started or advanced in dosage if serum potassium is > 5.0 or serum creatinine is > 220 μmol/L.[8] The drugs used should be chosen from the CCS list of medications that have evidence for reduction of HF symptoms, cardiovascular morbidity, and mortality.[19] Titration might take several weeks to months depending on disease severity. Most of our panelists (55%) believe the entire triple therapy titration to maximal tolerated or target doses should be completed within 4 months, and 93% believe this should be completed within 6 months. Titration of ACEi and β-blocker only would be slightly less than this duration. All respondents agreed that every titration would NOT necessarily require a face-to-face visit, unless there were clinical concerns regarding the titration.

A Note on New Therapies

The astute reader will note 2 new medications in the updated Figure 2. Ivabradine and LCZ696 have been noted in previous HF Updates and are recommended for eligible patients. These medications should both be considered only after standard triple therapy has been completed. The optimal order of use for these medications is not known, however, the careful clinician can consider the following issues: (1) ivabradine is generally limited by HR, can be titrated over 2-4 weeks, and is generally well tolerated by those with lower BP; and (2) LCZ696 is generally limited by hypotension—especially those who are unable to tolerate moderate or high doses of ACEi (or ARB)— and hyperkalemia. It is generally titrated over 6-12 weeks. At this time, the order of titration will be individualized. These issues will determine the order and rapidity of titration.

Helpful Links for the Practitioner

The CCS HF Medication Titration app (Med-HF) and HF Guidelines app (iCCS) are available at: http://www.ccs.ca/index.php/en/resources/mobile-apps.[19] These apps contain a detailed algorithm that can be used for all aspects of titration of evidence-based medications for HF including ACEi, ARB, MRA, and β-blockers. The iCCS Guidelines app can be used for inquiry into any part of the Guidelines updates. In addition, an online tool, the HF Guidelines Compendium, can be used to look up any subject related to HF, and the relevant guidelines and/or practical tips will appear, irrespective of the year published. As a result, the reader will always have access to the most up-to-date recommendations with 1 easy query.

A link to the HF Pocket Document is available at: http://www.ccs.ca/index.php/en/resources/pocket-guides.[20] A link to HF Educational Slide Decks is available at: http://www.ccs.ca/index.php/en/resources/educational-slide-decks.[21]

When Should I Measure Electrolytes, Serum Creatinine, and BUN?

In many HF clinics serum electrolytes, creatinine, and BUN are routinely measured every 1-3 months in stable patients. Otherwise, our panelists suggest they also be measured in the following settings:

- For patients with advanced symptoms, measure with each visit (or televisit).
- Within 5-7 days of any intensification/addition of diuretic therapy.
- Within 7-10 days of and initiation or change in ACEi, ARB, MRA, or nonsteroidal anti-inflammatory drug (NSAID) therapy. This can be shortened to 3-5 days if the earlier serum potassium is close to or > 5.0 mEq/L.
- Within 1-2 days of sodium (calcium or sodium polystyrene) or calcium resonium usage or initiation/change in potassium supplement therapy.
- Early on during the course of any intercurrent illness that might affect volume or renal status (eg, gastroenteritis, influenza, or after surgery).
- Concomitant with any brain natriuretic peptide (BNP) measurement because increasing creatinine might increase N-terminal (NT)-proBNP (but not BNP). Remember that β-blockers (and certain newer medications such as neprilysin inhibitors) might increase BNP levels.

How Should I Manage Hyper- or Hypokalemia in My Patients?

Changes in diet, fluid balance, diuretic therapy, and drugs that affect renal function (ACEi, ARB, MRA) might affect serum potassium. For this reason, it is always important that the patient understands to avoid or encourage potassium intake in their diet, depending on their own potassium status. Hyperkalemia and hypokalemia are both commonly seen during the management of patients with HF. The former is most commonly seen in patients who receive > 1 ACEi, ARB, or MRA medication, or have diabetes or stage ≥3 chronic kidney disease.[22,23] Hypokalemia is most often seen with combination or intravenous diuretic therapy, especially if a thiazide, such as metolazone is used as part of the regimen. Changes in these parameters are most common after drug initialization and titration but > 20% of abnormalities might occur many months after the introduction of a drug such as MRA, necessitating the regular monitoring of serum potassium.[24]

Although the text herein will provide general guidance as to how HF experts in Canada manage serum potassium abnormalities, the Med-HF app (please see the section on Helpful Links for the Practitioner) can also be used as a specific guide.[19] This app is also available as a PowerPoint slide set or Adobe document.[20,21]

Table 3. Suggested management approach for hyperkalemia, according to severity

Severity of hyperkalemia*	Initial management	When to recheck electrolytes and potassium	When to restart and/or retitrate RAAS inhibitors
Mild (serum K^+ 5.0-5.5 mmol/L)	• Continue all RAAS unless new and major increase in K^+ (if so, stop most recently added RAAS agent) • Reinforce potassium restriction • Avoid other sources of K^+ • Ensure patient is not hypovolemic	• Routine measurement unless K^+ has been gradually increasing over time • If RAAS agent has been stopped, recheck within 72 hours	• Usually not applicable • If RAAS agent has been stopped, restart when serum potassium decreases to within the patients usual level, or < 5.0 mmol/L, (whichever is higher) AND • Any concomitant condition contributing to recent changes is under control
Moderate (serum K^+ 5.6- 5.9)	• Continue all RAAS at half previous dose unless K^+ has been increasing over time or major increase in K^+ (if so, stop most recently added RAAS agent) • Reinforce potassium restriction • Avoid other sources of K^+ • Ensure patient is not hypovolemic	• Recheck K^+ and renal function within 72 hours • With repeated $K^+ > 5.5$, stop at least 1 RAAS agent and repeat measurement within 72 hours • With a second $K^+ > 5.5$, consider calcium or sodium polystyrene 30 g administration	• When serum potassium decreases to within the patients' usual level, or < 5.0 mmol/L, (whichever is higher) AND • Any concomitant condition contributing to recent changes is under control • RAAS medications should usually be reintroduced 1 at a time with intervening measurement of renal function and electrolytes
Serious or severe (serum $K^+ > 5.9$)	• Contact patient to proceed to health centre for clinical assessment and 12-lead electrocardiogram • Patient to undergo treatment according to local protocols for serious hyperkalemia • Hold all RAAS agents until reassessment	• Within 4-24 hours, depending on local acute hyperkalemia protocol (when symptomatic or if there are electrocardiographic changes consistent with hyperkalemia) • Again approximately 72 hours later	• When serum potassium decreases to within the patients' usual level, or < 5.0 mmol/L, (whichever is higher) AND • Any concomitant condition contributing to recent changes is under control • RAAS medications should usually be reintroduced 1 at a time with intervening measurement of renal function and electrolytes

RAAS, renin-angiotensin-aldosterone system.

*The above actions are suggested based on the assumption that the potassium level is correctly measured. For instance, hemolysis of blood might occur, which falsely increases the potassium level. In this instance, a repeat measure is necessary.

Hyperkalemia

The best treatment for hyperkalemia is prevention. In general, patients who are given ACEi, ARB, or MRA should be provided information on how to limit dietary potassium intake and, if necessary, asked to stop drugs that affect potassium levels, such as NSAIDs, or especially potassium supplements (including salt replacement foods). In addition, serum potassium levels might be falsely increased because of hemolysis. Although many laboratories will not report serum levels in a hemolyzed specimen, care should be taken to avoid acting on such a level.

Drugs such as ACEi, ARB, or MRA should be used with great care, or not at all in patients with glomerular filtration rate < 30 mL/min because evidence for their benefit is lacking in this situation.

Patients with serious hyperkalemia (> 6.0 mEq/L) should be immediately contacted to determine their clinical status and to proceed to the nearest health facility where indicated management can be given (such as electrocardiographic monitoring, intravenous insulin/glucose, salbutamol, and calcium). Patients with serum potassium < 6.0 can usually be managed in an ambulatory setting.

For clinicians who do not wish to use the Med-HF app, Table 3 can serve as a general guide for treatment of hyperkalemia and is based on (but not identical to) algorithms used in the **E**plerenone in **M**ild **P**atients **H**ospitalization **A**nd **S**urv**I**val **S**tudy in **H**eart **F**ailure (EMPHASIS-HF) and **C**andesartan in **H**eart Failure: **A**ssessment of **R**eduction in **M**ortality and Morbidity (CHARM) studies, in which different ACEi, ARB, and MRA combinations were administered.[25,26] In these studies, serious hyperkalemia (> 6.0 mEq/L) and hypokalemia (< 3.0 mEq/L) occurred in < 5% of cases.[26,27] This algorithm can apply to patients with HF (double or triple therapy) and when spironolactone is used instead of eplerenone.

Use of sodium or calcium polystyrene for treatment of hyperkalemia is typically reserved for serious hyperkalemia (> 6.0 mEq/L) or if conservative measures are not successful for less severe hyperkalemia (> 5.5 mEq/L in consecutive measurements). The need for repeated usage of this medication to reduce serum potassium typically should trigger a reassessment of the medical regimen. Many clinicians use polystyrene with a promotility agent, such as lactulose. This might not be necessary for as needed use, but repeated use of polystyrene agents might cause significant constipation.

Hypokalemia

Minimization of the use of intravenous loop diuretics and loop and thiazide diuretic combination therapy will lessen urinary potassium loss. Use of oral potassium supplements is effective but associated with gastrointestinal upset. Divided doses of slowly absorbed potassium, with titration according to the response is suggested with an initial dose of 40-80 mEq K^+ daily. One should consider chronic hypomagnesemia with secondary urinary potassium wasting in patients receiving chronic diuretics who present with refractory hypokalemia. This might be remedied by administration of 250-500 mg oral elemental magnesium per day.

Renal and electrolyte consequences of diuretic therapy

Increasing creatinine level is a common occurrence in the HF syndrome, and hyponatremia is frequently seen in frail

patients or those with advanced HF. The CCS published an update in 2007,[1] on which the Pocket Card, HF app and Med-HF app[19-21] are based. For full details we refer you to these documents. However a few comments can be made about the patient with increasing creatinine level (30% increase or > 26 μmol/L from baseline) or those with diuretic resistance (waning of diuretic response over time, failure to increase diuresis with increased diuretic dose, or urine volume < 1500 mL) and hyponatremia (Na < 135 mEq/L).

Increasing creatinine level

(1) A common cause is hypovolemia. A volume assessment of the patient is warranted and reduction/temporary cessation of diuretics.
(2) Avoid medication or substances that are known to affect renal function such as NSAIDs.
(3) Proactively reduce use of diuretics during concomitant episodes of dehydrating illnesses or periods of poor intake.
(4) Routine assessment of electrolytes and creatinine, especially in those who are receiving triple therapy and diuretics. Many clinics follow these tests every 1-3 months although the optimal frequency is not known.
(5) Be extremely careful when using multiple diuretics, because this will greatly increase the risk of hypotension (rapid diuresis) and hyponatremia.
(6) Most clinicians will stop the MRA and reassess before stopping the ACEi (or ARB).
(7) If these interventions fail, consultation with a nephrologist might be needed.
(8) The more rapidly the creatinine changes, the more frequent reassessment is required. Changes of > 20%-30% in creatinine should be reassessed within 7 days.

Diuretic resistance and hyponatremia

(1) As noted on the Pocket Card, most clinicians will first double the dose of loop diuretic. If there is a failure to lose body weight within 48 hours, clinicians will change to intravenous administration if feasible (same dose) or add a thiazide diuretic. The third option is to use an intravenous loop diuretic (either bolus or infusion) along with a thiazide diuretic.
(2) It is critically important to avoid symptomatic hypotension in this instance.
(3) It is also important to supplement potassium and/or chloride when they are deficient.
(4) Discontinue combination diuretic therapy as early as possible.
(5) Use of acetazolamide for management of metabolic alkalosis might be helpful if diuretics cannot be reduced, and tolvaptan is highly effective when serum sodium is < 130 mEq/L.
(6) Patience is important, a less aggressive goal of 0.5 kg per day of body weight reduction (or less in some cases) will allow for less diuretic-induced renal and/or electrolyte imbalance.
(7) It is important to ensure the patient is adherent to an acceptable fluid restriction—this is usually < 2000 mL per 24 hours. Recently, more aggressive fluid restrictions of 1000-1500 mL have come under question but might rarely be needed temporarily.
(8) It is also critically important to ensure that optimal treatments of the HF syndrome (vasodilator, treatment of hypoxia, tachycardia, etc) are enforced.

Should I Treat My HF Patients to a Specific HR or BP?

Current HF Guidelines are based on the concept that we use targets to identify when to initiate therapy. When an evidence-based therapy is initiated, it is titrated until the target dose is reached or intolerance occurs. However, a few comments can be made.

Blood pressure

Avoidance and treatment of systemic hypertension has long been a critical aspect of HF treatment and prevention. Available evidence indicates that patients with lower resting BP,[28] or who experience episodes of symptomatic hypotension also suffer greater morbidity and mortality compared with those with normal BP.[29,30] This is also true during acute HF.[31] In contrast, evidence-based therapies for HF with LVEF < 40% have been shown to confer at least as good a benefit irrespective of the starting BP, provided the medication is tolerated.[32] Indeed, many patients with low BP might do very well with evidence-based therapies.

- Apart from control of systemic hypertension, no BP must be targeted as long as the patient is not symptomatic because of low perfusion.
- There is no consensus on which BP is optimal, although some HF clinicians will empirically try to keep systolic BP < 110-120 mm Hg for patients with very low LVEF. The rationale is to reduce cardiac afterload, despite a lack of outcome evidence.
- There is observational evidence that symptomatic hypotension should be avoided during acute HF.
- Hypotension can complicate titration of evidence-based therapies such as ACEi, ARBs, or β-blockers. These simple strategies can be used to greatly reduce the likelihood of this problem:
  (1) Staggering of any vasoactive medication such that no 2 such drugs are given within 2 hours of each other.
  (2) Splitting medications into smaller, more frequent dosages might be helpful.
  (3) Many clinicians prescribe β-blockers to be taken with meals to slow down absorption.
  (4) Reduce or discontinue other medications (if possible) that lower BP but do not alter prognosis, such as calcium or α-blockers.
  (5) Titrate vasoactive medications more slowly and avoid titration when there is hypovolemia present.

Heart rate

Resting HR is directly related to mortality in patients with HF.[33,34] Decrease of an initially increased HR is associated with improved mortality, which is in turn associated with the degree of lowering of the HR.[33] In the past, resting HR was used only to identify whether approved β-blockers could be administered or titrated upward to the target dose.[8] Most clinicians would accept a resting HR of 50-60 beats per

Table 4. Suggested timing for measurement of LVEF, according to clinical scenario

Clinical scenario	Timing of measurement	Modality of measurement	Comments
New-onset HF	Immediately or within 2 weeks for baseline assessment	ECHO (preferred when available); or MUGA or CMRI	70% request ECHO and 30% MUGA; report should include numeric EF or small range of EF and diastolic function evaluation
Following titration of triple therapy for HFrEF, or consideration of ICD/CRT implantation	3 Months after completion of titration	ECHO or MUGA or CMRI (preferably the same modality and laboratory test as initial test)	LVEF after medical therapy might increase, obviating device therapy
Stable HF	Approximately every 2-3 years, especially if EF is > 40%	ECHO or MUGA or CMRI	Rationale is to identify improving (better prognosis) or worsening ventricular function (worse prognosis, need for additional therapy such as ICD/CRT)
After significant clinical event (ie, after some HF hospitalizations)	Within 30 days, during hospitalization if possible Not necessary when repeated admissions occur without need to identify a cause	ECHO or MUGA or CMRI, cardiac catheterization in context of ACS	Frequently helpful information such as EF, degree of valvular dysfunction, and RVSP

ACS, acute coronary syndrome; CMRI, cardiac magnetic resonance imaging; CRT, cardiac resynchronization therapy; ECHO, echocardiogram; EF, ejection fraction; HF, heart failure; HFrEF, HF with reduced EF; ICD, implantable cardioverter defibrillator; LVEF, left ventricular EF; MUGA, radionuclide angiography; RVSP, right ventricular systolic pressure.

minute (bpm) or as low as tolerated (usually not < 50 bpm). Increased HR (> 70-75 bpm) after β-blocker titration can identify patients with LVEF < 35% who might benefit from the Ik_f or 'funny' channel blocker ivabradine (soon available in Canada), which directly decreases HR in patients in sinus rhythm. However, even in this setting, the intent is to titrate the medication to the target of 7.5 mg twice daily as long as the medication is tolerated, not to a specific HR. For patients with atrial fibrillation, the evidence linking resting HR and outcomes is poor.

- HR is used to determine eligibility for β-blocker initiation and titration; the medication should be titrated to target dose if tolerated. This is also true for other HR-lowering drugs.
- In the case of atrial fibrillation, β-blockers are preferred. There is no specific target associated with optimal outcome although many suggest a rate < 80-100 bpm.

I Know I Should Get a Baseline Measure of LVEF, but Should I Measure It Again? If So, When Should It Be Measured?

It has been shown that LVEF might change substantially over time.[35,36] Indeed, approximately 25% of patients with initial LVEF < 40% (HF with reduced LVEF) might gain an increase to > 40%. These patients have an excellent prognosis. Conversely, 25% of patients with initial LVEF > 40% (HF with preserved EF [HFpEF]) might experience a decrease in LVEF < 40%.[36,37] Finally, in patients with initially low LVEF, it is necessary to document the response of EF to triple therapy to assess eligibility for implantable cardioverter defibrillator and/or cardiac resynchronization therapy. One schedule for measurement of LVEF is shown in Table 4.

What About Measurement of BNP or NT-proBNP?

Natriuretic peptides (NPs) are increasingly a part of the management of HF. In 2015, the CCS recommended the use of NPs in several clinical scenarios.[9] It is important to recognize that access to NP is variable across Canada, and so use will vary from region to region and according to indication. The following clinical scenarios for which BNP will commonly be measured are noted in the following list of scenarios. Scenarios 1-3 are more strongly advocated in the Guidelines.

(1) All patients on assessment in the emergency department with suspected but not proven HF.
(2) At end of titration of triple therapy for those with LVEF < 40%. In this situation, increased NP level might lead to a change in ACEi (or ARB) therapy to LCZ696.
(3) In patients with stable HFpEF in whom an increased NP level will lead to additional use of an MRA.
(4) In patients who are at risk of HF in whom elevated NP level will lead to closer follow-up.
(5) Before hospital discharge (when admitted for HF) in situations in which an increased level will change the follow-up plan, such as admission to a HF clinic.
(6) In patients followed by HF clinics who wish to use NPs to guide therapy.

Can HF Medications Ever Be Stopped? If So, Then When?

Guideline-directed medical therapy (GDMT) for patients with HF and reduced EF (< 40%) has dramatically changed the long-term natural history of the disease.[8] These drugs include ACEi inhibitors, ARB, MRA, and β-blockers. In an African American subset of moderately severe HF patients, the combination of nitrates and/or hydralazine is also disease-modifying. In contrast to these drugs, several other agents such as loop diuretics, thiazide diuretics, nitrates (alone), digoxin, and other drugs have not changed the long-term natural history of HF and can be stopped in the absence of symptoms and/or congestion.

Indeed, > 90% of our panel agreed that ACEi/ARB, β-blockers, and MRA agents, once indicated, should be given indefinitely.

However, 4 important points must be raised. First, many patients were excluded from clinical trials that involved GDMT including those with clearly reversible causes or specific forms of HF, many of which are outlined in Table 5.[38] Second, withdrawal of chronic ACEi/β-blocker therapy for patients with dilated cardiomyopathy (ischemic or non-ischemic) whose LVEF improved with triple therapy will result in a 60%-80% likelihood of recurrence of low LVEF, usually with symptoms.[39] As such, withdrawal of these medications should only be considered after consultation with a physician experienced and competent in the treatment of HF. Finally, reassessment of LVEF should occur within 3-6 months after withdrawal of GDMT and periodically thereafter, with any reduction of LVEF prompting reconsideration of the plan.

Our committee agreed that in a few specific situations, listed below, HF medications might be withdrawn if certain circumstances are present as listed in Table 5.

What About HFpEF?

Unfortunately, we still do not have proof that any specific medication will prolong life in patients with HFpEF.[9] However, evidence is increasing that we can reduce symptoms and improve quality of life in this condition, and recent studies suggest that MRA might be useful in those with increased NP level.[9] As mentioned in previous updates, our suggestions for treating HFpEF remain:

(1) The same recommendations for initial referral, repeat assessment, and measurement of LVEF and NP are identical irrespective of the type of HF.
(2) Use of β-blockers for concomitant conditions, such as previous myocardial infarction or angina.
(3) Use of ACEi or ARB in most patients.
(4) Use of MRA for patients who have had an increased NP level.
(5) Correction of any condition, such as systemic hypertension, valvular heart disease, cardiac ischemia, or tachycardia and/or atrial fibrillation that might have aggravated or precipitated HF.
(6) Treatment of concomitant comorbid conditions.
(7) Use of minimal doses of diuretics necessary to maintain euvolemia.
(8) Access to HF clinics, cardiac rehabilitation, and self-care management as per any other patient with HF.

How Should I Manage an Acute Episode of Gout?

Gout is a common complication of loop diuretic therapy, and frequently occurs during HF decompensation. NSAID agents should be avoided as shown in Table 6.

Is My Patient a Candidate for Heart Surgery?

Surgical coronary revascularization, mitral (or even tricuspid) valve repair, and (in carefully selected cases) LV aneurysm resection might have a profound effect on mortality, symptoms, and subsequent hospitalization.[4,44,45] As such, patients with HF should always be assessed for conditions amenable to surgical therapy. This action is typically performed on initial diagnosis of HF, but should always be a consideration after any major change in the clinical HF syndrome (especially if there is a heart murmur, symptoms of potential cardiac ischemia, or a significant change in assessment on echocardiography).

In general, most patients with HF will present without evidence of obvious cardiac ischemia or primary valvular pathology. In this setting, optimal medical care is instituted with a reassessment of LVEF, and surgical considerations are undertaken, if appropriate. In the minority of HF patients who present with ischemic cardiomyopathy or other structural cardiac abnormality, this surgical assessment will occur much earlier and before LV reassessment. Because advances in surgical therapy for HF continue to occur, surgical candidacy should be assessed (or reassessed!) at a high-volume surgical centre that provides advanced surgical therapies such as mechanical circulatory support and heart transplantation.

Table 5. Potential scenarios in which evidence-based medical therapy for heart failure might be withdrawn

Clinical presentation	Conditions to justify withdrawal of GDMT after 6-12 months of therapy	Comments
Tachycardia-related CM	• Normal EF (> 50%) • NYHA FC I • Underlying tachycardia controlled	Usually due to atrial fibrillation/flutter with increased HR, might rarely occur because of PVCs. Might need BB for rate control
Alcoholic CM	• Normal EF • NYHA FC I • Abstinence ETOH	Nutritional deficiency might coexist and require therapy Might need control of obesity and obstructive sleep apnea
Chemotherapy-related CM	• Normal EF • NYHA FC I • No further drug exposure	Certain types of chemotherapy (trastuzamab—high rate of LVEF improvement when it is stopped) are more likely to reverse than others (anthracyclines for which therapy should be continued) Long-term surveillance strongly recommended
Peripartum CM	• Normal EF • NYHA FC I	Repeat pregnancy might be possible for some.[40-42] Consultation at high-risk maternal centre should be undertaken
Valve replacement surgery	• Normalization of EF • NYHA FC I • Normally functioning valve	Less consensus on regurgitant lesions with ongoing dilation of LV

BB, β-blocker; CM, cardiomyopathy; EF, ejection fraction; ETOH, ethanol; FC, functional class; GDMT, guideline-directed medical therapy; HR, heart rate; LV, left ventricle; LVEF, left ventricular EF; NYHA, New York Heart Association; PVC, premature ventricular contraction.

Table 6. Potential approaches to treatment of acute gout in patients with HF

Type of therapy	Type of gout	Dosage and duration of therapy	Dosage adjustment
Acute gouty attack			
Oral colchicine	Any type	1.0-1.2 mg then 0.5-0.6 mg every 2 hours until pain relief with maximum of 3 mg per 24-hour period. May be used to abort gouty attack if used early enough	Not recommended for GFR < 15 mL/min High rate of diarrhea with aggressive dosing. Many will use only a single dose of 0.6 mg after first dose
Oral prednisone	Polyarticular gout, or inability to treat with colchicine	Prednisone, 0.5 mg/kg daily with rapid taper over 7-14 days	No adjustment needed Can be given intravenously or orally and might not worsen acute HF[43]
IA steroid injection	Monoarticular gout. Not suitable for polyarticular gout	IA triamcinolone 20 mg once IA cortisone 100 mg once	None required
Chronic prevention of gouty attacks			
Colchicine	Can reduce attack frequency	0.6 mg daily or twice per day in function of GFR	Not recommended for GFR < 15 mL/min
Allopurinol	First-line agent for reduction of uric acid	300 mg daily orally	Dose reduction for renal disease. 200 mg daily for GFR < 30 mL/min 100 mg daily for GFR < 20 mL/min 50 mg daily or 3 times weekly if ESRD
Febuxostat		40-80 mg daily orally	Reduce for GFR < 30 mL/min
Probenecid	Second- or third-line agent	250 orally twice per day to maximum 1000 mg twice per day	Multiple drug interactions Avoid if GFR < 30 mL/min

ESRD, end-stage renal disease; GFR, glomerular filtration rate; HF, heart failure; IA, intra-articular.

In What Ways Do I Care Differently for Frail Older Patients With HF?

Although the CCS HF Guidelines endorse that most of the recommendations for management of HF also apply to seniors, their successful implementation requires careful consideration of concurrent geriatric syndromes as stated in the 2006 HF update.[2] Frailty is commonly understood as a state of increased vulnerability that generally occurs among older persons, and arises from the presence of multiple deficits across multiple systems.[46]

Key points[47]

- The diagnosis of HF in older patients is complicated by nonspecific symptoms of shortness of breath, fatigue, fall, loss of autonomy, cognitive impairment, and incontinence, and overlaps with other common comorbidities. Clinicians should have a high index of suspicion for HF in this population.
- NPs are particularly useful for diagnosis of HF in older patients because of the increased difficulty of diagnosis.
- Most recommended HF therapies are effective in older patients and can be consistent with their goals of care, including alleviation of HF symptoms.
- Successful management of HF in older patients is most feasible in a chronic disease management setting.
- Clinicians should have early and frank discussion with patients and their families about the end-of-life preferences, and provide palliative care in appropriate patients.

I am concerned that increasing the doses of indicated HF medications in older HF patients would lead to falls

The CCS recommends GDMT at target doses as tolerated in all patients irrespective of age. However, symptomatic cerebral hypoperfusion resulting from excessive doses of medications is an important mechanism of falls in older persons. This is often exacerbated by volume depletion, because of diuresis and is compounded by their reduced thirst and renal salt retention. HF measurement of orthostatic vital signs, including immediately after standing, is an essential manoeuvre in assessment of volume status in an older person.

- Splitting daily doses of medications might help avoid the peak effect of a larger dose.
- Avoidance of hypovolemia with less aggressive diuresis or through permissive reduction of diuretic or ACEi during titration of β-blockers might reduce the risk of hypotension.
- Routine surveillance of electrolytes and renal function is essential.
- Persistent peripheral edema might be due to venous insufficiency or calcium-channel blockers and might persist despite adequate diuresis.

How Can Complaints of Urinary Frequency and Incontinence Be Addressed in Older HF Patients?

Urinary frequency, nocturia, and incontinence are common among older persons and are often attributed to the use of diuretics. This might affect patient adherence. However, urinary frequency or nocturia might occur because of increased intravascular volume from suboptimal HF control, nocturnal mobilization of peripheral edema in the recumbent position, and sleep apnea.[47]

A focused clinical history will help identify potential HF-related precipitants of urinary complaints:

- Ask about urinary symptoms, especially frequency and incontinence—patients might not volunteer this information.
- Assess volume status to identify volume overload.
- If incontinence is linked to an ACEi cough, consider changing to an ARB.

Table 7. The 3 elements of HF self-care[58]

Self-care terms	Self-care activities
Maintenance	Behaviours to reduce risk factors, improve health, and adhere to recommendations (eg, follow dietary restrictions, take medications as prescribed, exercise regularly)
Monitoring	Routine daily monitoring/vigilance to HF symptoms (eg, daily weights, checking for edema) and recognize a change when it occurs
Management	Evaluate a change in symptoms and determine what action is needed (eg, do nothing, call a health care provider). Evaluate the effectiveness of the action

HF, heart failure.

- A high index of suspicion for presence of sleep apnea in elderly HF patients is warranted.
- The management of persistent peripheral edema in the setting of optimal intravascular volume includes:
  - Discontinuation of offending medications such as calcium-channel blockers.
  - Elevate the head of the bed and/or use compression stockings.
  - Administering diuretics after the midday meal, leaving the patient relatively more volume-depleted at bedtime.
  - Patients might prefer to either avoid or to self-administer diuretics after a long excursion, rather than before. By allowing them to do this, adherence might increase.
- Persistent urinary complaints should trigger referral to a clinician specialized in incontinence management.

Why Are My Older HF Patients Continuously Readmitted Despite My Best Efforts?

Elderly patients with HF are more likely to suffer additional comorbid conditions in addition to HF.[48,49] Repeat hospitalization, approximately 50% of which is because of noncardiac causes, is thus more likely to occur in this group of patients.[48,50] In addition to a properly executed hospital discharge, extra care should be taken to identify potential causes of readmission, which if found, can be addressed directly or with prompt specialist referral[47,51]:

- Screening for cognitive impairment (such as with the Montreal Cognitive Assessment; minor training might be required).[52,53]
- Screening for major depression, using well-known screening tools.[54-56]
- Screening for frailty, such as with the Canadian Study on Health and Aging Frailty Scale or 5-second walk distance at discharge.[46]
- Poor nutrition and/or poor adherence to medical devices.
- Management of complex HF patients should occur in multidisciplinary disease management clinics, with close involvement of the primary care clinician.[47]

Other referrals to consider include:

- Pharmacy services;
- Home care services;
- Community support services (eg, Meals on Wheels, Alzheimer's Society);
- Specialized Geriatric Services.

How Do I Teach Self-Care to My Patients?

Self-care in HF is often described in the context of behaviours necessary to maintain or promote health and lifestyle changes and manage the symptoms and effects of living with HF.[57,58] The basic elements of self-care are shown in Table 7.

Topics relevant to self-care in HF are well documented.[58,59] Although patient education is necessary, simply providing patients with the standardized information is insufficient for optimization of self-care.[60,61] The key points for optimization of self-care in patients with HF are listed in Table 8.

Table 8. Tips for optimizing self-care in patients with HF[58-66]

Factors that affect self-care	Tips
Confidence	Self-care confidence is a modifier and mediator of success. Strategies to improve patient self-care confidence include: counselling to recognize benefits and help overcome barriers of self-care, reinforcing positive behaviours, setting mutual and realistic goals, and celebrating successes
Cognitive status	Consider screening (eg, MOCA) for cognitive impairment and literacy level in patients with ongoing challenges with engaging in self-care
Emotional status	Consider screening for depression/anxiety in patients with ongoing challenges with engaging in self-care
Relationship with HCP	Relationships require trust, and need to be collaborative, reciprocal, and respectful. HCPs need to view patient as a partner and adopt a collaborative approach
Learning environment	Patients need a safe environment (eg, not punitive) to explore real or potential situations in which self-care is difficult. Creative problem-solving, cognitive-behavioural strategies, and mutual goal-setting are necessary
Teaching approach	Self-care is a skill and requires practice and learning over time. Information on 'how' to apply self-care information into daily lives is necessary. Help patients work through their experience and strategies for self-care as opposed to reiterating self-care tasks and recommendations. Teach-back technique has been shown to be effective
Personalization of self-care symptom monitoring and management	HCPs can be 'detectives' and help patients decipher their unique and early symptoms of HF exacerbation from other symptoms that they might have attributed to HF. HCPs can help patients identify individual patterns of symptoms of deterioration and help construct decision aides to help them navigate key stages in the decision-making process around self-care
Family and caregivers	Caregivers often provide a substantial amount of support for patient self-care activities and need to be seen as partners in the overall care plan. Their contribution to self-care cannot be underestimated
Social support	Social support can be in the form of emotional, instrumental, informational, or appraisal. Assess for the need to enlist additional formal resources to support necessary self-care activities and behaviours for people with inadequate social support systems

HCP, health care provider; HF, heart failure; MOCA, Montreal Cognitive Assessment.

Conclusions

Guidelines form the basis for the provision of high-quality care for patients with HF, and underpin the development of best practices and the assessment of quality of care. The CCS has published comprehensive HF Guidelines and annual updates for the past 10 years. This Guidelines Companion has been developed in response to key practical questions that are unlikely to be answered by randomized controlled clinical trials. For the first time, we articulate answers to how soon and how often patients with HF should be seen, when they should be reassessed, how new therapies should be incorporated into treatment algorithms, and many other important questions. It is our hope that the HF clinician can use this tool to better integrate HF Guidelines into their busy practices.

References

1. Arnold JM, Howlett JG, Dorian P, et al. Canadian Cardiovascular Society Consensus Conference recommendations on heart failure update 2007: prevention, management during intercurrent illness or acute decompensation, and use of biomarkers. Can J Cardiol 2007;23:21-45.

2. Arnold JM, Liu P, Demers C, et al. Canadian Cardiovascular Society consensus conference recommendations on heart failure 2006: diagnosis and management. Can J Cardiol 2006;22:23-45.

3. Canadian Cardiovascular Society Heart Failure Management Primary Panel, Moe GW, Ezekowitz JA, et al. The 2013 Canadian Cardiovascular Society Heart Failure Management Guidelines Update: focus on rehabilitation and exercise and surgical coronary revascularization. Can J Cardiol 2014;30:249-63.

4. Howlett JG, McKelvie RS, Arnold JM, et al. Canadian Cardiovascular Society Consensus Conference Guidelines on heart failure, update 2009: diagnosis and management of right-sided heart failure, myocarditis, device therapy and recent important clinical trials. Can J Cardiol 2009;25:85-105.

5. Howlett JG, McKelvie RS, Costigan J, et al. The 2010 Canadian Cardiovascular Society Guidelines for the diagnosis and management of heart failure update: heart failure in ethnic minority populations, heart failure and pregnancy, disease management, and quality improvement/assurance programs. Can J Cardiol 2010;26:185-202.

6. Malcom J, Arnold O, Howlett JG, et al. Canadian Cardiovascular Society Consensus Conference Guidelines on heart failure—2008 update: best practices for the transition of care of heart failure patients, and the recognition, investigation and treatment of cardiomyopathies. Can J Cardiol 2008;24:21-40.

7. McKelvie RS, Moe GW, Cheung A, et al. The 2011 Canadian Cardiovascular Society heart failure management guidelines update: focus on sleep apnea, renal dysfunction, mechanical circulatory support, and palliative care. Can J Cardiol 2011;27:319-38.

8. McKelvie RS, Moe GW, Ezekowitz JA, et al. The 2012 Canadian Cardiovascular Society heart failure management guidelines update: focus on acute and chronic heart failure. Can J Cardiol 2013;29:168-81.

9. Moe GW, Ezekowitz JA, O'Meara E, et al. The 2014 Canadian Cardiovascular Society Heart Failure Management Guidelines Focus Update: anemia, biomarkers, and recent therapeutic trial implications. Can J Cardiol 2015;31:3-16.

10. Arnold M, Howlett J, Liu P, et al. The Canadian Cardiovascular Society (CCS) heart failure consensus conference program: shaping the future of heart failure management in Canada. Eur J Heart Fail Suppl 2008;7:17.

11. Howlett JG, McKelvie R, Ross H, et al. The Canadian Cardiovascular Society Heart Failure Guidelines implementation: initial results from the National Workshop Initiative. Eur J Heart Fail Suppl 2008;7:22.

12. Arnold JMO, Ignazweski A, Howlett J; on behalf of the Canadian Heart Failure Network Inc. Changes in drug utilization in patients referred to outpatient heart failure clinics in Canada between 1999 and 2007. J Am Coll Cardiol 2009;53. A166.

13. Howlett JG, Johnstone DE, Sketris I, et al. Identifying opportunities to address the congestive heart failure burden: the Improving Cardiovascular Outcomes in Nova Scotia (ICONS) study. Can J Cardiol 2003;19:439-44.

14. Howlett JM, Harkness K, Heckman G, et al. Survey for Practical HF Guidelines Implementations by Canadian Experts. Available at: http://ccs.ca/en/guidelines/guidelines-library. Accessed August 26, 2015.

15. Ross H, Howlett J, Arnold JM, et al. Treating the right patient at the right time: access to heart failure care. Can J Cardiol 2006;22:749-54.

16. Canadian Cardiovascular Society. Mobile apps. Available at: http://www.ccs.ca/index.php/en/resources/mobile-apps. Accessed May 15, 2015.

17. Funck-Brentano C, van Veldhuisen DJ, van de Ven LL, et al. Influence of order and type of drug (bisoprolol vs. enalapril) on outcome and adverse events in patients with chronic heart failure: a post hoc analysis of the CIBIS-III trial. Eur J Heart Fail 2011;13:765-72.

18. Willenheimer R, van Veldhuisen DJ, Silke B, et al. Effect on survival and hospitalization of initiating treatment for chronic heart failure with bisoprolol followed by enalapril, as compared with the opposite sequence: results of the randomized Cardiac Insufficiency Bisoprolol Study (CIBIS) III. Circulation 2005;112:2426-35.

19. Canadian Cardiovascular Society. Heart Failure medication titration App and Heart Failure Guidelines app. Available at: http://www.ccs.ca/index.php/en/resources/mobile-apps. Accessed May 15, 2015.

20. Canadian Cardiovascular Society. Heart Failure Pocket Guides. Available at: http://www.ccs.ca/index.php/en/resources/pocket-guides. Accessed May 15, 2015.

21. Canadian Cardiovascular Society. Heart Failure Guidelines Educational Slide Decks. Available at: http://www.ccs.ca/index.php/en/resources/educational-slide-decks. Accessed May 15, 2015.

22. Amir O, Hassan Y, Sarriff A, et al. Incidence of risk factors for developing hyperkalemia when using ACE inhibitors in cardiovascular diseases. Pharm World Sci 2009;31:387-93.

23. Kuijvenhoven MA, Haak EA, Gombert-Handoko KB, Crul M. Evaluation of the concurrent use of potassium-influencing drugs as risk factors for the development of hyperkalemia. Int J Clin Pharm 2013;35:1099-104.

24. Pitt B, Bakris G, Ruilope LM, et al. Serum potassium and clinical outcomes in the Eplerenone Post-Acute Myocardial Infarction Heart Failure Efficacy and Survival Study (EPHESUS). Circulation 2008;118:1643-50.

25. Zannad F, McMurray JJ, Drexler H, et al. Rationale and design of the Eplerenone in Mild Patients Hospitalization And SurvIval Study in Heart Failure (EMPHASIS-HF). Eur J Heart Fail 2010;12:617-22.

26. Young JB, Dunlap ME, Pfeffer MA, et al. Mortality and morbidity reduction with candesartan in patients with chronic heart failure and left ventricular systolic dysfunction: results of the CHARM low-left ventricular ejection fraction trials. Circulation 2004;110:2618-26.

27. Zannad F, McMurray JJ, Krum H, et al. Eplerenone in patients with systolic heart failure and mild symptoms. N Engl J Med 2011;364:11-21.

28. Meredith PA, Ostergren J, Anand I, et al. Clinical outcomes according to baseline blood pressure in patients with a low ejection fraction in the CHARM (Candesartan in Heart Failure: Assessment of Reduction in Mortality and Morbidity). Program. J Am Coll Cardiol 2008;52:2000-7.

29. Akosah KO, McHugh VL, Mathiason MA, et al. Closing the heart failure management gap in the community: managing hypotension and impact on outcomes. J Card Fail 2009;15:906-11.

30. Mak G, Murphy NF, Ali A, et al. Multiple neurohumoral modulating agents in systolic dysfunction heart failure: are we lowering blood pressure too much? J Card Fail 2008;14:555-60.

31. Gheorghiade M, Abraham WT, Albert NM, et al. Systolic blood pressure at admission, clinical characteristics, and outcomes in patients hospitalized with acute heart failure. JAMA 2006;296:2217-26.

32. Rouleau JL, Roecker EB, Tendera M, et al. Influence of pretreatment systolic blood pressure on the effect of carvedilol in patients with severe chronic heart failure: the Carvedilol Prospective Randomized Cumulative Survival (COPERNICUS) study. J Am Coll Cardiol 2004;43:1423-9.

33. Metra M, Torp-Pedersen C, Swedberg K, et al. Influence of heart rate, blood pressure, and beta-blocker dose on outcome and the differences in outcome between carvedilol and metoprolol tartrate in patients with chronic heart failure: results from the COMET trial. Eur Heart J 2005;26:2259-68.

34. Castagno D, Skali H, Takeuchi M, et al. Association of heart rate and outcomes in a broad spectrum of patients with chronic heart failure: results from the CHARM (Candesartan in Heart Failure: Assessment of Reduction in Mortality and morbidity) program. J Am Coll Cardiol 2012;59:1785-95.

35. Basuray A, French B, Ky B, et al. Heart failure with recovered ejection fraction: clinical description, biomarkers, and outcomes. Circulation 2014;129:2380-7.

36. Dunlay SM, Roger VL, Weston SA, Jiang R, Redfield MM. Longitudinal changes in ejection fraction in heart failure patients with preserved and reduced ejection fraction. Circ Heart Fail 2012;5:720-6.

37. Clarke CL, Grunwald GK, Allen LA, et al. Natural history of left ventricular ejection fraction in patients with heart failure. Circ Cardiovasc Qual Outcomes 2013;6:680-6.

38. Effect of enalapril on mortality and the development of heart failure in asymptomatic patients with reduced left ventricular ejection fractions. The SOLVD Investigators. N Engl J Med 1992;327:685-91.

39. Hopper I, Samuel R, Hayward C, Tonkin A, Krum H. Can medications be safely withdrawn in patients with stable chronic heart failure? Systematic review and meta-analysis. J Card Fail 2014;20:522-32.

40. Grewal J, Silversides CK, Colman JM. Pregnancy in women with heart disease: risk assessment and management of heart failure. Heart Fail Clin 2014;10:117-29.

41. Elkayam U. Risk of subsequent pregnancy in women with a history of peripartum cardiomyopathy. J Am Coll Cardiol 2014;64:1629-36.

42. Elkayam U, Akhter MW, Singh H, et al. Pregnancy-associated cardiomyopathy: clinical characteristics and a comparison between early and late presentation. Circulation 2005;111:2050-5.

43. Liu C, Zhao Q, Zhen Y, et al. Prednisone in Uric Acid lowering in Symptomatic Heart Failure Patients With Hyperuricemia (PUSH-PATH) study. Can J Cardiol 2013;29:1048-54.

44. Velazquez EJ, Lee KL, Deja MA, et al. Coronary-artery bypass surgery in patients with left ventricular dysfunction. N Engl J Med 2011;364:1607-16.

45. Jones RH, Velazquez EJ, Michler RE, et al. Coronary bypass surgery with or without surgical ventricular reconstruction. N Engl J Med 2009;360:1705-17.

46. Martocchia A, Frugoni P, Indiano I, et al. Screening of frailty in elderly patients with disability by the means of Marigliano-Cacciafesta polypathology scale (MCPS) and Canadian Study of Health and Aging (CSHA) scales. Arch Gerontol Geriatr 2013;56:339-42.

47. Chan M, Tsuyuki R. Heart failure in the elderly. Curr Opin Cardiol 2013;28:234-41.

48. Shah RU, Tsai V, Klein L, Heidenreich PA. Characteristics and outcomes of very elderly patients after first hospitalization for heart failure. Circ Heart Fail 2011;4:301-7.

49. Manzano L, Babalis D, Roughton M, et al. Predictors of clinical outcomes in elderly patients with heart failure. Eur J Heart Fail 2011;13:528-36.

50. Braunstein JB, Anderson GF, Gerstenblith G, et al. Noncardiac comorbidity increases preventable hospitalizations and mortality among Medicare beneficiaries with chronic heart failure. J Am Coll Cardiol 2003;42:1226-33.

51. Tanner CE, Fromme EK, Goodlin SJ. Ethics in the treatment of advanced heart failure: palliative care and end-of-life issues. Congest Heart Fail 2011;17:235-40.

52. McLennan SN, Mathias JL, Brennan LC, Stewart S. Validity of the montreal cognitive assessment (MoCA) as a screening test for mild cognitive impairment (MCI) in a cardiovascular population. J Geriatr Psychiatry Neurol 2011;24:33-8.

53. Nasreddine ZS, Phillips NA, Bedirian V, et al. The Montreal Cognitive Assessment, MoCA: a brief screening tool for mild cognitive impairment. J Am Geriatr Soc 2005;53:695-9.

54. Moller HJ. Methodological aspects in the assessment of severity of depression by the Hamilton Depression Scale. Eur Arch Psychiatry Clin Neurosci 2001;251(suppl 2):II13-20.

55. Schein RL, Koenig HG. The Center for Epidemiological Studies-Depression (CES-D) Scale: assessment of depression in the medically ill elderly. Int J Geriatr Psychiatry 1997;12:436-46.

56. Smarr KL, Keefer AL. Measures of depression and depressive symptoms: Beck Depression Inventory-II (BDI-II), Center for Epidemiologic Studies Depression Scale (CES-D), Geriatric Depression Scale (GDS), Hospital Anxiety and Depression Scale (HADS), and Patient Health Questionnaire-9 (PHQ-9). Arthritis Care Res 2011;63(suppl 11):S454-66.

57. Newman S, Steed L, Mulligan K. Self-management interventions for chronic illness. Lancet 2004;364:1523-37.

58. Riegel B, Moser DK, Anker SD, et al. State of the science: promoting self-care in persons with heart failure: a scientific statement from the American Heart Association. Circulation 2009;120:1141-63.

59. Lainscak M, Blue L, Clark AL, et al. Self-care management of heart failure: practical recommendations from the Patient Care Committee of the Heart Failure Association of the European Society of Cardiology. Eur J Heart Fail 2011;13:115-26.

60. Buck HG, Harkness K, Wion R, et al. Caregivers' contributions to heart failure self-care: a systematic review. Eur J Cardiovasc Nurs 2015;14:79-89.

61. Harkness K, Spaling MA, Currie K, Strachan PH, Clark AM. A systematic review of patient heart failure self-care strategies. J Cardiovasc Nurs 2015;30:121-35.

62. Riegel B, Jaarsma T, Stromberg A. A middle-range theory of self-care of chronic illness. ANS Adv Nurs Sci 2012;35:194-204.

63. Barnason S, Zimmerman L, Young L. An integrative review of interventions promoting self-care of patients with heart failure. J Clin Nurs 2012;21:448-75.

64. Graven LJ, Grant JS. Social support and self-care behaviors in individuals with heart failure: an integrative review. Int J Nurs Stud 2014;51:320-33.

65. Siabani S, Leeder SR, Davidson PM. Barriers and facilitators to self-care in chronic heart failure: a meta-synthesis of qualitative studies. Springerplus 2013;2:320.

66. Zavertnik JE. Self-care in older adults with heart failure: an integrative review. Clin Nurse Spec 2014;28:19-32.