HFSA 2010 Guideline Executive Summary

Executive Summary: HFSA 2010 Comprehensive Heart Failure Practice Guideline

HEART FAILURE SOCIETY OF AMERICA

St. Paul, Minnesota

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ABSTRACT

Heart failure (HF) is a syndrome characterized by high mortality, frequent hospitalization, reduced quality of life, and a complex therapeutic regimen. Knowledge about HF is accumulating so rapidly that individual clinicians may be unable to readily and adequately synthesize new information into effective strategies of care for patients with this syndrome. Trial data, though valuable, often do not give direction for individual patient management. These characteristics make HF an ideal candidate for practice guidelines. The 2010 Heart Failure Society of America comprehensive practice guideline addresses the full range of evaluation, care, and management of patients with HF.

Key Words: Heart failure, practice guidelines.

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A copy of the HFSA Comprehensive Heart Failure Practice Guideline can be found at www.onlinejcf.com

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Section 1: Development and Implementation of a Comprehensive Heart Failure Practice Guideline

Heart failure (HF) is a syndrome characterized by high mortality, frequent hospitalization, poor quality of life, multiple comorbidities, and a complex therapeutic regimen. Knowledge about HF is accumulating so rapidly that individual clinicians may be unable to readily and adequately synthesize new information into effective principles of care for patients with this syndrome. Trial data, though valuable, often do not give adequate direction for individual patient management.

Given the complex and changing picture of HF and the accumulation of evidence-based HF therapy, it is not possible for the clinician to rely solely on personal experience and observation to guide therapeutic decisions. The situation is exacerbated because HF is now a chronic condition in most patients, meaning that the outcome of therapeutic decisions might not be apparent for several years. The prognosis of individual patients differs considerably, making it difficult to generalize. Treatments might not dramatically improve symptoms of the disease process, yet might provide important reductions or delays in morbid events and deaths. The assessment of specific therapeutic outcomes is complicated by the potential differential impact of various cotherapies.

The complexity of HF, its high prevalence in society, and the availability of many therapeutic options make it an ideal candidate for practice guidelines. Additional assumptions driving the development of HF guidelines are presented in Table 1.1.

The first HF guideline developed by the Heart Failure Society of America (HFSA) had a narrow scope, concentrating on the pharmacologic treatment of chronic, symptomatic left ventricular dysfunction.[1] It did not consider subsets of the clinical syndrome of HF, such as acute decompensated HF and ''diastolic dysfunction,'' or issues such as prevention. The subsequent comprehensive clinical practice guideline published in 2006 addressed a full range of topics including prevention, evaluation, disease management, and pharmacologic and device therapy for patients with HF.[2] The 2010 guideline updates and expands each of these areas and adds a section on the Genetic Evaluation of Cardiomyopathy published separately in 2009.[3] The discussion of end of life management has also been considerably expanded. Appendix A is a comparison of the 2006

Table 1.1. Assumptions Underlying HFSA Practice Guideline

Clinical decisions must be made.
Correct course of action may not be readily apparent.
Multiple non-pharmacologic, pharmacologic, and device therapies are available.
Reasonably valid methods exist to address knowledge base and evaluate medical evidence.
Data beyond randomized clinical trials exist that enhance medical decision making.
Uncertainties remain concerning approaches to treatment after review of totality of medical evidence.
Expert opinion has a role in management decisions when Strength of Evidence A data are not available to guide management.
A consensus of experts remains the best method of management recommendations when Strength of Evidence A data are not available

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and 2010 guideline, summarizing the modifications, additions, and deletions in the guideline recommendations. Appendix B is a list of acronyms (including clinical trials) used in the 2010 guideline.

HFSA Guideline Approach to Medical Evidence

Two considerations are critical in the development of practice guidelines: assessing strength of evidence and determining strength of recommendation. Strength of evidence is determined both by the type of evidence available and the assessment of validity, applicability, and certainty of a specific type of evidence. Following the lead of previous guidelines, strength of evidence in this guideline is heavily dependent on the source or type of evidence used. The HFSA guideline process has used three grades (A, B, or C) to characterize the type of evidence available to support specific recommendations (Table 1.2).

It must be recognized, however, that the evidence supporting recommendations is based largely on population responses that may not always apply to individuals within the population. Therefore, data may support overall benefit of one treatment over another but cannot exclude that some individuals within the population may respond better to the other treatment. Thus, guidelines can best serve as evidence-based recommendations for management, not as mandates for management in every patient. Furthermore, it must be recognized that trial data on which recommendations are based have often been carried out with background therapy not comparable to therapy in current use. Therefore, physician decisions regarding the management of individual patients may not always precisely match the recommendations. A knowledgeable physician who integrates the guidelines with pharmacologic and physiologic insight and knowledge of the individual being treated should provide the best patient management.

Strength of Evidence A. Randomized controlled clinical trials provide what is considered the most valid form of guideline evidence. Some guidelines require at least 2 positive randomized clinical trials before the evidence for a recommendation can be designated level A. The HFSA guideline committee has occasionally accepted a single randomized, controlled, outcome-based clinical trial as sufficient for level A evidence when the single trial is large with a substantial number of endpoints and has consistent and robust outcomes. However, randomized clinical trial data, whether derived from one or multiple trials, have not been taken simply at face value. They have been evaluated for: (1) endpoints studied, (2) level of significance, (3) reproducibility of findings, (4) generalizability of study results, and (5) sample size and number of events on which outcome results are based.

Table 1.2. Relative Weight of Evidence Used to Develop HFSA Practice Guideline

Hierarchy of Types of Evidence	
Level A	Randomized, Controlled, Clinical Trials
	May be assigned based on results of a single trial
Level B	Cohort and Case-Control Studies
	Post hoc, subgroup analysis, and meta-analysis
	Prospective observational studies or registries
Level C	Expert Opinion
	Observational studies-epidemiologic findings
	Safety reporting from large-scale use in practice

Strength of Evidence B. The HFSA guideline process also considers evidence arising from cohort studies or smaller clinical trials with physiologic or surrogate endpoints. This level B evidence is derived from studies that are diverse in design and may be prospective or retrospective in nature. They may involve subgroup analyses of clinical trials or have a case control or propensity design using a matched subset of trial populations. Dose-response studies, when available, may involve all or a portion of the clinical trial population. Evidence generated from these studies has well-recognized, inherent limitations. Nevertheless, their value is enhanced through attention to factors such as pre-specification of hypotheses, biologic rationale, and consistency of findings between studies and across different populations.

Strength of Evidence C. The present HFSA guideline makes extensive use of expert opinion, or C-level evidence. The need to formulate recommendations based on level C evidence is driven primarily by a paucity of scientific evidence in many areas critical to a comprehensive guideline. For example, the diagnostic process and the steps used to evaluate and monitor patients with established HF have not been the subject of clinical studies that formally test the validity of one approach versus another. In areas such as these, recommendations must be based on expert opinion or go unaddressed.

The value of expert opinion as a form of evidence remains disputed. Many contend that expert opinion is a weak form of observational evidence, based on practice experience and subject to biases and limitations. Advocates believe expert opinion represents a complex synthesis of observational insights into disease pathophysiology and the benefits of therapy in broad populations of patients. They stress the value of the interchange of experience and ideas among colleagues, who collectively treat thousands of patients. Through contact with numerous individual health care providers who may discuss patients with them, experts are exposed to rare safety issues and gain insight into the perceptions of practitioners concerning the efficacy of particular treatments across a wide spectrum of HF.

Despite the case that can be made for its value, recommendations based on expert opinion alone have been limited to those circumstances when a definite consensus could be reached across the guideline panel and reviewers.

HFSA Guideline Approach to Strength of Recommendation

Determining Strength. Although level of evidence is important, the strength given to specific recommendations is

critical. The process used to determine the strength of individual recommendations is complex. The goal of guideline development is to achieve the best recommendations for evaluation and management, considering not only efficacy, but the cost, convenience, side effect profile, and safety of various therapeutic approaches. The HFSA guideline committee often determined the strength of a recommendation by the ''totality of evidence,'' which is a synthesis of all types of available data, pro and con, about a particular therapeutic option.

Totality of Evidence. Totality of evidence includes not only results of clinical trials, but also expert opinion and findings from epidemiologic and basic science studies. Agreement among various types of evidence, especially from different methodologies, increases the likelihood that a particular therapy is valuable. Although many equate evidence-based medicine with the results of a few individual clinical trials, the best judgment seems to be derived from a careful analysis of all available trial data combined with integration of results from the basic laboratory and the findings of epidemiologic studies.

Scale of Strength. The HFSA guideline employs the categorization for strength of recommendation outlined in Table 1.3. There are several degrees of favorable recommendations and a single category for therapies felt to be not effective. The phrase ''is recommended'' should be taken to mean that the recommended therapy or management process should be followed as often as possible in individual patients. Exceptions are carefully delineated. ''Should be considered'' means that a majority of patients should receive the intervention, with some discretion involving individual patients. ''May be considered'' means that individualization of therapy is indicated (Table 1.3). When the available evidence is considered to be insufficient or too premature, or consensus fails, issues are labeled unresolved and included as appropriate at the end of the relevant section.

Table 1.3. HFSA System for Classifying the Strength of Recommendations

''Is recommended''	Part of routine care Exceptions to therapy should be minimized
''Should be considered''	Majority of patients should receive the intervention Some discretion in application to individual patients should be allowed
''May be considered''	Individualization of therapy is indicated
''Is not recommended''	Therapeutic intervention should not be used

Process of Guideline Development

Key steps in the development of this guideline are listed in Table 1.4. Having determined the broad scope of the current guideline, subcommittees of the guideline committee were formed for each section of the guideline. A literature search with relevant key words and phrases for each guideline section were provided to members of the subcommittees and the full Guideline Committee. Members of each subcommittee were asked to review the search and identify any additional relevant medical evidence for each assigned section. Changes in recommendation and background were carried out by each subcommittee with conference calls directed by the Guideline Committee chair. Each section was presented for comments and consensus approval to the Guideline Committee. Once subsections were complete, the Executive Council reviewed and commented on each section and these comments were returned to the Guideline Committee for changes and once complete, for final approval by the Executive Council.

Table 1.4. Steps in the Development of the 2010 HFSA Practice Guideline

Determine the scope of the practice guideline
Form subcommittees with expertise for each guideline section
Perform literature search relevant to each guideline section and distribute to subcommittee and committee members
Solicit additional relevant information from subcommittee and committee members for each subsection
Formulate new recommendations and revise previous recommendations assigning Strength of Recommendation and Strength of Evidence
Form consensus of subcommittee for each section by conference call
Assign writing of additional or revised background by subcommittee
Full committee review of each section with revisions by subcommittee
Review of each completed section by Executive Council with revisions made by full committee and returned to Executive Council for final approval.
Disseminate document
Update document as changes are necessary

Consensus. The development of a guideline involves the selection of individuals with expertise and experience to drive the process of formulating specific recommendations and producing a written document. The role of these experts goes well beyond the formulation of recommendations supported by expert opinion.

Experts involved in the guideline process must function as a collective, not as isolated individuals. Expert opinion is not always unanimous. Interpretations of data vary. Disagreements arise over the generalizability and applicability of trial results to various patient subgroups. Experts are influenced by their own experiences with particular therapies, but still generally agree on the clinical value of trial data. Discomfort with the results of trials reported as positive or negative generally focus on factors that potentially compromise the evidence. Unfortunately, there are no absolute rules for downgrading or upgrading trial results or for deciding that the limitations of the trial are sufficient to negate what has been regarded as a traditionally positive or negative statistical result.

The HFSA Guideline Committee sought resolution of difficult cases through consensus building. An open, dynamic discussion meant that no single voice was allowed to dominate. Written documents were essential to this process, because they provided the opportunity for feedback from all members of the group. On occasion, consensus of opinion was sufficient to override positive or negative results of almost any form of evidence. The HFSA process

had a strong commitment to recommendations based on objective evidence rigorously reviewed by a panel of experts.

Issues that caused difficulty for the HFSA guideline process were some of the more important ones faced by the committee, because they mirrored those that are often most challenging to clinicians in day-to-day practice. The foundation of the HFSA guideline process was the belief that the careful judgment of recognized opinion leaders in these controversial areas is more likely to be correct than ad hoc decisions made ''on the spot'' by physicians in practice.

The involvement of many groups in the development of this guideline helped avoid the introduction of bias, which can be personal, practice-based, or based on financial interest. Committee members and reviewers from the Executive Council received no direct financial support from the HFSA or any other source for the development of the guideline. Support was provided by the HFSA administrative staff, but the writing of the document was performed on a volunteer basis primarily by the Committee. Financial relationships that might represent conflicts of interest were collected annually from all members of the Guideline Committee and the Executive Council. Current relationships are shown in Appendix C.

Dissemination and Continuity. The value of a practice guideline is significantly influenced by the scope of its dissemination. The first and second HFSA guidelines were available on the Internet, and thousands of copies were downloaded. The current document will be implemented on the Internet both for file transfer and as a hypertext source of detailed knowledge concerning HF.

An important final consideration is the continuity of the guideline development process. The intent is to create a ''living document'' that will be updated and amended as necessary to ensure continuing relevance. The rapid development of new knowledge in HF from basic and clinical research and the continuing evolution of pharmacologic and device therapy for this condition provides a strong mandate for timely updates. The HFSA intends to undertake targeted reviews and updates in areas where new research has implications for practice. Section 17: The Genetic Evaluation of Cardiomyopathy is an example of this policy.

Summary

Practice guidelines have become a major part of the clinical landscape and seem likely to become more rather than less pervasive. Some may perceive guidelines as another mechanism for process management or as another instrument for cost control. But there is a more patient-centered rationale for their development, especially for a common, potentially debilitating, and often fatal syndrome such as HF. Despite advances in clinical trial methodology and the extensive use of studies to evaluate therapeutics and the care process, essential elements of the management process remain undefined for many clinical problems. HF is no exception. Traditionally, management guidelines were determined on an ad hoc basis by physicians and other health care providers in the field. The development and utilization of practice guidelines has emerged as an alternative strategy. The methodology of guideline development needs improvement, but when these documents are properly conceived and formulated, their importance to patient care seems evident. This HFSA guideline on HF is designed as a ''living document,'' which will continue to serve as a resource for helping patients with HF.

Section 2: Conceptualization and Working Definition of Heart Failure

HF remains a major and growing societal problem despite advances in detection and therapy.[4-7] However, there is no widely accepted characterization and definition of HF, probably because of the complexity of the syndrome. The conceptualization and working definition of HF presented here emerged as these guidelines were developed. They are critical to understanding HF and approaching its treatment appropriately.

Conceptual Background. HF is a syndrome rather than a primary diagnosis. It has many potential etiologies, diverse clinical features, and numerous clinical subsets. Patients may have a variety of primary cardiovascular diseases and never develop cardiac dysfunction, and those in whom cardiac dysfunction is identified through testing may never develop clinical HF. In addition to cardiac dysfunction, other factors, such as vascular stiffness, dyssynchrony, and renal sodium handling, play major roles in the manifestation of the syndrome of HF.

Patients at risk for many cardiovascular diseases are at risk for HF. Early identification and treatment of risk factors is perhaps the most significant step in limiting the public health impact of HF.[8-10] Emphasis on primary and secondary prevention is particularly critical because of the difficulty of successfully treating left ventricular (LV) dysfunction, especially when severe.[8] Current therapeutic advances in the treatment of HF do not make prevention any less important.

Although HF is progressive, current therapy may provide stability and even reversibility. The inexorable progression of HF from LV remodeling and dysfunction is no longer inevitable. Prolonged survival with mild to moderate LV dysfunction is now possible. Therapy with angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs), beta blockers, and cardiac resynchronization therapy (CRT) can lead to slowing or to partial reversal of remodeling.

Because of this prolonged survival, comorbid conditions, such as coronary artery disease (CAD) or renal failure, can progress, complicating treatment. Given this prolonged survival, considerable attention is devoted in this guideline to disease management, the use of multidrug therapy, and the management of patients with HF at the end of life.

Working Definition. Although HF may be caused by a variety of disorders, the following comprehensive

guideline and this working definition focus on HF primarily from the loss or dysfunction of myocardial muscle or interstitium.

> **HF is a syndrome caused by cardiac dysfunction, generally resulting from myocardial muscle dysfunction or loss and characterized by either LV dilation or hypertrophy or both. Whether the dysfunction is primarily systolic or diastolic or mixed, it leads to neurohormonal and circulatory abnormalities, usually resulting in characteristic symptoms such as fluid retention, shortness of breath, and fatigue, especially on exertion. In the absence of appropriate therapeutic intervention, HF is usually progressive at the level of both cardiac function and clinical symptoms. The severity of clinical symptoms may vary substantially during the course of the disease process and may not correlate with changes in underlying cardiac function. Although HF is progressive and often fatal, patients can be stabilized and myocardial dysfunction and remodeling may improve, either spontaneously or as a consequence of therapy. In physiologic terms, HF is a syndrome characterized by either or both pulmonary and systemic venous congestion and/or inadequate peripheral oxygen delivery, at rest or during stress, caused by cardiac dysfunction.**

Additional Definitions

HF is often classified as HF with reduced systolic function versus HF with preserved systolic function. Myocardial remodeling often precedes the clinical syndrome of HF. Additional definitions are provided in Table 2.1.

Table 2.1. Additional HF Definitions

"HF With Reduced Left Ventricular Ejection Fraction (LVEF)" Sometimes: "HF With a Dilated Left Ventricle"	A clinical syndrome characterized by signs and symptoms of HF and reduced LVEF. Most commonly associated with LV chamber dilation.
"HF With Preserved LVEF" Sometimes: "HF With a Nondilated LV"	A clinical syndrome characterized by signs and symptoms of HF with preserved LVEF. Most commonly associated with a nondilated LV chamber. May be the result of valvular disease or other causes (Section 11).
"Myocardial Remodeling"	Pathologic myocardial hypertrophy or dilation in response to increased myocardial stress. These changes are generally accompanied by pathologic changes in the cardiac interstitium. Myocardial remodeling is generally a progressive disorder.

Section 3: Prevention of Ventricular Remodeling, Cardiac Dysfunction, and Heart Failure

HF is an all-too-frequent outcome of hypertension and arterial vascular disease, making it a major public health concern.[11,12] Epidemiologic, clinical, and basic research have identified a number of antecedent conditions that predispose individuals to HF and its predecessors, LV remodeling and dysfunction.[13-21] Recognition that many of these risk factors can be modified and that treating HF is difficult and costly has focused attention on preventive strategies for HF.

Development of both systolic and diastolic dysfunction related to adverse ventricular remodeling may take years to produce significant ill effects.[22-28] Although the precise mechanisms for the transition to symptomatic HF are not clear, many modifiable factors have been identified that predispose or aggravate the remodeling process and the development of cardiac dysfunction. Treatment of systemic hypertension, with or without LV hypertrophy, reduces the development of HF.[8,29-36] Prevention of myocardial infarction (MI) in patients with atherosclerotic cardiovascular disease is a critical intervention, since occurrence of MI confers an 8- to 10-fold increased risk for subsequent HF.[30] Other modifiable risk factors include anemia, diabetes, hyperlipidemia, obesity, valvular abnormalities, alcohol, certain illicit drugs, some cardiotoxic medications, and diet.[37,38]

Recommendations for Patients With Risk Factors for Ventricular Remodeling, Cardiac Dysfunction, and Heart Failure

3.1 A careful and thorough clinical assessment, with appropriate investigation for known or potential risk factors, is recommended in an effort to prevent development of LV remodeling, cardiac dysfunction, and HF. These risk factors include, but are not limited to, hypertension, hyperlipidemia, atherosclerosis, diabetes mellitus, valvular disease, obesity, physical inactivity, excessive alcohol intake, dietary choices, and smoking. (Strength of Evidence = A)

3.2 The recommended goals for the management of specific risk factors for the development of cardiac dysfunction and HF are shown in Table 3.1.

3.3 ACE inhibitors are recommended for prevention of HF in patients at high risk of this syndrome, including those with CAD, peripheral vascular disease, or stroke. Patients with diabetes and another major risk factor or patients with diabetes who smoke or have microalbuminuria are also at high risk and should receive ACE inhibitors. (Strength of Evidence = A)

3.4 Beta blockers are recommended for patients with prior MI to reduce mortality, recurrent MI, and the development of HF. (Strength of Evidence = A)

Table 3.1. Goals for the Management of Risk Factors for the Development of Heart Failure

Risk Factor	Population	Treatment Goal	Strength of Evidence
Hypertension	No diabetes or renal disease	<140/90 mmHg	A
	Diabetes	<130/80 mmHg	A
	Renal insufficiency and >1g/day of proteinuria	127/75	A
	Renal insufficiency and ≤1 g/day of proteinuria	130/85	A
	Everyone with hypertension	Limit sodium to ≤1500 mg/day	A
Diabetes	See American Diabetes Association (ADA) Guideline		
Hyperlipidemia	See National Cholesterol Education Program (NCEP) Guideline		
Physical Inactivity	Everyone	Sustained aerobic activity 20-30 minutes, 3-5 times weekly	B
Obesity	BMI >30	Weight reduction to achieve BMI <30	C
Excessive alcohol intake	Men	Limit alcohol intake to 1-2 drink equivalents per day	C
	Women	1 drink equivalent per day	
	Those with propensity to abuse alcohol or with alcoholic cardiomyopathy	Abstention	
Smoking	Everyone	Cessation	A
Vitamin/mineral deficiency	Everyone	Diet high in K^+/calcium	B
Poor diet	Everyone	4 or more servings of fruit and vegetables per day; One or more servings of breakfast cereal per week	B

Section 4. Evaluation of Patients for Ventricular Dysfunction and Heart Failure

Patients undergoing evaluation for ventricular dysfunction and HF fall into 3 general groups: (1) patients at risk of developing HF, (2) patients suspected of having HF based on signs and symptoms or incidental evidence of abnormal cardiac structure or function, and (3) patients with established symptomatic HF.

Patients at Risk for Heart Failure

Patients identified to be at risk for HF require aggressive management of modifiable risk factors as outlined in Section 3 of this guideline. Patients with risk factors may have undetected abnormalities of cardiac structure or function. In addition to risk factor reduction, these patients require careful assessment for the presence of symptoms of HF and, depending on their underlying risk, may warrant noninvasive evaluation of cardiac structure and function.

Recommendations for Evaluation of Patients at Risk for Heart Failure

4.1 Evaluation for clinical manifestations of HF with a routine history and physical examination is recommended in patients with the medical conditions or test findings listed in Table 4.1. (Strength of Evidence = B)

4.2 Assessment of Cardiac Structure and Function. Echocardiography with Doppler is recommended to determine cardiac structure and function in asymptomatic patients with the disorders or findings listed in Table 4.2. (Strength of Evidence = B)

4.3 Routine determination of plasma B-type natriuretic peptide (BNP) or N-terminal pro-BNP (NT-proBNP) concentration as part of a screening evaluation for structural heart disease in asymptomatic patients is not recommended. (Strength of Evidence = B)

Table 4.1. Indications for Evaluation of Clinical Manifestations of HF

Conditions	Hypertension
	Diabetes
	Obesity
	CAD (eg, after MI, revascularization)
	Peripheral arterial disease or cerebrovascular disease
	Valvular heart disease
	Family history of cardiomyopathy in a first-degree relative
	History of exposure to cardiac toxins
	Sleep-disordered breathing
Test Findings	Sustained arrhythmias
	Abnormal ECG (eg, LVH, left bundle branch block, pathologic Q waves)
	Cardiomegaly on chest X-ray

Table 4.2. Assess Cardiac Structure and Function in Patients with the Following Disorders or Findings

CAD (eg, after MI, revascularization)
Valvular heart disease
Family history of cardiomyopathy in a first-degree relative
Atrial fibrillation or flutter
Electrocardiographic evidence of LVH, left bundle branch block, or pathologic Q waves
Complex ventricular arrhythmia
Cardiomegaly

Patients Suspected of Having HF

The evaluation of patients suspected of having HF focuses on interpretation of signs and symptoms that have

Table 4.3. Symptoms Suggesting the Diagnosis of HF

Symptoms	Dyspnea at rest or on exertion
	Reduction in exercise capacity
	Orthopnea
	Paroxysmal nocturnal dyspnea (PND) or nocturnal cough
	Edema
	Ascites or scrotal edema
Less specific presentations of HF	Early satiety, nausea and vomiting, abdominal discomfort
	Wheezing or cough
	Unexplained fatigue
	Confusion/delirium
	Depression/weakness (especially in the elderly)

led to the consideration of this diagnosis. Careful history and physical examination, combined with evaluation of cardiac structure and function, should be undertaken to determine the cause of symptoms and to evaluate the degree of underlying cardiac pathology.

Recommendations for Evaluation of Patients Suspected of Having HF

4.4 Symptoms Consistent with HF. The symptoms listed in Table 4.3 suggest the diagnosis of HF. It is recommended that each of these symptoms be elicited in all patients in whom the diagnosis of HF is being considered. (Strength of Evidence = B)

4.5 Physical Examination. It is recommended that patients suspected of having HF undergo careful physical examination with determination of vital signs and careful evaluation for signs shown in Table 4.4. (Strength of Evidence = B)

Table 4.4. Signs to Evaluate in Patients Suspected of Having HF

Cardiac Abnormality	Sign
Elevated cardiac filling pressures and fluid overload	Elevated jugular venous pressure
	S3 gallop
	Rales
	Hepatojugular reflux
	Ascites
	Edema
Cardiac enlargement	Laterally displaced or prominent apical impulse
	Murmurs suggesting valvular dysfunction
Reduced cardiac output	Narrow pulse pressure
	Cool extremities
	Tachycardia with pulsus alternans
Arrhythmia	Irregular pulse suggestive of atrial fibrillation or frequent ectopy

4.6 It is recommended that BNP or NT-proBNP levels be assessed in all patients suspected of having HF, especially when the diagnosis is not certain. (Strength of Evidence = A)

4.7 Differential Diagnosis. The differential diagnoses in Table 4.5 should be considered as alternative explanations for signs and symptoms consistent with HF. (Strength of Evidence = B)

Table 4.5. Differential Diagnosis for HF Symptoms and Signs

Myocardial ischemia
Pulmonary disease (pneumonia, asthma, chronic obstructive pulmonary disease, pulmonary embolus, primary pulmonary hypertension)
Sleep-disordered breathing
Obesity
Deconditioning
Malnutrition
Anemia
Hepatic failure
Chronic kidney disease
Hypoalbuminemia
Venous stasis
Depression
Anxiety and hyperventilation syndromes
Hyper or hypo-thyroidism

Patients With Established HF

The evaluation of patients with an established diagnosis of HF is undertaken to identify the etiology, assess symptom nature and severity, determine functional impairment, and establish a prognosis. Follow-up of patients with HF or cardiac dysfunction involves continuing reassessment of symptoms, functional capacity, prognosis, and therapeutic effectiveness.

Recommendations for the Evaluation of Patients With Established HF

4.8 It is recommended that patients with a diagnosis of HF undergo evaluation as outlined in Table 4.6. (Strength of Evidence = C)

4.9 Symptoms. In addition to symptoms characteristic of HF (dyspnea, fatigue, decreased exercise tolerance, fluid retention), evaluation of the following symptoms should be considered in the diagnosis of HF:

- Angina
- Symptoms suggestive of embolic events
- Symptoms suggestive of sleep-disordered breathing

Table 4.6. Initial Evaluation of Patients With a Diagnosis of HF

Assess clinical severity of HF by history and physical examination
Assess cardiac structure and function
Determine the etiology of HF, with particular attention to reversible causes
Evaluate for coronary disease and myocardial ischemia
Evaluate the risk of life-threatening arrhythmia
Identify any exacerbating factors for HF
Identify comorbidities which influence therapy
Identify barriers to adherence

- Symptoms suggestive of arrhythmias, including palpitations
- Symptoms of possible cerebral hypoperfusion, including syncope, presyncope, or lightheadedness (Strength of Evidence = B)

4.10 Functional Capacity/Activity Level. It is recommended that the severity of clinical disease and functional limitation be evaluated and recorded and the ability to perform typical daily activities be determined. This evaluation may be graded by metrics such as New York Heart Association (NYHA) functional class (Table 4.7) (Strength of Evidence = A) or by the 6-minute walk test. (Strength of Evidence = C)

Table 4.7. Criteria for NYHA Functional Classification in Patients With HF

Class I	No limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, or dyspnea.
Class II	Slight limitation of physical activity. Comfortable at rest, but ordinary physical activity results in fatigue, palpitations, or dyspnea.
Class III	IIIA: Marked limitation of physical activity. Comfortable at rest, but less than ordinary activity causes fatigue, palpitation, or dyspnea. IIIB: Marked limitation of physical activity. Comfortable at rest, but minimal exertion causes fatigue, palpitation, or dyspnea.
Class IV	Unable to carry on any physical activity without discomfort. Symptoms of cardiac insufficiency present at rest. If any physical activity is undertaken, discomfort is increased.

4.11 Volume Status. The degree of volume excess is a key consideration during treatment. It is recommended that it be routinely assessed by determining:

- Presence of paroxysmal nocturnal dyspnea or orthopnea
- Presence of dyspnea on exertion
- Daily weights and vital signs with assessment for orthostatic changes
- Presence and degree of rales, S3 gallop, jugular venous pressure elevation, hepatic enlargement and tenderness, positive hepatojugular reflux, edema, and ascites (Strength of Evidence = B)

4.12 Standard Laboratory Tests. It is recommended that the following laboratory tests be obtained routinely in patients being evaluated for HF: serum electrolytes, blood urea nitrogen, creatinine, glucose, calcium, magnesium, fasting lipid profile (low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, triglycerides), complete blood count, serum albumin, uric acid, liver function tests, urinalysis, and thyroid function. (Strength of Evidence = B)

4.13 Electrocardiogram (ECG). It is recommended that all patients with HF have an ECG performed to:

- Assess cardiac rhythm and conduction (in some cases, using Holter monitoring or event monitors)
- Assess electrical dyssynchrony (wide QRS or bundle branch block), especially when left ventricular ejection fraction (LVEF) $<35\%$
- Detect LV hypertrophy or other chamber enlargement
- Detect evidence of myocardial infarction (MI) or ischemia
- Assess QTc interval, especially with drugs that prolong QT intervals (Strength of Evidence = B)

4.14 Chest X-Ray. It is recommended that all patients with HF have a postero-anterior and lateral chest X-ray examination for determination of heart size, evidence of fluid overload, detection of pulmonary and other diseases, and appropriate placement of implanted cardiac devices. (Strength of Evidence = B)

4.15 Additional Laboratory Tests. It is recommended that patients with no apparent etiology of HF or no specific clinical features suggesting unusual etiologies undergo additional directed blood and laboratory studies to determine the cause of HF. (Strength of Evidence = B)

4.16 Evaluation of myocardial ischemia is recommended in those who develop new-onset LV systolic dysfunction especially in the setting of suspected myocardial ischemia or worsening symptoms with pre-existing CAD. The choice of testing modality should depend on the clinical suspicion and underlying cardiac risk factors. Coronary angiography should be considered when pre-test probability of underlying ischemic cardiomyopathy is high and an invasive coronary intervention may be considered. (See Section 13 for specific clinical situations and Strength of Evidence)

4.17 Exercise testing for functional capacity is not recommended as part of routine evaluation in patients with HF. Specific circumstances in which maximal exercise testing with measurement of expired gases should be considered include (Strength of Evidence = C):

- Assessing disparity between symptomatic limitation and objective indicators of disease severity
- Distinguishing non HF-related causes of functional limitation, specifically cardiac versus pulmonary
- Considering candidacy for cardiac transplantation or mechanical circulatory support
- Determining the prescription for cardiac rehabilitation
- Addressing specific employment capabilities

4.18 Routine endomyocardial biopsy is not recommended in cases of new-onset HF. Endomyocardial biopsy should be considered in patients with rapidly progressive clinical HF or ventricular dysfunction, despite appropriate medical therapy. Endomyocardial

biopsy also should be considered in patients suspected of having myocardial infiltrative processes, such as sarcoidosis or amyloidosis, or in patients with malignant arrhythmias out of proportion to LV dysfunction, where sarcoidosis and giant cell myocarditis are considerations. (Strength of Evidence = C)

4.19 It is recommended that clinical evaluation at each follow-up visit include determination of the elements listed in Table 4.9. (Strength of Evidence = B)

These assessments should include the same symptoms and signs assessed during the initial evaluation. (Strength of Evidence = B)

Table 4.9. Elements to Determine at Follow-Up Visits of HF Patients

Functional capacity and activity level
Changes in body weight
Patient understanding of and compliance with dietary sodium restriction
Patient understanding of and compliance with medical regimen
History of arrhythmia, syncope, presyncope, palpitation or ICD discharge
Adherence and response to therapeutic interventions
The presence or absence of exacerbating factors for HF, including worsening ischemic heart disease, hypertension, and new or worsening valvular disease

4.20 In the absence of deteriorating clinical presentation, repeat measurements of ventricular volume and LVEF should be considered in these limited circumstances:

- When a prophylactic implantable cardioverter defibrillator (ICD) or cardiac resynchronization therapy (CRT) device and defibrillator (CRT-D) placement is being considered in order to determine that LVEF criteria for device placement are still met after medical therapy (Strength of Evidence = B)
- When patients show substantial clinical improvement (for example, in response to beta blocker treatment or following pregnancy in patients with peripartum cardiomyopathy). Such change may denote improved prognosis, although it does not in itself mandate alteration or discontinuation of specific treatments (see Section 7). (Strength of Evidence = C)
- In alcohol and cardiotoxic substance abusers who have discontinued the abused substance. (Strength of Evidence = C)
- In patients receiving cardiotoxic chemotherapy. (Strength of Evidence = B)

Repeat determination of LVEF is usually unnecessary in patients with previously documented LV dilatation and low LVEF who manifest worsening signs or symptoms of HF, unless the information is needed to justify a change in patient management (such as surgery or device implantation). (Strength of Evidence = C)

4.21 It is recommended that reevaluation of electrolytes and renal function occur at least every 6 months in clinically stable patients and more frequently following changes in therapy or with evidence of change in volume status. More frequent assessment of electrolytes and renal function is recommended in patients with severe HF, those receiving high doses of diuretics, those on aldosterone antagonists, and those who are clinically unstable. (Strength of Evidence = C)

See Section 7 for recommendations for patients on an aldosterone receptor antagonist.

Section 5: Management of Asymptomatic Patients With Reduced Left Ventricular Ejection Fraction

LV remodeling and reduced LVEF should be distinguished from the syndrome of clinical HF. When LVEF is reduced (<40%), but there are no signs and symptoms of HF, the condition frequently is referred to as asymptomatic LV dysfunction (ALVD). It is important to distinguish between ALVD and patients categorized as NYHA Class I HF. Although patients with NYHA Class I HF do not currently have HF symptoms, they may have ALVD currently, or they may have clinical systolic HF with symptoms in the past. In contrast, patients with ALVD have no past history of HF symptoms. It is now well recognized that there may be a latency period when the LVEF is reduced before the development of symptomatic HF. Although most attention in the HF literature has centered on patients with symptoms, evidence now indicates that ALVD is more common than previously assumed. The recent realization that therapies aimed at symptomatic HF may improve outcomes in patients with ALVD has increased the importance of recognizing and treating patients with this condition.

The management of patients with ALVD focuses on controlling cardiovascular risk factors and on the prevention or reduction of progressive ventricular remodeling. Exercise, smoking cessation, hypertension control, as well as treatment with ACE inhibitors (or ARBs) and beta blockers, all have a potential role in the treatment of this syndrome.

Recommendations for the Management of Asymptomatic Patients With Reduced LVEF

5.1 It is recommended that all patients with ALVD exercise regularly according to a physician-directed prescription to avoid general deconditioning; to optimize weight, blood pressure, and diabetes control; and to reduce cardiovascular risk. (Strength of Evidence = C)

5.2 Smoking cessation is recommended in all patients including those with ALVD. (Strength of Evidence = B)

5.3 Alcohol abstinence is recommended if there is current or previous history of excessive alcohol intake. (Strength of Evidence = C)

5.4 It is recommended that all patients with ALVD with hypertension achieve optimal blood pressure control. (Strength of Evidence = B)

5.5 ACE inhibitor therapy is recommended for asymptomatic patients with reduced LVEF (<40%). (Strength of Evidence = A)

5.6 ARBs are recommended for asymptomatic patients with reduced LVEF who are intolerant of ACE inhibitors from cough or angioedema. (Strength of Evidence = C)

Routine use of the combination of ACE inhibitors and ARBs for prevention of HF is not recommended in this population. (Strength of Evidence = C)

5.7 Beta blocker therapy should be considered in asymptomatic patients with reduced LVEF. (post-MI, Strength of Evidence = B; non post-MI, Strength of Evidence = C)

Section 6: Nonpharmacologic Management and Health Care Maintenance in Patients With Chronic Heart Failure

Nonpharmacologic management strategies represent an important contribution to HF therapy. They may significantly impact patient stability, functional capacity, mortality, and quality of life. These strategies include diet and nutrition, oxygen supplementation, and management of concomitant conditions such as sleep apnea, insomnia, depression, and sexual dysfunction. Exercise training may also play a role in appropriate patients. Attention should be focused on the appropriate management of routine health maintenance issues.

Recommendations for Diet and Nutrition

6.1 Dietary instruction regarding sodium intake is recommended in all patients with HF. Patients with HF and diabetes, dyslipidemia, or severe obesity should be given specific dietary instructions. (Strength of Evidence = B)

6.2 Dietary sodium restriction (2-3 g daily) is recommended for patients with the clinical syndrome of HF and preserved *or* depressed left ventricular ejection fraction (LVEF). Further restriction (<2 g daily) may be considered in moderate to severe HF. (Strength of Evidence = C)

6.3 Restriction of daily fluid intake to <2 L is recommended in patients with severe hyponatremia (serum sodium <130 mEq/L) and should be considered for all patients demonstrating fluid retention that is difficult to control despite high doses of diuretic and sodium restriction. (Strength of Evidence = C)

6.4 It is recommended that specific attention be paid to nutritional management of patients with advanced HF and unintentional weight loss or muscle wasting (cardiac cachexia). Measurement of nitrogen balance, caloric intake, and prealbumin may be useful in determining appropriate nutritional supplementation. Caloric supplementation is recommended. Anabolic steroids are not recommended for cachexic patients. (Strength of Evidence = C)

6.5 Patients with HF, especially those on diuretic therapy and restricted diets, should be considered for daily multivitamin-mineral supplementation to ensure adequate intake of the recommended daily value of essential nutrients. Evaluation for specific vitamin or nutrient deficiencies is rarely necessary. (Strength of Evidence = C)

6.6 Documentation of the type and dose of naturoceutical products used by patients with HF is recommended. (Strength of Evidence = C)

Naturoceutical use is not recommended for relief of symptomatic HF or for the secondary prevention of cardiovascular events. Patients should be instructed to avoid using natural or synthetic products containing ephedra (ma huang), ephedrine, or its metabolites because of an increased risk of mortality and morbidity. Products should be avoided that may have significant drug interactions with digoxin, vasodilators, beta blockers, antiarrhythmic drugs, and anticoagulants. (Strength of Evidence = B)

Recommendations for Other Therapies

6.7 Continuous positive airway pressure to improve daily functional capacity and quality of life is recommended in patients with HF and obstructive sleep apnea documented by approved methods of polysomnography. (Strength of Evidence = B)

6.8 Supplemental oxygen, either at night or during exertion, is not recommended for patients with HF in the absence of an indication of underlying pulmonary disease. Patients with resting hypoxemia or oxygen desaturation during exercise should be evaluated for residual fluid overload or concomitant pulmonary disease. (Strength of Evidence = B)

6.9 The identification of treatable conditions, such as sleep-disordered breathing, urologic abnormalities, restless leg syndrome, and depression should be considered in patients with HF and chronic insomnia. Pharmacologic aids to sleep induction may be necessary. Agents that do not risk physical dependence are preferred. (Strength of Evidence = C)

Recommendations for Specific Activity and Lifestyle Issues

6.10 It is recommended that screening for endogenous or prolonged reactive depression in patients with HF be conducted following diagnosis and at periodic intervals as clinically indicated. For pharmacologic

treatment, selective serotonin reuptake inhibitors are preferred over tricyclic antidepressants, because the latter have the potential to cause ventricular arrhythmias, but the potential for drug interactions should be considered. (Strength of Evidence = B)

6.11 Nonpharmacologic techniques for stress reduction may be considered as a useful adjunct for reducing anxiety in patients with HF. (Strength of Evidence = C)

6.12 It is recommended that treatment options for sexual dysfunction be discussed openly with both male and female patients with HF. (Strength of Evidence = C)

The use of phosphodiasterase-5 inhibitors such as sildenafil may be considered for use for sexual dysfunction in patients with chronic stable HF. These agents are not recommended in patients taking nitrate preparations. (Strength of Evidence = C)

Recommendations for Routine Health Care Maintenance

6.13 It is recommended that patients with HF be advised to stop smoking and to limit alcohol consumption to ≤2 standard drinks per day in men or ≤1 standard drink per day in women. Patients suspected of having an alcohol-induced cardiomyopathy should be advised to abstain from alcohol consumption. Patients suspected of using illicit drugs should be counseled to discontinue such use. (Strength of Evidence = B)

6.14 Pneumococcal vaccine and annual influenza vaccination are recommended in all patients with HF in the absence of known contraindications. (Strength of Evidence = B)

6.15 Endocarditis prophylaxis is not recommended based on the diagnosis of HF alone. Consistent with the AHA recommendation, 'prophylaxis should be given for only specific cardiac conditions, associated with the highest risk of adverse outcome from endocarditis.'[39] These are: 'prosthetic cardiac valves; previous infective endocarditis; congenital heart disease (CHD)' such as: 'unrepaired cyanotic CHD, including palliative shunts and conduits; completely repaired congenital heart defect with prosthetic material or device, whether placed by surgery or by catheter intervention, during the first six months after the procedure; repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch or prosthetic device (which inhibit endothelialization); cardiac transplantation recipients who develop cardiac valvulopathy.' (Strength of Evidence = C)

6.16 Nonsteroidal anti-inflammatory drugs, including cyclooxygenase-2 inhibitors, are not recommended in patients with chronic HF. The risk of renal failure and fluid retention is markedly increased in the setting of reduced renal function or ACE-inhibitor therapy. (Strength of Evidence = B)

6.17 It is recommended that patients with new- or recent-onset HF be assessed for employability following a reasonable period of clinical stabilization. An objective assessment of functional exercise capacity is useful in this determination. (Strength of Evidence = B)

6.18 It is recommended that patients with chronic HF who are employed and whose job description is compatible with their prescribed activity level be encouraged to remain employed, even if a temporary reduction in hours worked or task performed is required. Retraining should be considered and supported for patients with a job demanding a level of physical exertion exceeding recommended levels. (Strength of Evidence = B)

Recommendations for Exercise Testing/Exercise Training

6.19 It is recommended that patients with HF undergo exercise testing to determine suitability for exercise training (patient does not develop significant ischemia or arrhythmias).

If deemed safe, exercise training should be considered for patients with HF in order to facilitate understanding of exercise expectations (heart rate ranges and appropriate levels of exercise training), to increase exercise duration and intensity in a supervised setting, and to promote adherence to a general exercise goal of 30 minutes of moderate activity/exercise, 5 days per week with warm up and cool down exercises. (Strength of Evidence = B)

Section 7: Heart Failure in Patients With Reduced Ejection Fraction

There are 3 primary issues that must be considered when treating HF patients with reduced LVEF: (1) improving symptoms and quality of life, (2) slowing the progression or reversing cardiac and peripheral dysfunction, and (3) reducing mortality. General measures, such as salt restriction, weight loss, lipid control, and other nonpharmacologic measures are addressed in Section 6. Pharmacologic approaches to symptom control, including diuretics, vasodilators, intravenous inotropic drugs, anticoagulants, and antiplatelet agents are discussed at the end of this section.

Two classes of agents have become the recommended cornerstone of therapy to delay or halt progression of cardiac dysfunction and improve mortality: ACE inhibitors and beta blockers. Even while these agents are underused in the treatment of HF, new classes of agents have been added that show an impact on mortality, complicating decisions about optimal pharmacologic therapy. These include

Table 7.1. ACE-inhibitor, Angiotensin Receptor Blocker, and Beta-Blocker Therapy in Heart Failure with Low Ejection Fraction

Generic Name	Trade Name	Initial Daily Dose	Target Dose	Mean Dose Achieved in Clinical Trials
ACE-inhibitors				
Captopril	Capoten	6.25 mg tid	50 mg tid	122.7 mg/day[160]
Enalapril	Vasotec	2.5 mg bid	10 mg bid	16.6 mg/day[42]
Fosinopril	Monopril	5-10 mg qd	80 mg qd	n/a
Lisinopril	Zestril, Prinivil	2.5-5 mg qd	20 mg qd	*4.5 mg/day (low dose ATLAS) 33.2 mg/day (high dose ATLAS)[161]
Quinapril	Accupril	5 mg bid	80 mg qd	n/a
Ramipril	Altace	1.25-2.5 mg qd	10 mg qd	n/a
Trandolapril	Mavik	1 mg qd	4 mg qd	n/a
Angiotensin Receptor Blockers				
Candesartan	Atacand	4-8 mg qd	32 mg qd	24 mg/day[162]
Losartan	Cozaar	12.5-25 mg qd	150 mg qd	129 mg/day[163]
Valsartan	Diovan	40 mg bid	160 mg bid	254 mg/day[164]
Beta-blockers				
Bisoprolol	Zebeta	1.25 mg qd	10 mg qd	8.6 mg/day[47]
Carvedilol	Coreg	3.125 mg bid	25 mg bid	37 mg/day[165]
Carvedilol	Coreg CR	10 mg qd	80 mg qd	
Metoprolol succinate CR/XL	Toprol XL	12.5-25 mg qd	200 mg qd	159 mg/day[48]
Aldosterone Antagonists				
Spironolactone	Aldactone	12.5 to 25 mg qd	25 mg qd	26 mg/day[60]
Eplerenone	Inspra	25 mg qd	50 mg qd	42.6 mg/day[61]
Other Vasodilators				
Fixed dose Hydralazine/ Isosorbide dinitrate	BiDil	37.5 mg hydralazine/20 mg isosorbide dinitrate tid	75 mg hydralazine/40 mg isosorbide dinitrate tid	142.5 mg hydralazine/76 mg isosorbide dinitrate/day[166]
Hydralazine	Apresoline	37.5 mg qid	75 mg qid	270 mg/day[167]
Isosorbide dinitrate	Isordil	20 mg qid	40 mg qid	136 mg/day[167]

*No difference in mortality between high and low dose groups, but 12% lower risk of death or hospitalization in high dose group vs. low dose group.

ARBs, aldosterone antagonists, and the combination of hydralazine and an oral nitrate (Table 7.1).

Recommendations for ACE-inhibitors

There is compelling evidence that ACE inhibitors should be used to inhibit the renin-angiotensin-aldosterone system (RAAS) in all HF patients with reduced LVEF, whether or not they are symptomatic (Table 7.1). A number of large clinical trials have demonstrated improvement in morbidity and mortality in HF patients with reduced LVEF, both chronically and post-MI.[40-42]

7.1 ACE inhibitors are recommended for routine administration to symptomatic and asymptomatic patients with LVEF ≤ 40%. (Strength of Evidence = A)

ACE inhibitors should be titrated to doses used in clinical trials, as tolerated during concomitant up-titration of beta blockers. (Strength of Evidence = C)

Recommendations for Alternatives to ACE-inhibitors

ACE inhibitors can have some troublesome side effects, including cough and angioedema, which may limit therapy with these agents. ARBs have been demonstrated to be well tolerated in randomized trials of patients judged to be intolerant of ACE inhibitors.[43,44] Both drugs have similar effects on blood pressure, renal function, and potassium.[43] Thus, patients intolerant of ACE-inhibitors for these reasons may also be intolerant of ARBs, and the combination of hydralazine and oral nitrates should be considered for these patients.

7.2 It is recommended that other therapy be substituted for ACE inhibitors in the following circumstances:

- In patients who cannot tolerate ACE inhibitors due to cough, ARBs are recommended. (Strength of Evidence = A)

  The combination of hydralazine and an oral nitrate may be considered in such patients not tolerating ARB therapy. (Strength of Evidence = C)

- Patients intolerant to ACE inhibitors from hyperkalemia or renal insufficiency are likely to experience the same side effects with ARBs. In these cases, the combination of hydralazine and an oral nitrate should be considered. (Strength of Evidence = C)

7.3 ARBs are recommended for routine administration to symptomatic and asymptomatic patients with an LVEF ≤ 40% who are intolerant to ACE inhibitors for reasons other than hyperkalemia or renal insufficiency. (Strength of Evidence = A)

7.4 ARBs should be considered in patients experiencing angioedema while on ACE inhibitors based on their underlying risk and with recognition that angioedema has been reported infrequently with ARBs. (Strength of Evidence = B)

The combination of hydralazine and oral nitrates may be considered in such patients not tolerating ARB therapy. (Strength of Evidence = C)

Recommendations for Angiotensin Receptor Blockers

Both ACE inhibitors and ARBs inhibit the RAAS, but by different mechanisms. ACE inhibitors block an enzyme responsible for converting angiotensin I to angiotensin II and for degrading various kinins. However, during chronic therapy, angiotensin II levels are not completely suppressed by ACE inhibitors. ARBs block the effects of angiotensin II on the ATI receptor, independent of the source of angiotensin II production. ARBs have been compared to ACE-inhibitors in several clinical trials, in both chronic HF and in post-MI HF populations.

7.5 Individual ARBs may be considered as initial therapy rather than ACE inhibitors for patients with the following conditions:

- HF Post-MI (Strength of Evidence = A)
- Chronic HF and reduced LVEF (Strength of Evidence = B)

Recommendations for Beta Adrenergic Receptor Blockers

Beta blocker therapy, advocated for HF by some investigators since the 1970s, remains a major advance in the treatment of patients with HF and reduced LVEF. Several large-scale clinical trials, involving more than 10,000 patients, have provided unequivocal evidence of important reductions in both mortality and morbidity.[45-51] The marked beneficial effects of beta blockade has been well demonstrated in large-scale clinical trials of symptomatic patients with NYHA class II-IV HF and reduced LVEF using carvedilol, bisoprolol, and metoprolol controlled release/extended release (CR/XL). [47-51] These trials added beta blockade to background therapy that included ACE inhibitors and diuretics in more than 90% of patients. The trial results support benefit from both $beta_1$ selective and nonselective beta blockers, whether ancillary properties are present or not. beta blocking agents with intrinsic sympathomimetic activity are likely to worsen survival and should be avoided in patients with HF.[52] The beta-blockers studied in clinical trials are now established as routine therapy in patients with reduced LVEF. This therapy is well tolerated by a large majority of patients with HF, even those with comorbid conditions like diabetes mellitus,[53,54] chronic obstructive lung disease,[55] and peripheral vascular disease.[56]

7.6 Beta blockers shown to be effective in clinical trials of patients with HF are recommended for patients with an LVEF ≤40%. (Strength of Evidence = A)

7.7 The combination of a beta blocker and an ACE inhibitor is recommended as routine therapy for asymptomatic patients with a LVEF ≤40%

- Post-MI (Strength of Evidence = B)
- Non Post-MI (Strength of Evidence = C)

7.8 Beta blocker therapy is recommended for patients with a recent decompensation of HF after optimization of volume status and successful discontinuation of intravenous diuretics and vasoactive agents, including inotropic support. Whenever possible, beta blocker therapy should be initiated in the hospital setting at a low dose prior to discharge in stable patients. (Strength of Evidence = B)

7.9 Beta blocker therapy is recommended in the great majority of patients with HF and reduced LVEF, even if there is concomitant diabetes, chronic obstructive lung disease, or peripheral vascular disease. Beta blocker therapy should be used with caution in patients with diabetes with recurrent hypoglycemia, with asthma, or with resting limb ischemia. Considerable caution should be used if beta blockers are initiated in patients with marked bradycardia (<55 beats/min) or marked hypotension (systolic blood pressure <80 mm Hg). Beta blockers are not recommended in patients with asthma with active bronchospasm. (Strength of Evidence = C)

7.10 It is recommended that beta blockade be initiated at low doses and uptitrated gradually, typically at 2-week intervals in patients with reduced LVEF, and after 3-10 day intervals in patients with reduced LVEF following newly diagnosed MI. (Strength of Evidence = B)

7.11 It is recommended that beta blocker therapy be continued in most patients experiencing a symptomatic exacerbation of HF during chronic maintenance treatment, unless they develop cardiogenic shock, refractory volume overload, or symptomatic bradycardia (Strength of Evidence = C)

A temporary reduction of dose (generally by one-half) in this setting may be considered. Abrupt discontinuation in patients with symptomatic exacerbation should be avoided, unless the situation is life-threatening. (Strength of Evidence = C)

If discontinued or reduced, beta blockers should be reinstated before the patient is discharged. In general, doses should be uptitrated to the previous well-tolerated dose as soon as safely possible (Strength of Evidence = B)

Recommendations for Combination ACE-inhibitor, ARB, and Beta Adrenergic Receptor Blocker Therapy

7.12 The routine administration of an ARB is not recommended in addition to ACE inhibitor and beta blocker therapy in patients with a recent acute MI and reduced LVEF. (Strength of Evidence = A)

7.13 The addition of an ARB should be considered in patients with HF due to reduced LVEF who have persistent symptoms or progressive worsening despite optimized therapy with an ACE inhibitor and beta blocker. (Strength of Evidence = A)

Recommendations for Aldosterone Antagonists

Sustained activation of aldosterone appears to play an important role in the pathophysiology of HF.[57] Although ACE inhibition may transiently decrease aldosterone secretion, there are diverse stimuli other than angiotensin II for the production of this hormone.[58] Studies suggest a rapid return of aldosterone to levels similar to those before ACE inhibition.[59] Aldosterone antagonists have demonstrated efficacy in both severe HF and in post-MI HF.[60,61] Hyperkalemia is a serious adverse effect associated with both non-selective (i.e. spironolactone) and selective (i.e. eplerenone) aldosterone antagonists. In addition to hyperkalemia, gynecomastia or breast pain may be important side effects of spironolactone, but not eplerenone.

7.14 Administration of an aldosterone antagonist is recommended for patients with NYHA class IV (or class III, previously class IV) HF from reduced LVEF (<35%) while receiving standard therapy, including diuretics. (Strength of Evidence = A)

7.15 Administration of an aldosterone antagonist should be considered in patients following an acute MI, with clinical HF signs and symptoms or history of diabetes mellitus, and an LVEF <40%. Patients should be on standard therapy, including an ACE inhibitor (or ARB) and a beta blocker. (Strength of Evidence = A)

7.16 Aldosterone antagonists are not recommended when creatinine is >2.5 mg/dL (or creatinine clearance is <30 ml/min) or serum potassium is >5.0 mmol/L or in conjunction with other potassium-sparing diuretics. (Strength of Evidence = A)

7.17 It is recommended that serum potassium concentration be monitored frequently following initiation or change in an aldosterone antagonist. Monitoring should reflect protocols followed in clinical trials. (Strength of Evidence = A)

7.18 In the absence of persistent hypokalemia (<4.0 mmol/L), supplemental potassium is not recommended in patients taking an aldosterone antagonist. (Strength of Evidence = A)

Recommendations for Oral Nitrates and Hydralazine

The combination of hydralazine and isosorbide dinitrate has shown efficacy in several trials and plays a role in HF therapy as an alternative to ACE-inhibitors. Based on the results of the African American Heart Failure Trial (A-HeFT), it also is part of standard HF therapy in African Americans with HF and reduced LVEF.

7.19 A combination of hydralazine and isosorbide dinitrate is recommended as part of standard therapy in addition to beta blockers and ACE inhibitors for African Americans with HF and reduced LVEF.

- NYHA III or IV HF (Strength of Evidence = A)
- NYHA II HF (Strength of Evidence = B) (See Section 15: Special Populations)

7.20 A combination of hydralazine and isosorbide dinitrate may be considered in non-African-American patients with HF and reduced LVEF who remain symptomatic despite optimized standard therapy. (Strength of Evidence = C)

Recommendations for Optimal Use of Multi-Drug Therapy

Multi-drug therapy is required for optimal management to slow progression and improve outcome in patients with HF and reduced LVEF. An ACE inhibitor plus a beta blocker is standard background therapy. An ARB can be substituted for an ACE inhibitor if clinically indicated. An ARB can be added to an ACE inhibitor in individuals in whom beta blocker is contraindicated or not tolerated. The optimal choice of additional drug therapy to further improve outcome in patients already treated with 2 of these 3 drugs is not firmly established. An aldosterone inhibitor, an ARB (if the patient is already on an ACE inhibitor) and the combination of isosorbide dinitrate and hydralazine have all been shown to exert further benefit in controlled trials, but have not been the subject of comparative trials. The choice among these agents may be influenced by the patient's age, renal function, serum potassium, racial background, and severity of the clinical syndrome. Certain combinations require careful monitoring.

7.21 Additional pharmacologic therapy should be considered in patients with HF and reduced LVEF who have persistent symptoms or progressive worsening despite optimized therapy with an ACE inhibitor and beta blocker. The choice of specific agent will be influenced by clinical considerations, including renal function status, chronic serum potassium concentration, blood pressure, and volume status. The triple combination of an ACE inhibitor, an ARB, and an aldosterone antagonist is not recommended because of the high risk of hyperkalemia. (Strength of Evidence = C)

- Addition of an ARB. (Strength of Evidence = A)
- Addition of an aldosterone antagonist:
  - for severe HF (Strength of Evidence =A)
  - for moderate HF (Strength of Evidence = C)
  - for post-MI HF (Strength of Evidence = A)
- Addition of the combination of hydralazine/isosorbide dinitrate:
  - for African Americans (Strength of Evidence = A)
  - for others (Strength of Evidence = C)

7.22 Additional pharmacological therapy should be considered in patients with HF and reduced LVEF *who are unable to tolerate a beta blocker* and have persistent symptoms or progressive worsening despite optimized therapy with an ACE inhibitor. The choice of specific agent will be influenced by clinical considerations,

including renal function status, chronic serum potassium concentration, blood pressure and volume status. The triple combination of an ACE inhibitor, an ARB, and an aldosterone antagonist is not recommended due to the high risk of hyperkalemia. (Strength of Evidence = C)

- Addition of an ARB. (Strength of Evidence = C)
- Addition of an aldosterone antagonist:
  - for severe HF (Strength of Evidence = C)
  - for moderate HF (Strength of Evidence = C)
- Addition of the combination of hydralazine/isosorbide dinitrate:
  - for African Americans (Strength of Evidence = C)
  - for others (Strength of Evidence = C)

Recommendations for Diuretic Therapy

Loop and distal tubular diuretics are necessary adjuncts in the medical therapy for HF when symptoms are the result of sodium and water retention. Diuretics reduce congestive symptoms and signs and can be titrated as needed to restore euvolemia and to reach an estimated ''dry'' weight goal for the patient. Relief of signs and symptoms must be achieved without causing side effects, particularly symptomatic hypotension or worsening renal function.

7.23 Diuretic therapy is recommended to restore and maintain normal volume status in patients with clinical evidence of fluid overload, generally manifested by congestive symptoms (orthopnea, edema, and shortness of breath), or signs of elevated filling pressures (jugular venous distention, peripheral edema, pulsatile hepatomegaly, and, less commonly, rales). (Strength of Evidence = A) Loop diuretics rather than thiazide-type diuretics are typically necessary to restore normal volume status in patients with HF. (Strength of Evidence = B)

7.24 The initial dose of diuretic may be increased as necessary to relieve congestion. Restoration of normal volume status may require multiple adjustments over many days and occasionally weeks in patients with severe fluid overload evidenced by massive edema or ascites. After a diuretic effect is achieved with short-acting loop diuretics, increasing administration frequency to twice or even 3 times per day will provide more diuresis with less physiologic perturbation than larger single doses. (Strength of Evidence = B)

Oral torsemide may be considered in patients in whom poor absorption of oral medication or erratic diuretic effect may be present, particularly those with right-sided HF and refractory fluid retention despite high doses of other loop diuretics. (Strength of Evidence = C)

Intravenous administration of diuretics may be necessary to relieve congestion. (Strength of Evidence = A)

Diuretic refractoriness may represent patient nonadherence, a direct effect of diuretic use on the kidney, or progression of underlying cardiac dysfunction.

7.25 Addition of chlorothiazides or metolazone, once or twice daily, to loop diuretics should be considered in patients with persistent fluid retention despite high-dose loop diuretic therapy. But chronic daily use, especially of metolazone, should be avoided if possible because of the potential for electrolyte shifts and volume depletion. These drugs may be used periodically (every other day or weekly) to optimize fluid management. Metolazone will generally be more potent and much longer-acting in this setting and in patients with chronic renal insufficiency, so administration should be adjusted accordingly. Volume status and electrolytes must be monitored closely when multiple diuretics are used. (Strength of Evidence = C)

7.26 Careful observation for the development of side effects, including electrolyte abnormalities, symptomatic hypotension, renal dysfunction, or worsening renal function, is recommended in patients treated with diuretics, especially when used at high doses and in combination. Patients should undergo routine laboratory studies and clinical examination as dictated by their clinical response. (Strength of Evidence = B)

7.27 Patients requiring diuretic therapy to treat fluid retention associated with HF generally require chronic treatment, although often at lower doses than those required initially to achieve diuresis. Decreasing or even discontinuing diuretics may be considered in patients experiencing significant improvement in clinical status and cardiac function or in those who successfully restrict dietary sodium intake. These patients may undergo cautious weaning of diuretic dose and frequency with careful observation for recurrent fluid retention. (Strength of Evidence = C)

7.28 It is recommended that patients and caregivers be given education that will enable them to demonstrate understanding of the early signs of fluid retention and the plan for initial therapy. (Strength of Evidence = C)

Selected patients may be educated to adjust daily dose of diuretic in response to weight gain from fluid overload (typically short-term weight gain of 2 to 4 lb). (Strength of Evidence = C) (See Section 6 for more information on this topic)

Recommendations for Digoxin

Data from the Digitalis Investigation Group (DIG) trial and the combined databases of several other large trials provide evidence of digoxin's efficacy.[62-68] Digoxin is a drug that is inexpensive and can be given once daily, and it continues to have a therapeutic role in symptomatic patients with HF from reduced LVEF.

7.29 Digoxin may be considered to improve symptoms in patients with reduced LVEF (LVEF ≤40%) who have signs or symptoms of HF while receiving standard therapy, including ACE inhibitors and beta blockers:
- NYHA class II-III (Strength of Evidence = B)
- NYHA class IV (Strength of Evidence = C)

7.30 It is recommended that the dose of digoxin, which should be based on lean body mass, renal function, and concomitant medications, should be 0.125 mg daily in the majority of patients and the serum digoxin level should be <1.0 ng/mL, generally 0.7-0.9 ng/mL. (Strength of Evidence = B)

7.31 Digoxin should be considered for achieving adequate control of the ventricular response to atrial fibrillation in patients with HF. (Strength of Evidence = B)

7.32 High doses of digoxin (maintenance dose >0.25 mg daily) for the purpose of rate control are not recommended. (Strength of Evidence = C)

Recommendations for Anticoagulation and Antiplatelet Drugs

Patients with HF are recognized to be at increased risk for arterial or venous thromboembolic events. In addition to atrial fibrillation and poor ventricular function, which promote stasis and increase the risk of thrombus formation, patients with HF have other manifestations of hypercoagulability. Evidence of heightened platelet activation, increased plasma and blood viscosity, and increased plasma levels of fibrinopeptide A, beta—thromboglobulin, D-dimer, and von Willebrand factor have been found in many patients.[69-71] Despite a predisposition, estimates regarding the incidence of thromboemboli in patients with HF vary substantially between 1.4% and 4.2% per 100 patient years.[72-74] Although variability in the reported incidence likely results from differences in the populations studied and the methodology used to identify these events, the consensus is that pulmonary and systemic emboli are not common in HF patients in sinus rhythm. Traditionally, discussion of anticoagulation in patients with HF has centered on warfarin. Antiplatelet agents are often used in patients with HF from ischemic heart disease.

7.33 Treatment with warfarin (goal international normalized ratio [INR] 2.0-3.0) is recommended for all patients with HF and chronic or documented paroxysmal, persistent, or long-standing atrial fibrillation (Strength of Evidence = A) or a history of systemic or pulmonary emboli, including stroke or transient ischemic attack (Strength of Evidence = C), unless contraindicated.

7.34 It is recommended that patients with symptomatic or asymptomatic ischemic cardiomyopathy and documented recent large anterior MI or recent MI with documented LV thrombus be treated with warfarin (goal INR 2.0-3.0) for the initial 3 months post-MI (Strength of Evidence = B) unless contraindicated.

Other patients with ischemic or nonischemic cardiomyopathy and LV thrombus should be considered for chronic anticoagulation, depending on the characteristics of the thrombus, such as its size, mobility, and degree of calcification. (Strength of Evidence = C)

7.35 Long-term treatment with an antiplatelet agent, generally aspirin in doses of 75 to 81 mg, is recommended for patients with HF due to ischemic cardiomyopathy, whether or not they are receiving ACE inhibitors. (Strength of Evidence = B)

Warfarin (goal INR 2.0-3.0) and clopidogrel (75 mg) also have prevented vascular events in post-MI patients and may be considered as alternatives to aspirin. (Strength of Evidence = B)

7.36 Routine use of aspirin is not recommended in patients with HF without atherosclerotic vascular disease. (Strength of Evidence = C)

Recommendations for Amiodarone Therapy

Ventricular arrhythmias are common in HF patients, and sudden cardiac death (SCD) continues to account for a significant proportion of the mortality in this syndrome. Many antiarrhythmic drugs have adverse hemodynamic effects sufficient to have negative consequences in patients with HF. Patients with HF are at higher risk for proarrhythmic effects of antiarrhythmic agents. The major role for the use of these agents in HF is to reduce recurrences of symptomatic arrhythmias, usually in patients who have an ICD.[75]

7.37 Antiarrhythmic agents, including amiodarone, are not recommended for the primary prevention of sudden death in patients with HF. (Strength of Evidence = A).

7.38 In patients with HF and an ICD, amiodarone may be considered to reduce the frequency of recurrent symptomatic arrhythmias causing ICD shocks. (Strength of Evidence = C)

7.39 It is recommended that when amiodarone therapy is initiated, the potential for interactions with other drugs be reviewed. The maintenance doses of digoxin, warfarin, and some statins should be reduced when amiodarone is initiated and then carefully monitored. Adjustment in doses of these drugs and laboratory assessment of drug activity or serum concentration after initiation of amiodarone is recommended. (Strength of Evidence = A)

7.40 Routine use of amiodarone therapy for asymptomatic arrhythmias that are not felt to contribute to HF or ventricular dysfunction is not recommended. (Strength of Evidence = B)

7.41 n-3 polyunsaturated fatty acids (PUFA) may be considered to reduce mortality in HF patients with NYHA class II-IV symptoms and reduced LVEF. (Strength of Evidence = B)

Section 8: Disease Management, Advance Directives, and End-of-Life Care in Heart Failure

The majority of HF care is performed at home by the patient and family or caregiver. If these individuals do not know what is required, fail to see its importance, or face barriers to engagement in self-care, they will not participate effectively. For this reason, comprehensive education and counseling are the foundation for all HF management. The goals of education and counseling are to help patients, their families, and caregivers acquire the knowledge, skills, strategies, problem solving abilities, and motivation necessary for adherence to the treatment plan and effective participation in self-care. The inclusion of family members and other caregivers is especially important, because HF patients often suffer from cognitive impairment, functional disabilities, multiple comorbidities and other conditions that limit their ability to fully comprehend, appreciate, or enact what they learn.[76-82]

Recommendations for Education and Counseling

8.1 It is recommended that patients with HF and their family members or caregivers receive individualized education and counseling that emphasizes self-care. This education and counseling should be delivered by providers using a team approach in which nurses with expertise in HF management provide the majority of education and counseling, supplemented by physician input and, when available and needed, input from dietitians, pharmacists, and other health care providers. (Strength of Evidence = B)

Teaching is not sufficient without skill building and specification of critical target behaviors. It is recommended that essential elements of patient education (with associated skills) are utilized to promote self-care with associated skills shown in Table 8.1. (Strength of Evidence = B)

8.2 It is recommended that patients' literacy, cognitive status, psychological state, culture, and access to social and financial resources be taken into account for optimal education and counseling. Because cognitive impairment and depression are common in HF and can seriously interfere with learning, patients should be screened for these. Patients found to be cognitively impaired need additional support to manage their HF. (Strength of Evidence = B)

8.3 It is recommended that educational sessions begin with an assessment of current HF knowledge, issues about which the patient wants to learn, and the patient's perceived barriers to change. Education sessions should address specific issues (eg, medication nonadherence) and their causes (eg, lack of knowledge vs cost vs forgetting) and employ strategies that promote behavior change, including motivational approaches. (Strength of Evidence = B)

8.4 It is recommended that the frequency and intensity of patient education and counseling vary according to the stage of illness. Patients in advanced HF or with persistent difficulty adhering to the recommended regimen require the most education and counseling. Patients should be offered a variety of options for learning about HF according to their individual preferences:

- Videotape
- One-on-one or group discussion
- Reading materials, translators, telephone calls, mailed information
- Internet
- Visits

Repeated exposure to material is recommended because a single session is never sufficient. (Strength of Evidence = B)

8.5 It is recommended that during the care process patients be asked to:

- Demonstrate knowledge of the name, dose, and purpose of each medication
- Sort foods into high- and low-sodium categories
- Demonstrate their preferred method for tracking medication dosing
- Show provider daily weight log
- Reiterate symptoms of worsening HF
- Reiterate when to call the provider because of specific symptoms or weight changes. (Strength of Evidence = B)

8.6 During acute care hospitalization, only essential education is recommended, with the goal of assisting patients to understand HF, the goals of its treatment, and the post-hospitalization medication and follow-up regimen. Education begun during hospitalization should be supplemented and reinforced within 1-2 weeks after discharge, continued for 3-6 months, and reassessed periodically. (Strength of Evidence = B)

Recommendations for Disease Management Programs

Practitioners who care for patients with HF are challenged daily with preventing common, recurrent rehospitalizations for exacerbations. Disease management is "a comprehensive, integrated system for managing patients…by using best practices, clinical practice improvement…and other resources and tools to reduce overall cost and improve measurable outcomes in the quality of care."[83] A number of disease management programs have been studied, including HF clinics,[84-100] care delivered in the home or to patients who are at home,[101-117] and telemonitoring.[118-124] These programs focus on multiple aspect of patient care, including optimization of drug

Table 8.1. Essential Elements of Patient Education With Associated Skills and Target Behaviors

Elements of Education	Skill Building and Critical Target Behaviors
Definition of HF (linking disease, symptoms, and treatment) and cause of patient's HF	• Discuss basic HF information, cause of patient's HF, and how symptoms relate to HF status
Recognition of escalating symptoms and concrete plan for response to particular symptoms	• Identify specific signs and symptoms (eg, increasing fatigue or shortness of breath with usual activities, dyspnea at rest, nocturnal dyspnea or orthopnea, edema) • Perform daily weights and know how to respond to evidence of volume overload • Develop action plan for how and when to notify the provider, changes to make in diet, fluid and diuretics
Indications and use of each medication	• Reiterate medication dosing schedule, basic reason for specific medications, and what to do if a dose is missed
Modify risks for HF progression	• Smoking cessation • Maintain blood pressure in target range • Maintain normal HgA1c, if diabetic • Maintain specific body weight
Specific diet recommendations: individualized low-sodium diet; recommendation for alcohol intake	• Understand and comply with sodium restriction • Demonstrate how to read a food label to check sodium amount per serving and sort foods into high- and low-sodium groups • Reiterate limits for alcohol consumption or need for abstinence if history of alcohol abuse
Specific activity/exercise recommendations	• Comply with prescribed exercise
Importance of treatment adherence and behavioral strategies to promote	• Plan and use a medication system that promotes routine adherence • Plan for refills

therapy, patient and family/caregiver education and counseling, emphasis on self-care, vigilant follow-up, early attention to signs and symptoms of fluid overload, coordination of care with other providers, quality assessment, and increased access to the health care provider.

8.7 Patients recently hospitalized for HF and other patients at high risk for HF decompensation should be considered for comprehensive HF disease management. High-risk patients include those with renal insufficiency, low output state, diabetes, chronic obstructive pulmonary disease, persistent NYHA class III or IV symptoms, frequent hospitalization for any cause, multiple active comorbidities, or a history of depression, cognitive impairment, inadequate social support, poor health literacy, or persistent nonadherence to therapeutic regimens. (Strength of Evidence = A)

8.8 It is recommended that HF disease management programs include the components shown in Table 8.3 based on patient characteristics and needs. (Strength of Evidence = B)

Table 8.3. Recommended Components of a HF Disease Management Program

- Comprehensive education and counseling individualized to patient needs
- Promotion of self care, including self-adjustment of diuretic therapy in appropriate patients (or with family member/caregiver assistance)
- Emphasis on behavioral strategies to increase adherence
- Vigilant follow-up after hospital discharge or after periods of instability
- Optimization of medical therapy
- Increased access to providers
- Early attention to signs and symptoms of fluid overload
- Assistance with social and financial concerns

8.9 It is recommended that HF disease management include integration and coordination of care between the primary care physician and HF care specialists and with other agencies, such as home health and cardiac rehabilitation. (Strength of Evidence = C)

8.10 It is recommended that patients in a HF disease management program be followed until they or their family/caregiver demonstrate independence in following the prescribed treatment plan, adequate or improved adherence to treatment guidelines, improved functional capacity, and symptom stability. Higher risk patients with more advanced HF may need to be followed permanently. Patients who experience increasing episodes of exacerbation or who demonstrate instability after discharge from a program should be referred again to the service. (Strength of Evidence = B)

Recommendations for Advance Directives and End-of-Life Care

HF has a worse prognosis than many common cancers,[125] and premature death from progressive acute decompensated heart failure (ADHF) or SCD is frequent. Recent advances in HF treatment have resulted in substantial reductions in annual mortality from these modes of death. Nevertheless, the mortality rate in HF remains high, making advance directives and end-of-life care important issues for patients with this condition. Hospice services or other end-of-life care should only be implemented after full and appropriate application of evidence-based pharmacologic and cardiac device

therapies, unless documentation of intolerance or contraindication to such treatments is present. For critically ill patients, clinicians should acknowledge to the patient and their family the potentially life-threatening nature of their condition, and supportive care for them should be implemented as indicated. In most cases, adequate time (weeks to months) must be given to allow medical therapies to exert a beneficial therapeutic effect. In addition, issues such as access to care, adherence to medications and other self care behaviors, and knowledge about HF must be addressed. End-of-life care most often includes continuing HF therapies, which may effectively ease symptoms and stabilize or improve quality of life. A discussion about HF course and prognosis should be conducted with all patients to the extent that they are willing to participate in such a conversation. Discussion of end-of-life care can occur when the patient has progressed to a state of severe, refractory HF.

8.11 It is recommended that patient and family or caregiver discussions about quality of life and prognosis be included in the disease management of HF. (Strength of Evidence = C)

8.12 It is recommended that:

- **a.** Seriously ill patients with HF and their families be educated to understand that patients with HF are at high risk of death, even while aggressive efforts are made to prolong life.
- **b.** Patients with HF be made aware that HF is potentially life-limiting, but that pharmacologic and device therapies and self-management can prolong life. In most cases, chronic HF pharmacologic and device therapies should be optimized as indicated before identifying that patients are near end-of-life.
- **c.** Identification of end-of-life in a patient should be made in collaboration with clinicians experienced in the care of patients with HF when possible.
- **d.** End-of-life management should be coordinated with the patient's primary care physician.
- **e.** As often as possible, discussions regarding end-of-life care should be initiated while the patient is still capable of participating in decision-making. (Strength of Evidence = C)

8.13 End-of-life care should be considered in patients who have advanced, persistent HF with symptoms at rest despite repeated attempts to optimize pharmacologic, cardiac device, and other therapies, as evidenced by 1 or more of the following:

- HF hospitalization [126,127] (Strength of Evidence = B)
- Chronic poor quality of life with minimal or no ability to accomplish activities of daily living (Strength of Evidence = C)
- Need for continuous intravenous inotropic therapy support [128,129] (Strength of Evidence = B)

8.14 It is recommended that end-of-life care strategies be individualized and include core HF pharmacologic therapies, effective symptom management and comfort measures, while avoiding unnecessary testing. New life-prolonging interventions should be discussed with patients and care-givers with careful discussion of whether they are likely to improve symptoms. (Strength of Evidence = C)

8.15 It is recommended that a specific discussion about resuscitation be held in the context of planning for overall care and for emergencies with all patients with HF. The possibility of SCD for patients with HF should be acknowledged. Specific plans to reduce SCD (for example with an ICD) or to allow natural death should be based on the individual patient's risks and preferences for an attempt at resuscitation with specific discussion of risks and benefits of inactivation the ICD. Preferences for attempts at resuscitation and plans for approach to care should be readdressed at turning points in the patient's course or if potentially life-prolonging interventions are considered. (Strength of Evidence = C)

8.16 It is recommended that, as part of end-of-life care, patients and their families/caregivers have a plan to manage a sudden decompensation, death, or progressive decline. Inactivation of an implantable defibrillation device should be discussed in the context of allowing natural death at end of life. A process for deactivating defibrillators should be clarified in all settings in which patients with HF receive care. (Strength of Evidence = C)

8.17 Patients with HF receiving end-of-life care should be considered for enrollment in hospice that can be delivered in the home, a nursing home, or a special hospice unit. (Strength of Evidence = C)

Section 9: Electrophysiology Testing and the Use of Devices in Heart Failure

Device therapy has become an integral part of the treatment for HF. Appropriate patient selection in terms of HF characteristics, severity, and other comorbidities is a key consideration to ensure the optimal application of this therapy.

Recommendations for General Electrophysiology Testing

9.1 It is recommended that the decision to undertake electrophysiologic intervention, including implantable cardioverter defibrillator (ICD) implantation, be made in light of functional status and prognosis based on severity of underlying HF and comorbid conditions. If an ICD is considered due to left ventricular (LV) dysfunction which is of recent onset, LV

function should be reassessed, ideally after 3-6 months of optimal medical therapy. (Strength of Evidence = C)

Recommendations for Electrophysiology Testing and Evaluation of Syncope

9.2 Immediate evaluation is recommended in patients with HF who present with syncope. In the absence of a clear identifiable noncardiac cause, consultation with an EP specialist should be obtained. (Strength of Evidence = C)

9.3 Routine EP testing is not recommended in patients with LV systolic dysfunction who have asymptomatic nonsustained ventricular tachycardia (VT) in the absence of prior infarction. (Strength of Evidence = B)

Recommendations for Prophylactic ICD Placement

More than 80 percent of patients who experience a life-threatening ventricular tachyarrhythmia do not survive to benefit from an ICD. Thus, the concept of the ICD for primary prevention of SCD has received considerable attention. Several large trials have demonstrated efficacy of prophylactic ICDs in certain patient groups.[130-135]

9.4a Prophylactic ICD placement should be considered in patients with an LVEF ≤35% and mild to moderate HF symptoms:
- Ischemic etiology (Strength of Evidence = A)
- Non-ischemic etiology (Strength of Evidence = B)

See Recommendation 9.1 for additional criteria.

9.4b In patients who are undergoing implantation of a biventricular pacing device according to the criteria in recommendations 9.7-9.8, use of a device that provides defibrillation should be considered. (Strength of Evidence = B)

See Recommendation 9.1 for additional criteria.

9.5 ICD placement is not recommended in chronic, severe refractory HF when there is no reasonable expectation for improvement or in patients with a life expectancy of less than 1 year. (Strength of Evidence = C)

9.6 ICD implantation is recommended for survivors of cardiac arrest from ventricular fibrillation or hemodynamically unstable sustained VT that is not due to a transient, potentially reversible cause, such as acute MI. (Strength of Evidence = A)

Recommendations for Biventricular Resynchronization Pacing

The majority of patients with HF have interventricular conduction delay, and up to 30% to 50% have manifest bundle branch block caused by direct pathologic involvement of specialized conduction or by scarring of the myocardium.[136] CRT seeks to normalize depolarization to improve the efficiency of ventricular contraction and ventricular septal motion, decrease atrioventricular valve regurgitation, and increase diastolic filling time.[137]

9.7 Biventricular pacing therapy is recommended for patients in sinus rhythm with a widened QRS interval (≥120 ms) and severe LV systolic dysfunction (LVEF ≤ 35%) who have persistent, moderate to severe HF (NYHA III) despite optimal medical therapy. (Strength of Evidence = A)

9.8 Biventricular pacing therapy may be considered for patients with atrial fibrillation with a widened QRS interval (≥120 ms) and severe LV systolic dysfunction LVEF ≤35% who have persistent, moderate to severe HF (NYHA III) despite optimal medical therapy. (Strength of Evidence = B)

9.9 Selected ambulatory NYHA IV patients in sinus rhythm with QRS ≥120 ms and LV systolic dysfunction may be considered for biventricular pacing therapy. (Strength of Evidence = B)

9.10 Biventricular pacing therapy may be considered in patients with reduced LVEF and QRS ≥ 150 ms who have NYHA I or II HF symptoms. (Strength of Evidence = B)

9.11 In patients with reduced LVEF who require chronic pacing and in whom frequent ventricular pacing is expected, biventricular pacing may be considered. (Strength of Evidence = C)

Recommendations for Dual Chamber Pacemakers

9.12 The routine use of dual (atrioventricular [AV]) chamber pacemakers for HF in the absence of symptomatic bradycardia or high-grade AV block is not recommended. (Strength of Evidence = A)

Section 10: Surgical Approaches to the Treatment of Heart Failure

Despite advances in medical management of HF, there remain circumstances in which surgical procedures are the only or the best treatment option. These include heart transplantation and procedures that (1) repair the heart, (2) reshape it, or (3) replace all or part of heart function.

Recommendations for Surgical Approaches

10.1 It is recommended that the decision to undertake surgical intervention for severe HF be made in light of functional status and prognosis based on severity of underlying HF and comorbid conditions. Procedures

should be done at centers with demonstrable expertise and multidisciplinary medical and surgical teams experienced in the selection, care, and perioperative and long-term management of high risk patients with severe HF. (Strength of Evidence = C)

10.2 Evaluation for heart transplantation is recommended in selected patients with severe HF, debilitating refractory angina, or ventricular arrhythmia that cannot be controlled despite drug, device, or alternative surgical therapy. (Strength of Evidence = B)

10.3 Isolated mitral valve repair or replacement for severe mitral regurgitation secondary to ventricular dilatation in the presence of severe left ventricular (LV) systolic dysfunction is not generally recommended. (Strength of Evidence = C)

10.4 Partial LV resection ("Batista procedure") is not recommended in nonischemic cardiomyopathy. (Strength of Evidence = B)

10.5 Patients awaiting heart transplantation who have become refractory to all means of medical circulatory support should be considered for a mechanical support device as a bridge to transplant. (Strength of Evidence = B)

10.6 Permanent mechanical assistance using an implantable assist device may be considered in highly selected patients with severe HF refractory to conventional therapy who are not candidates for heart transplantation, particularly those who cannot be weaned from intravenous inotropic support at an experienced HF center. (Strength of Evidence = B)

10.7 Patients with refractory HF and hemodynamic instability, and/or compromised end-organ function, with relative contraindications to cardiac transplantation or permanent mechanical circulatory assistance expected to improve with time or restoration of an improved hemodynamic profile should be considered for urgent mechanical circulatory support as a ''bridge to decision.'' These patients should be referred to a center with expertise in the management of patients with advanced HF. (Strength of Evidence = C)

Section 11: Evaluation and Management of Patients With Heart Failure and Preserved Left Ventricular Ejection Fraction

A substantial number of patients with HF have preserved LVEF, variably defined as an LVEF >40%, >45%, or >50%.[138,139] When these patients have invasive or non-invasive evidence of abnormal diastolic function (either abnormal relaxation, filling or stiffness) they are said to have ''diastolic HF''.[140] Although the term ''HF with normal LVEF'' is often used to denote this group, because ''normal'' is variously defined, ''HF with preserved LVEF'' will be the active definition in this document. The left ventricle in HF with preserved LVEF may be characterized by LV hypertrophy,[141] concentric remodeling, increased extracellular matrix,[142] abnormal calcium handling, abnormal relaxation and filling and decreased diastolic distensibility.[143,144] Activation of the neurohormonal milieu, including the RAAS and the sympathetic nervous system, is common in HF with and without preserved LVEF.[144]

Recommendations for Patients With Heart Failure and Preserved LVEF

11.1 Careful attention to differential diagnosis is recommended in patients with HF and preserved LVEF to distinguish among a variety of cardiac disorders, because treatments may differ. These various entities may be distinguished based on echocardiography, electrocardiography, and stress imaging (via exercise or pharmacologic means, using myocardial perfusion or echocardiographic imaging) and cardiac catheterization. See complete guideline Section 11 for Figures 11.1, 11.2, and 11.3 for guidance to a differential diagnosis. (Strength of Evidence = C)

11.2 Evaluation for ischemic heart disease and inducible myocardial ischemia is recommended in patients with HF and preserved LVEF (see Section 13). (Strength of Evidence = C)

11.3 Blood pressure monitoring is recommended in patients with HF and preserved LVEF (Section 14, Recommendation 14.1). (Strength of Evidence = C)

11.4 Counseling on the use of a low-sodium diet (Section 6) is recommended for all patients with HF, including those with preserved LVEF. (Strength of Evidence = C)

11.5 Diuretic treatment is recommended in all patients with HF and clinical evidence of volume overload, including those with preserved LVEF. Treatment may begin with either a thiazide or loop diuretic. In more severe volume overload or if response to a thiazide is inadequate, treatment with a loop diuretic should be implemented. Excessive diuresis, which may lead to orthostatic changes in blood pressure and worsening renal function, should be avoided. (Strength of Evidence = C)

11.6 In the absence of other specific indications for these drugs, angiotensin receptor blockers (ARBs) or angiotensin converting enzyme (ACE) inhibitors may be considered in patients with HF and preserved LVEF.

- ARBs (Strength of Evidence = C)
- ACE inhibitors (Strength of Evidence = C)

11.7 ACE inhibitors should be considered in all patients with HF and preserved LVEF who have symptomatic atherosclerotic cardiovascular disease or diabetes

and one additional risk factor. (Strength of Evidence = C)

In patients who meet these criteria but are intolerant to ACE inhibitors, ARBs should be considered. (Strength of Evidence = C)

11.8 Beta blocker treatment is recommended in patients with HF and preserved LVEF who have:

- Prior myocardial infarction (Strength of Evidence = A)
- Hypertension (see Section 14) (Strength of Evidence = B)
- Atrial fibrillation requiring control of ventricular rate (Strength of Evidence = B)

11.9 Calcium channel blockers should be considered in patients with HF and preserved LVEF and:

- Atrial fibrillation requiring control of ventricular rate and intolerance to beta blockers. In these patients, diltiazem or verapamil should be considered. (Strength of Evidence = C)
- Symptom-limiting angina. (Strength of Evidence = A)
- Hypertension. (Strength of Evidence = C)

11.10 Measures to restore and maintain sinus rhythm may be considered in patients who have symptomatic atrial flutter-fibrillation and preserved LVEF, but this decision should be individualized. (Strength of Evidence = C)

Section 12: Evaluation and Management of Patients With Acute Decompensated Heart Failure

Data from several studies have refined our understanding of the clinical characteristics of patients hospitalized with worsening HF.[145-148] These studies demonstrate that the majority of patients hospitalized with HF have evidence of systemic hypertension on admission and commonly have preserved LVEF. Most hospitalized patients have significant volume overload, and congestive symptoms predominate. Patients with severely impaired systolic function, reduced blood pressure, and symptoms from poor end-organ perfusion are in the distinct minority. Natural history studies have shown that ADHF represents a period of high risk for patients, during which their likelihood of death and rehospitalization is significantly greater than for a comparable period of chronic, but stable HF.[146]

The clinical classification of patients with ADHF continues to evolve and reflects ongoing changes in our understanding of the pathophysiology of this syndrome.[149] Worsening renal function, persistent neurohormonal activation, and progressive deterioration in myocardial function all seem to play a role. Decompensation also commonly occurs without a fundamental worsening of underlying cardiac structure or function. Failure to adhere to prescribed medications related to inadequate financial resources, poor compliance, and lack of education or an inadequate medical regimen may lead to hospitalization without a worsening of underlying circulatory function.

There is a paucity of controlled clinical trial data to define optimal treatment for patients with ADHF. The few trials have focused primarily on symptom relief, not outcomes, and have mainly enrolled patients with reduced LVEF who were not hypertensive. Clinical studies to determine the best care processes to achieve the multiple goals for patients admitted with ADHF are lacking. The recommendations in this section address the common therapeutic dilemmas associated with the broad group of patients with ADHF using the best available evidence from clinical research and consensus expert opinion.

Recommendations for Acute Decompensated Heart Failure

12.1 The diagnosis of Acute Decompensated HF should be based primarily on signs and symptoms. (Strength of Evidence = C)

When the diagnosis is uncertain, determination of B-type natriuretic peptide (BNP) or N-terminal pro-B-type natriuretic peptide (NT-proBNP) concentration is recommended in patients being evaluated for dyspnea who have signs and symptoms compatible with HF. (Strength of Evidence = A)

The natriuretic peptide concentration should not be interpreted in isolation, but in the context of all available clinical data bearing on the diagnosis of HF, and with the knowledge of cardiac and non-cardiac factors that can raise or lower natriuretic peptide levels.

12.2 Hospital admission is recommended for patients presenting with ADHF when the clinical circumstances listed in Table 12.1(a) are present. Patients presenting with ADHF should be considered for hospital admission when the clinical circumstances listed in Table 12.1(b) are present. (Strength of Evidence = C)

12.3 It is recommended that patients admitted with ADHF be treated to achieve the goals listed in Table 12.3. (Strength of Evidence = C)

12.4 Patients admitted with ADHF should be carefully monitored. It is recommended that the items listed in Table 12.4 be assessed at the stated frequencies. (Strength of Evidence = C)

12.5 It is recommended that patients admitted with ADHF and evidence of fluid overload be treated initially with loop diuretics - usually given intravenously rather than orally. (Strength of Evidence = B)

Ultrafiltration may be considered in lieu of diuretics. (Strength of Evidence = B)

12.6 It is recommended that diuretics be administered at doses needed to produce a rate of diuresis sufficient

Table 12.1. Recommendations for Hospitalizing Patients Presenting With ADHF

Recommendation	Clinical Circumstances
(a) Hospitalization Recommended	Evidence of severe ADHF, including:
	Hypotension
	Worsening renal function
	Altered mentation
	Dyspnea at rest
	Typically reflected by resting tachypnea
	Less commonly reflected by oxygen saturation <90%
	Hemodynamically significant arrhythmia
	Including new onset of rapid atrial fibrillation
	Acute coronary syndromes
(b) Hospitalization Should Be Considered	Worsened congestion
	Even without dyspnea
	Signs and symptoms of pulmonary or systemic congestion
	Even in the absence of weight gain
	Major electrolyte disturbance
	Associated comorbid conditions
	Pneumonia
	Pulmonary embolus
	Diabetic ketoacidosis
	Symptoms suggestive of transient ischemic accident or stroke
	Repeated ICD firings
	Previously undiagnosed HF with signs and symptoms of systemic or pulmonary congestion

Table 12.4. Monitoring Recommendations for Patients Hospitalized With ADHF

Frequency	Value	Specifics
At least daily	Weight	Determine after voiding in the morning
		Account for possible increased food intake due to improved appetite
At least daily	Fluid intake and output	
More than daily	Vital signs	Orthostatic blood pressure if indicated
		Oxygen saturation daily until stable
At least daily	Signs	Edema
		Ascites
		Pulmonary rales
		Hepatomegaly
		Increased JVP
		Hepatojugular reflux
		Liver tenderness
At least daily	Symptoms	Orthopnea
		Paroxysmal nocturnal dyspnea (PND) or cough
		Nocturnal cough
		Dyspnea
		Fatigue, lightheadedness
At least daily	Electrolytes	Potassium
		Sodium
At least daily	Renal function	BUN
		Serum creatinine*

*See background section for additional recommendations on laboratory evaluations.

to achieve optimal volume status with relief of signs and symptoms of congestion (edema, elevated JVP, dyspnea), without inducing an excessively rapid reduction in 1) intravascular volume, which may result in symptomatic hypotension and/or worsening renal function, or 2) serum electrolytes, which may precipitate arrhythmias or muscle cramps. (Strength of Evidence = C)

12.7 Careful repeated assessment of signs and symptoms of congestion and changes in body weight is recommended, because clinical experience suggests it is difficult to determine that congestion has been adequately treated in many patients. (Strength of Evidence = C)

Table 12.3. Treatment Goals for Patients Admitted for ADHF

Improve symptoms, especially congestion and low-output symptoms
Restore normal oxygenation
Optimize volume status
Identify etiology (see Table 4.6)
Identify and address precipitating factors
Optimize chronic oral therapy
Minimize side effects
Identify patients who might benefit from revascularization
Identify patients who might benefit from device therapy
Identify risk of thromboembolism and need for anticoagulant therapy
Educate patients concerning medications and self management of HF
Consider and, where possible, initiate a disease management program

12.8 Monitoring of daily weights, intake, and output is recommended to assess clinical efficacy of diuretic therapy. Routine use of a Foley catheter is not recommended for monitoring volume status. However, placement of a catheter is recommended when close monitoring of urine output is needed or if a bladder outlet obstruction is suspected of contributing to worsening renal function. (Strength of Evidence = C)

12.9 Careful observation for development of a variety of side effects, including renal dysfunction, electrolyte abnormalities, symptomatic hypotension, and gout is recommended in patients treated with diuretics, especially when used at high doses and in combination. Patients should undergo routine laboratory studies and clinical examination as dictated by their clinical response. (Strength of Evidence = C)

It is recommended that serum potassium and magnesium levels be monitored at least daily and maintained in the normal range. More frequent monitoring may be necessary when diuresis is rapid. (Strength of Evidence = C)

Overly rapid diuresis may be associated with severe muscle cramps. If indicated, treatment with potassium replacement is recommended. (Strength of Evidence = C)

12.10 Careful observation for the development of renal dysfunction is recommended in patients treated with diuretics. Patients with moderate to severe renal dysfunction and evidence of fluid retention should continue to be treated with diuretics. In the presence of severe fluid overload, renal dysfunction may improve with diuresis. (Strength of Evidence = C)

12.11 When congestion fails to improve in response to diuretic therapy, the following options should be considered:

- Re-evaluating presence/absence of congestion
- Sodium and fluid restriction,
- Increasing doses of loop diuretic,
- Continuous infusion of a loop diuretic, or
- Addition of a second type of diuretic orally (metolazone or spironolactone) or intravenously (chlorothiazide).

Another option, ultrafiltration, may be considered. (Strength of Evidence = C)

12.12 A low sodium diet (2 g daily) is recommended for most hospitalized patients. (Strength of Evidence = C)

In patients with recurrent or refractory volume overload, stricter sodium restriction may be considered. (Strength of Evidence = C)

12.13 Fluid restriction (<2 L/day) is recommended in patients with moderate hyponatremia (serum sodium <130 mEq/L) and should be considered to assist in treatment of fluid overload in other patients. (Strength of Evidence = C)

In patients with severe (serum sodium <125 mEq/L) or worsening hyponatremia, stricter fluid restriction may be considered. (Strength of Evidence = C)

12.14 Routine administration of supplemental oxygen in the presence of hypoxia is recommended. (Strength of Evidence = C)

Routine administration of supplemental oxygen in the absence of hypoxia is not recommended. (Strength of Evidence = C)

12.15 Use of non-invasive positive pressure ventilation may be considered for severely dyspneic patients with clinical evidence of pulmonary edema. (Strength of Evidence = A)

12.16 Venous thromboembolism prophylaxis with low dose unfractionated heparin (UFH), low molecular weight heparin (LMWH), or fondaparinux to prevent proximal deep venous thrombosis (DVT) and pulmonary embolism (PE) is recommended for patients who are admitted to the hospital with ADHF and who are not already anticoagulated and have no contraindication to anticoagulation. (Strength of Evidence = B)

Venous thromboembolism prophylaxis with a mechanical device (intermittent pneumatic compression devices or graded compression stockings) to prevent proximal DVT and PE should be considered for patients who are admitted to the hospital with ADHF and who are not already anticoagulated and who have a contraindication to anticoagulation. (Strength of Evidence = C)

12.17 In the absence of symptomatic hypotension, intravenous nitroglycerin, nitroprusside or nesiritide may be considered as an addition to diuretic therapy for rapid improvement of congestive symptoms in patients admitted with ADHF. (Strength of Evidence = B)

Frequent blood pressure monitoring is recommended with these agents. (Strength of Evidence = B)

These agents should be decreased in dosage or discontinued if symptomatic hypotension or worsening renal function develops. (Strength of Evidence = B)

Reintroduction in increasing doses may be considered once symptomatic hypotension is resolved. (Strength of Evidence = C)

12.18 Intravenous vasodilators (nitroglycerin or nitroprusside) and diuretics are recommended for rapid symptom relief in patients with acute pulmonary edema or severe hypertension. (Strength of Evidence = C)

12.19 Intravenous vasodilators (nitroprusside, nitroglycerin, or nesiritide) may be considered in patients with ADHF who have persistent severe HF despite aggressive treatment with diuretics and standard oral therapies.

- Nitroprusside (Strength of Evidence = B)
- Nitroglycerine, Nesiritide (Strength of Evidence = C)

12.20 Intravenous inotropes (milrinone or dobutamine) may be considered to relieve symptoms and improve end-organ function in patients with advanced HF characterized by LV dilation, reduced LVEF, and diminished peripheral perfusion or end-organ dysfunction (low output syndrome), particularly if these patients have marginal systolic blood pressure (<90 mm Hg), have symptomatic hypotension despite adequate filling pressure, or are unresponsive to, or intolerant of, intravenous vasodilators. (Strength of Evidence = C)

These agents may be considered in similar patients with evidence of fluid overload if they respond poorly to intravenous diuretics or manifest diminished or worsening renal function. (Strength of Evidence = C)

When adjunctive therapy is needed in other patients with ADHF, administration of vasodilators

should be considered instead of intravenous inotropes (milrinone or dobutamine). (Strength of Evidence = C)

Intravenous inotropes (milrinone or dobutamine) are not recommended unless left heart filling pressures are known to be elevated or cardiac index is severely impaired based on direct measurement or clear clinical signs. (Strength of Evidence = C)

It is recommended that administration of intravenous inotropes (milrinone or dobutamine) in the setting of ADHF be accompanied by continuous or frequent blood pressure monitoring and continuous monitoring of cardiac rhythm. (Strength of Evidence = C)

If symptomatic hypotension or worsening tachyarrhythmias develop during administration of these agents, discontinuation or dose reduction should be considered. (Strength of Evidence = C)

12.21 The routine use of invasive hemodynamic monitoring in patients with ADHF is not recommended. (Strength of Evidence = A)

12.22 Invasive hemodynamic monitoring should be considered in a patient:

- who is refractory to initial therapy,
- whose volume status and cardiac filling pressures are unclear,
- who has clinically significant hypotension (typically SBP <80 mm Hg) or worsening renal function during therapy, or
- who is being considered for cardiac transplant and needs assessment of degree and reversibility of pulmonary hypertension, or
- in whom documentation of an adequate hemodynamic response to the inotropic agent is necessary when chronic outpatient infusion is being considered. (Strength of Evidence = C)

12.23 It is recommended that patients admitted with ADHF undergo evaluation for the following precipitating factors: atrial fibrillation or other arrhythmias (eg, atrial flutter, other supraventricular VT or VT), exacerbation of hypertension, myocardial ischemia/infarction, exacerbation of pulmonary congestion, anemia, thyroid disease, significant drug interactions, and other less common factors. (Strength of Evidence = C)

12.24 It is recommended that every effort be made to use the hospital stay for assessment and improvement of patient adherence via patient and family education and social support services (see Section 8). (Strength of Evidence = B)

Table 12.7. Discharge Criteria for Patients With HF

Recommended for all HF patients	• Exacerbating factors addressed. • Near optimal volume status observed. • Transition from intravenous to oral diuretic successfully completed. • Patient and family education completed, including clear discharge instructions • LVEF documented • Smoking cessation counseling initiated • Near optimal pharmacologic therapy achieved, including ACE inhibitor and beta blocker (for patients with reduced LVEF), or intolerance documented (Sections 7 and 11) • Follow-up clinic visit scheduled, usually for 7-10 days
Should be considered for patients with advanced HF or recurrent admissions for HF	• Oral medication regimen stable for 24 hours • No intravenous vasodilator or inotropic agent for 24 hours • Ambulation before discharge to assess functional capacity after therapy • Plans for postdischarge management (scale present in home, visiting nurse or telephone follow up generally no longer than 3 days after discharge) • Referral for disease management, if available

12.25 It is recommended that criteria in Table 12.7 be met before a patient with HF is discharged from the hospital. (Strength of Evidence = C)

In patients with advanced HF or recurrent admissions for HF, additional criteria listed in Table 12.7 should be considered. (Strength of Evidence = C)

12.26 Discharge planning is recommended as part of the management of patients with ADHF. Discharge planning should address the following issues:

- Details regarding medication, dietary sodium restriction, and recommended activity level
- Follow-up by phone or clinic visit early after discharge to reassess volume status
- Medication and dietary compliance
- Alcohol moderation and smoking cessation
- Monitoring of body weight, electrolytes and renal function
- Consideration of referral for formal disease management. (Strength of Evidence = C)

Section 13: Evaluation and Therapy for Heart Failure in the Setting of Ischemic Heart Disease

The most common cause of chronic HF is no longer hypertension or valvular heart disease; it is CAD.[2] The changing pattern in the risk factors for HF is evidenced in the

Framingham Heart Study, which documents a decrease in valvular disease and LV hypertrophy and an increase in MI from 1950 to 1998.[3] As survival from MI continues to improve, it is expected that the number of patients with CAD and HF will also increase.

HF in the setting of CAD is a heterogeneous condition with several factors contributing to LV systolic dysfunction and HF symptoms. After an MI, there is loss of functioning myocytes, development of myocardial fibrosis, and subsequent LV remodeling, resulting in chamber dilatation and neurohormonal activation - all leading to progressive dysfunction of the remaining viable myocardium.[49]

Several studies have shown that CAD is associated with an increase in mortality rates in patients with HF.[30-36] Data also suggest that the mechanism of sudden death may differ between ischemic and nonischemic HF patients, with acute coronary events representing the major cause of sudden death in HF patients with CAD.[38] These findings further emphasize the importance of accurate differentiation between ischemic and nonischemic causes of HF.

Managing HF in patients with CAD or a history of CAD may be significantly different than managing HF due to primary cardiomyopathy. Antiplatelet agents, smoking cessation, and lipid-lowering therapy are particularly important interventions in patients with HF due to CAD.[40] Trials of milrinone,[41] amiodarone,[18] amlodipine,[15] and digoxin suggest that patients with HF in the setting of CAD may have a less favorable outcome than patients with HF from primary cardiomyopathy. Revascularization in highly selected patients with reduced LVEF and significant CAD, particularly those with anginal symptoms, may be associated with improved survival and may be considered in addition to risk modification.[33,42-49]

Recommendations for Heart Failure in the Setting of Ischemic Heart Disease

13.1 Ongoing assessment for risk factors for CAD is recommended in all patients with chronic HF regardless of LVEF. (Strength of Evidence = A)

13.2 It is recommended that the diagnostic approach for CAD be individualized based on patient preference and comorbidities, eligibility, symptoms suggestive of angina and willingness to undergo revascularization. (Strength of Evidence = C)

13.3 It is recommended that patients with HF and symptoms suggestive of angina undergo cardiac catheterization with coronary angiography to assess for potential revascularization. (Strength of Evidence = B)

13.4 It is recommended that, at the initial diagnosis of HF and any time symptoms worsen without obvious cause, patients with HF, no angina, and known CAD should undergo risk assessment that may include noninvasive stress imaging and/or coronary angiography to assess severity of coronary disease and the presence of ischemia. (Strength of Evidence = C)

13.5 It is recommended that patients with HF, no angina, and unknown CAD status who are at high risk for CAD should undergo noninvasive stress imaging and/or coronary angiography to assess severity of coronary disease and the presence of ischemia. (Strength of Evidence = C)

13.6 In patients with HF, no angina, and unknown CAD status who are at low risk for CAD noninvasive evaluation should be considered and coronary angiography may be considered. (Strength of Evidence = C)

13.7 Any of the following imaging tests should be considered to identify inducible ischemia or viable myocardium:

- Exercise or pharmacologic stress myocardial perfusion imaging
- Exercise or pharmacologic stress echocardiography
- Cardiac magnetic resonance imaging (MRI)
- Positron emission tomography scanning (PET).

(Strength of Evidence = B)

13.8 It is recommended that the following risk factors be managed according to the indicated guidelines:

- Lipids (see National Cholesterol Education Program Adult Treatment Panel III) (http://www.nhlbi.nih.gov/guidelines/cholesterol) [92,93]
- Smoking (see Section 3)
- Physical activity (see Section 6)
- Weight (see Section 3)
- Blood pressure (see Section 14 and JNC VII Guidelines) (http://www.nhlbi.nih.gov/guidelines/hypertension) [94]

(See individual guidelines for Strength of Evidence).

13.9 Antiplatelet therapy is recommended to reduce vascular events in patients with HF and CAD unless contraindicated. (aspirin, Strength of Evidence = A; clopidogrel, Strength of Evidence = B)

13.10 ACE inhibitors are recommended in all patients with either reduced or preserved LVEF after an MI. (Strength of Evidence = A)

13.11 Beta blockers are recommended for the management of all patients with reduced LVEF or post-MI. (Strength of Evidence = B)

13.12 It is recommended that ACE-inhibitor and beta blocker therapy be initiated early (<48 hours) during hospitalization in hemodynamically stable post-MI patients with reduced LVEF or HF. (Strength of Evidence = A)

13.13 Nitrate preparations should be considered in patients with HF when additional medication is needed for relief of anginal symptoms. (Strength of Evidence = B)

13.14 Calcium channel blockers may be considered in patients with HF who have angina despite the optimal use of beta blockers and nitrates. Amlodipine and felodipine are the preferred calcium channel blockers in patients with angina and decreased systolic function. Based on available data, first generation calcium channel blockers (i.e. diltiazem, verapamil) should be avoided in patients with CAD, HF, and LVEF <40, unless necessary for heart rate control or other indications. (Strength of Evidence = C)

13.15 It is recommended that coronary revascularization be performed in patients with HF and suitable coronary anatomy for relief of refractory angina or acute coronary syndrome. (Strength of Evidence = B)

13.16 Coronary revascularization with coronary artery bypass surgery or percutaneous coronary intervention (PCI) as appropriate should be considered in patients with HF and suitable coronary anatomy who have demonstrable evidence of myocardial viability in areas of significant obstructive coronary disease or the presence of inducible ischemia. (Strength of Evidence = C)

Section 14: Managing Patients With Hypertension and Heart Failure

Blood pressure is a simple measurement that assesses the interaction of heart function with vascular impedance. When heart function is normal, the impedance is the main determinant of blood pressure. Therefore, pressure (systolic and mean) becomes a powerful risk factor for development of LV hypertrophy, increased myocardial oxygen consumption, coronary atherosclerosis, and subsequent HF.[150,151] Control of blood pressure in this setting is critical to prevent the development and progression of LV dysfunction.[152]

When LV function is impaired, however, the relationship between impedance and cardiac function becomes more complex. Increases of impedance may impair LV emptying and thus not be reflected in a higher pressure. Under those circumstances therapy is aimed at the impedance, not at the blood pressure. Indeed, blood pressure may rise in response to effective therapy that improves LV emptying or reverses remodeling even if the impedance is reduced.

Recommendation for Patients With Hypertension and Preserved LVEF and Asymptomatic LVH, or for Patients With Hypertension and HF With Preserved LVEF (Stage B)

14.1 It is recommended that blood pressure be optimally treated to lower systolic and usually diastolic levels. More than 1 drug may be required. Target resting levels should be $<130/<80$ mm Hg, if tolerated. (Strength of Evidence = A)

Recommendations for Patients With Hypertension and Asymptomatic LV Dysfunction With LV Dilation and a Low LVEF

14.2 Prescription of an angiotensin converting enzyme (ACE) inhibitor (dose equivalent to 20 mg daily enalapril) is recommended (Strength of Evidence = A)

14.3 Addition of a beta blocker (dose equivalent to HF trials) is recommended even if blood pressure is controlled. (Strength of Evidence = C)

14.4 If blood pressure remains $>130/80$ mm Hg then the addition of a thiazide diuretic is recommended, followed by a dihydropyridine calcium antagonist (eg, amlodipine or felodipine) or other antihypertensive drugs. (Strength of Evidence = C)

Recommendations for Patients With Hypertension and Symptomatic LV Dysfunction With LV Dilation and Low LVEF

14.5 Prescription of target doses of ACE inhibitors, angiotensin receptor blockers (ARBs), beta blockers, aldosterone inhibitors, and isosorbide dinitrate/hydralazine in various combinations (with a loop diuretic if needed) is recommended, based on doses used in large-scale outcome trials (see Table 7.1). (Strength of Evidence = A)

14.6 If blood pressure remains $>130/80$ mm Hg, a dihydropyridine calcium antagonist (eg, amlodipine or felodipine) may be considered or other antihypertensive medication doses increased. (Strength of Evidence = C)

Section 15: Management of Heart Failure in Special Populations

HF is a prevalent condition in women, African Americans, and the elderly of both sexes and any race. In the absence of contradictory data, the clinical recommendations based on trial data derived from predominately younger white male study populations have generally been applied equally to these groups. However, there are etiologic and pathophysiologic considerations specific to these groups that warrant attention if care and outcomes are to be optimized. Although a significant number of women and elderly patients with HF have preserved LV systolic function there is little evidence-based data to guide therapy in this group. Other special populations - ethnic groups such as Hispanics, Asians, American Indians, or Pacific Islanders - are important special populations but there are

inadequate data currently available about HF management to discuss these groups individually. Discussion in this section is based primarily on available data from subgroup analyses of randomized HF trials and the results of cohort studies. A substantial amount of the data on drug efficacy comes from studies of patients treated after a recent acute MI.

Recommendations

15.1 As with younger patients, it is recommended that elderly patients, particularly those age >80 years, be evaluated for HF when presenting with symptoms of dyspnea and fatigue. (Strength of Evidence = C)

15.2 Beta blocker and ACE inhibitor therapy is recommended as standard therapy in all elderly patients with HF due to LV systolic dysfunction. (Strength of Evidence = B)

In the absence of contraindications, these agents are also recommended in the very elderly (age >80 years). (Strength of Evidence = C)

15.3 As in all patients, but especially in the elderly, careful attention to volume status, the possibility of symptomatic cerebrovascular disease, and the presence of postural hypotension is recommended during therapy with ACE inhibitors, beta blockers and diuretics. (Strength of Evidence = C)

15.4 Beta blocker therapy is recommended for women with HF from:
- symptomatic LV systolic dysfunction (Strength of Evidence = B)
- asymptomatic LV systolic dysfunction (Strength of Evidence = C)

15.5 ACE inhibitor therapy is recommended as standard therapy in all women with symptomatic or asymptomatic LV systolic dysfunction. (Strength of Evidence = B)

15.6 ARBs are recommended for administration to symptomatic and asymptomatic women with an LVEF ≤ 40% who are intolerant to ACE inhibitors for reasons other than hyperkalemia or renal insufficiency. (Strength of Evidence = A)

15.7 The combination of hydralazine/isosorbide dinitrate is recommended as standard therapy for African American women with moderate to severe HF symptoms who are on background neurohormonal inhibition. (Strength of Evidence = B)

15.8 Beta blockers are recommended as part of standard therapy for African Americans with HF due to:
- symptomatic LV systolic dysfunction (Strength of Evidence = B)
- asymptomatic LV systolic dysfunction (Strength of Evidence = C)

15.9 ACE inhibitors are recommended as part of standard therapy for African-American patients with HF from symptomatic or asymptomatic LV systolic dysfunction. (Strength of Evidence = C)

15.10 ARBs are recommended as substitute therapy for HF in African Americans intolerant of ACE inhibitors. (Strength of Evidence = B)

15.11 A combination of hydralazine and isosorbide dinitrate is recommended as part of standard therapy in addition to beta blockers and ACE-inhibitors for African Americans with LV systolic dysfunction and:
- NYHA class III or IV HF (Strength of Evidence = A)
- NYHA class II HF (Strength of Evidence = B)

Section 16: Myocarditis: Current Treatment

Myocarditis is a distinct clinical entity with a wide variety of cardiac manifestations including HF. Potential etiologies may include toxins, medications, physical agents and, most importantly, infections. The most common forms appear to be postviral in origin. The pathophysiology of myocarditis has been well established in animal models with myocardial damage due not only to direct infection, but also consequent to postinfectious, autoimmune-mediated myocardial inflammatory damage. In humans, ongoing myocardial inflammation may result in dilated cardiomyopathy, restrictive cardiomyopathy, or acute LV failure without dilatation (fulminant myocarditis). Controversy continues to surround the best approach to the management of patients considered to have myocarditis. The following recommendation is based on a review of available data from uncontrolled and controlled evaluations of immunomodulatory therapy for the treatment of myocarditis.

Recommendations

16.1 Routine use of immunosuppressive therapies is not recommended for patients with myocarditis. (Strength of Evidence = A)

16.2 Endomyocardial biopsy should be considered in patients with an acute deterioration of cardiac function of unknown etiology who are unresponsive to medical therapy. (Strength of Evidence = B)

Section 17: Genetic Evaluation of Cardiomyopathy*

The evidence indicating that hypertrophic cardiomyopathy (HCM) has a genetic basis is extensive: HCM is now understood largely to be a genetic disease of contractile proteins, although less commonly, infiltrative etiologies

may also be causative. The evidence supporting a genetic basis for dilated cardiomyopathy (DCM), after other more common causes have been excluded (eg, ischemic disease, hypothyroidism, cardiotoxic agents such as Adriamycin), is now substantial for familial dilated cardiomyopathy (FDC), where FDC is defined as DCM of unknown cause in 2 or more closely related family members. However, whether sporadic DCM has a genetic basis remains an open question, especially when detectable familial disease has been clinically excluded by testing closely related family members. Thus, although some recommendations formulated for the genetic evaluation of cardiomyopathy, such as the need for family history, apply to all entities, other recommendations must be tailored to account for these differences. This is particularly relevant as these guidelines use the generic term ''cardiomyopathy'' to imply possible familial or genetic cause, assuming that all other detectable causes of cardiomyopathy have been ruled out. This is particularly relevant for DCM where multiple nongenetic causes are possible as noted previously. Recent discoveries indicate that arrhythmogenic right ventricular dysplasia/cardiomyopathy (ARVD/C) is largely caused by mutations in genes encoding proteins of the desmosome. Although initially recognized predominantly in the right ventricle, LV involvement in 20% to 40% of patients has prompted the change in nomenclature from ARVD to ARVD/C.[153] Discovering the genetic basis of restrictive cardiomyopathy (RCM) has been more challenging, because RCM is much less common than DCM or HCM, and less commonly presents with familial disease. Left ventricular noncompaction (LVNC) is an anatomic abnormality of LV myocardial development: LV compaction is incomplete, leaving deep trabeculations in the LV myocardium. LVNC was categorized as a specific type of cardiomyopathy by an expert panel in 2006,[154] and some genetic association has been observed. Although initially reported to be a rare condition associated with adverse outcome,[155] more recent reports[156-158] have called into question those preliminary conclusions.[159] Three different echocardiographic criteria have been used for diagnosis.[156] These authors suggested that the diagnostic criteria for LVNC might be too sensitive. Because of the uncertainty of diagnostic standards leading to difficulty clarifying its phenotype, we suggest that the LVNC recommendations in this document be limited to those individuals with only the most prominent disease.

Recommendations for the Genetic Evaluation of Cardiomyopathy

17.1 A careful family history for ≥3 generations is recommended for all patients with cardiomyopathy.

- Hypertrophic cardiomyopathy (Strength of Evidence = A)
- Dilated cardiomyopathy (Strength of Evidence = A)
- Arrhythmogenic right ventricular dysplasia (Strength of Evidence = A)
- Left ventricular noncompaction (Strength of Evidence = A)
- Restrictive cardiomyopathy (Strength of Evidence = B)
- Cardiomyopathies associated with extracardiac manifestations (Strength of Evidence = A)

17.2 Clinical screening for cardiomyopathy in asymptomatic first-degree relatives is recommended.

a. Cardiomyopathy Phenotype

- Hypertrophic cardiomyopathy (Strength of Evidence = A)
- Dilated cardiomyopathy (Strength of Evidence = A)
- Arrhythmogenic right ventricular dysplasia (Strength of Evidence = A)
- Left ventricular noncompaction (Strength of Evidence = B)
- Restrictive cardiomyopathy (Strength of Evidence = B)
- Cardiomyopathies associated with extracardiac manifestations (Strength of Evidence = A)

b. Clinical screening for cardiomyopathy is recommended at intervals (see below) in asymptomatic

Cardiomyopathy Phenotype	Interval if genetic testing is negative and/or if clinical family screening is negative	Screening interval if a mutation is present	Strength of Evidence
Hypertrophic	Every 3 years until 30 years of age, except yearly during puberty; after 30 years, if symptoms develop	Every 3 years until 30 years of age, except yearly during puberty; every 5 years thereafter	B
Dilated	Every 3-5 years beginning in childhood	Yearly in childhood; every 1-3 years in adults	B
ARVD/C	Every 3-5 years after age 10	Yearly after age 10 to 50 years of age	C
LVNC	Every 3 years beginning in childhood	Yearly in childhood; every 1-3 years in adults	C
Restrictive	Every 3-5 years beginning in adulthood	Yearly in childhood; every 1-3 years in adults	C

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at-risk relatives who are known to carry the disease-causing mutation(s). (Strength of Evidence = A)

c. Clinical screening for cardiomyopathy is recommended for asymptomatic at-risk first-degree relatives when genetic testing has not been performed or has not identified a disease-causing mutation. (Strength of Evidence = A)

d. It is recommended that clinical screening consist of:
- History (with special attention to HF symptoms, arrhythmias, presyncope, and syncope)
- Physical examination (with special attention to the cardiac and skeletal muscle systems)
- Electrocardiogram
- Echocardiogram
- CK-MM (at initial evaluation only)
- Signal-averaged electrocardiogram (SAECG) in ARVD only
- Holter monitoring in HCM, ARVD
- Exercise treadmill testing in HCM
- Magnetic resonance imaging in ARVD (Strength of Evidence = B)

e. Clinical screening for cardiomyopathy should be considered at the following times and intervals or at any time that signs or symptoms appear.

f. At-risk first-degree relatives with any abnormal clinical screening tests (regardless of genotype) should be considered for repeat clinical screening at 1 year. (Strength of Evidence = C)

17.3 Evaluation, genetic counseling, and genetic testing of cardiomyopathy patients are complex processes. Referral to centers expert in genetic evaluation and family-based management should be considered. (Strength of Evidence = B)

17.4 Genetic testing should be considered for the one most clearly affected person in a family to facilitate family screening and management.

a. Cardiomyopathy Phenotype
- Hypertrophic cardiomyopathy (Strength of Evidence = A)
- Dilated cardiomyopathy (Strength of Evidence = B)
- Arrhythmogenic right ventricular dysplasia (Strength of Evidence = A)
- Left ventricular noncompaction (Strength of Evidence = C)
- Restrictive cardiomyopathy (Strength of Evidence = C)
- Cardiomyopathies associated with extracardiac manifestations (Strength of Evidence = A)

Cardiomyopathy Phenotype	Gene Tests Available*	Yield of Positive Results
HCM	MYH7, MYBPC3, TNNT2 TNNI3, TPMI, ACTC, MYL2, MYL3	MYH7, MYBPC3 each account for 30%-40% of mutations, TNNT2 for 10%-20%. Genetic cause can be identified in 35%-45% overall; up to 60%-65% when the family history is positive.
DCM	LMNA, MYH7, TNNT2, SCN5A, DES, MYBPC3, TNNI3, TPMI, ACTC, PLN, LDB3 and TAZ	5.5%, 4.2%, 2.9%, for LMNA, MYH7, and TNNT2, respectively. All data are from research cohorts
ARVD	DSP, PKP2, DSG2, DSC2	6%-16%, 11%-43%, 12%-40%, for DSP, PKP2, and DSG2, respectively
LVNC	Uncertain – see discussion	Uncertain – see discussion
RCM	Uncertain – see discussion	Uncertain – see discussion

*GeneTests (www.genetests.org) is a National Institutes of Health-funded resource that lists clinical (and research) molecular genetic testing laboratories for the cardiomyopathies.

b. Specific genes available for screening based on cardiac phenotype

c. Screening for Fabry disease is recommended in all men with sporadic or non-autosomal dominant (no male-to-male) transmission of unexplained cardiac hypertrophy. (Strength of Evidence = B)

17.5 Genetic and family counseling is recommended for all patients and families with cardiomyopathy. (Strength of Evidence = A)

17.6 Medical therapy based on cardiac phenotype is recommended (see section 7). (Strength of Evidence = A)

17.7 Device therapies for arrhythmia and conduction system disease based on cardiac phenotype are recommended (see section 9). (Strength of Evidence = B)

17.8 In patients with cardiomyopathy and significant arrhythmia or known risk of arrhythmia an ICD may be considered before the LVEF falls below 35%. (Strength of Evidence = C)

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Disclosures

See Appendix C.

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Appendix A. Comparison of the 2006 and 2010 HFSA Guideline

	2006 Guideline Recommendation	2010 Guideline Recommendation	Comments
	Section 3: Prevention of Ventricular Remodeling, Cardiac Dysfunction, and Heart Failure		
3.1	A careful and thorough clinical assessment, with appropriate investigation for known or potential risk factors, is recommended in an effort to prevent development of LV remodeling, cardiac dysfunction, and HF. These risk factors include, but are not limited to, hypertension, hyperlipidemia, atherosclerosis, diabetes mellitus, valvular disease, obesity, physical inactivity, excessive alcohol intake, and smoking. (Strength of Evidence = A)	A careful and thorough clinical assessment, with appropriate investigation for known or potential risk factors, is recommended in an effort to prevent development of LV remodeling, cardiac dysfunction, and HF. These risk factors include, but are not limited to, hypertension, hyperlipidemia, atherosclerosis, diabetes mellitus, valvular disease, obesity, physical inactivity, excessive alcohol intake, dietary choices, and smoking. (Strength of Evidence = A)	Addition of dietary choices to list of risk factors
3.2	No changes		
3.3	No changes		
3.4	No changes		
	Section 4: Evaluation of Patients for Ventricular Dysfunction and Heart Failure		
4.1	Evaluation with a routine history, physical examination, chest x-ray, and electrocardiogram (ECG) is recommended in patients with the medical conditions or test findings listed in Table 4.1. (Strength of Evidence = B)	Evaluation for clinical manifestations of HF with a routine history and physical examination is recommended in patients with the medical conditions or test findings listed in Table 4.1. (Strength of Evidence = B)	Modification of wording and deletion of chest x-ray and ECG (retained in Table 4.1)
4.2	Assessment of Cardiac Structure and Function. Echocardiography with Doppler is recommended to determine LV size and function in patients without signs or symptoms suggestive of HF who have the risk factors listed in Table 4.2. (Strength of Evidence = B)	Assessment of Cardiac Structure and Function. Echocardiography with Doppler is recommended to determine cardiac structure and function in asymptomatic patients with the disorders or findings listed in Table 4.2. (Strength of Evidence = B)	Modification of wording and terminology
4.3	Determination of plasma B-type natriuretic peptide (BNP) or N-terminal pro-BNP concentration is not recommended as a routine part of the evaluation for structural heart disease in patients at risk but without signs or symptoms of HF. (Strength of Evidence = B)	Routine determination of plasma BNP or NT-proBNP concentration as part of a screening evaluation for structural heart disease in asymptomatic patients is not recommended. (Strength of Evidence = B)	Modification of wording and terminology
4.4	Symptoms Consistent with HF. The symptoms listed in Table 4.3 suggest the diagnosis of HF. It is recommended that each of these symptoms be solicited and graded in all patients in whom the diagnosis of HF is being considered. (Strength of Evidence = B)	Symptoms Consistent with HF. The symptoms listed in Table 4.3 suggest the diagnosis of HF. It is recommended that each of these symptoms be elicited in all patients in whom the diagnosis of HF is being considered. (Strength of Evidence = B)	Modification of wording and addition of depression to Table 4.3
4.5	Physical Examination. It is recommended that patients suspected of having HF undergo careful physical examination with determination of vital signs and be carefully evaluated for signs and symptoms shown in Table 4.4. (Strength of Evidence = C)	Physical Examination. It is recommended that patients suspected of having HF undergo careful physical examination with determination of vital signs and careful evaluation for signs shown in Table 4.4. (Strength of Evidence = B)	Modification of wording and change in Strength of Evidence from C to B and addition of reduced cardiac output and arrhythmia to cardiac abnormalities in Table 4.4
4.6	It is recommended that BNP or NT-proBNP levels be assessed in all patients suspected of having HF when the diagnosis is not certain. (Strength of Evidence = B)	It is recommended that BNP or NT-proBNP levels be assessed in all patients suspected of having HF, especially when the diagnosis is not certain. (Strength of Evidence = A)	Modification of wording and change in Strength of Evidence from B to A

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Appendix A. (*continued*)

	2006 Guideline Recommendation	2010 Guideline Recommendation	Comments
4.7	The differential diagnoses in Table 4.5 should be considered as alternative explanations for signs and symptoms consistent with HF. (Strength of Evidence = C)	Differential Diagnosis. The differential diagnoses in Table 4.5 should be considered as alternative explanations for signs and symptoms consistent with HF. (Strength of Evidence = B)	Modification of wording and change in Strength of Evidence from C to B and addition of chronic kidney disease and thyroid abnormalities to Table 4.5
4.8	No changes		
4.9	Symptoms. In addition to symptoms characteristic of HF, the following symptoms should be considered in the diagnosis of HF: • Angina • Symptoms of possible cerebral hypoperfusion, including syncope, pre-syncope, or lightheadedness • Symptoms suggestive of embolic events • Symptoms suggestive of sleep-disordered breathing (Strength of Evidence = C)	Symptoms. In addition to symptoms characteristic of HF (dyspnea, fatigue, decreased exercise tolerance, fluid retention), evaluation of the following symptoms should be considered in the diagnosis of HF: • Angina • Symptoms suggestive of embolic events • Symptoms suggestive of sleep-disordered breathing • Symptoms suggestive of arrhythmias, including palpitations • Symptoms of possible cerebral hypoperfusion, including syncope, pre-syncope, or lightheadedness (Strength of Evidence = B)	Clarification of HF symptoms and addition of arrhythmia to list of symptoms and change in Strength of Evidence from C to B
4.10	No changes		
4.11	The degree of volume excess is a key consideration during treatment. It is recommended that it be routinely assessed by determining: • Presence of paroxysmal nocturnal dyspnea or orthopnea • Daily weights and vital signs with assessment for orthostatic changes • Presence and degree of rales, S3 gallop, jugular venous pressure elevation, positive hepatojugular reflux, edema, and ascites (Strength of Evidence = B)	Volume Status. The degree of volume excess is a key consideration during treatment. It is recommended that it be routinely assessed by determining: • Presence of paroxysmal nocturnal dyspnea or orthopnea • Presence of dyspnea on exertion • Daily weights and vital signs with assessment for orthostatic changes • Presence and degree of rales, S3 gallop, jugular venous pressure elevation, hepatic enlargement and tenderness, positive hepatojugular reflux, edema, and ascites (Strength of Evidence = B)	Addition of presence of dyspnea on exertion and hepatic enlargement/tenderness to list of assessments
4.12	It is recommended that the following laboratory tests be obtained routinely in patients being evaluated for HF: serum electrolytes, blood urea nitrogen, creatinine, glucose, calcium, magnesium, lipid profile (low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, triglycerides), complete blood count, serum albumin, liver function tests, urinalysis, and thyroid function. (Strength of Evidence = B)	Standard Laboratory Tests. It is recommended that the following laboratory tests be obtained routinely in patients being evaluated for HF: serum electrolytes, blood urea nitrogen, creatinine, glucose, calcium, magnesium, fasting lipid profile (low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, triglycerides), complete blood count, serum albumin, uric acid, liver function tests, urinalysis, and thyroid function. (Strength of Evidence = B)	Addition of uric acid to list of standard laboratory tests
4.13	It is recommended that all patients with HF have an ECG performed to: • Assess cardiac rhythm and conduction • Detect LV hypertrophy • Evaluate QRS duration, especially when ejection fraction (EF) $<35\%$ • Detect evidence of myocardial infarction or ischemia (Strength of Evidence = B)	Electrocardiogram (ECG). It is recommended that all patients with HF have an ECG performed to: • Assess cardiac rhythm and conduction (in some cases, using Holter monitoring or event monitors) • Assess electrical dyssynchrony (wide QRS or bundle branch block), especially when left ventricular ejection fraction (LVEF) $<35\%$ • Detect LV hypertrophy or other chamber enlargement • Detect evidence of MI or ischemia • Assess QTc interval, especially with drugs that prolong QT intervals (Strength of Evidence = B)	Addition of electrical dyssynchrony and QTc interval to list of ECG assessments

4.14	It is recommended that all patients with HF have a posteroanterior and lateral chest X-ray examination for determination of heart size, evidence of fluid overload, and detection of pulmonary and other diseases. (Strength of Evidence = B)	Chest X-Ray. It is recommended that all patients with HF have a posteroanterior and lateral chest X-ray examination for determination of heart size, evidence of fluid overload, detection of pulmonary and other diseases, and appropriate placement of implanted cardiac devices. (Strength of Evidence = B)	Addition of placement of implanted cardiac devices to list of chest x-rays assessments
4.15	Additional Laboratory Tests. It is recommended that patients with no apparent etiology of HF or no specific clinical features suggesting unusual etiologies undergo additional directed blood and laboratory studies to determine the cause of HF. (Strength of Evidence = C)	Additional Laboratory Tests. It is recommended that patients with no apparent etiology of HF or no specific clinical features suggesting unusual etiologies undergo additional directed blood and laboratory studies to determine the cause of HF. (Strength of Evidence = B)	Change in Strength of Evidence from C to B
4.16		Evaluation of myocardial ischemia is recommended in those who develop new-onset LV systolic dysfunction especially in the setting of suspected myocardial ischemia or worsening symptoms with pre-existing CAD. The choice of testing modality should depend on the clinical suspicion and underlying cardiac risk factors. Coronary angiography should be considered when pre-test probability of underlying ischemic cardiomyopathy is high and an invasive coronary intervention may be considered. (See Section 13 for specific clinical situations and Strength of Evidence)	New recommendation
4.17 (previous 4.16)	Exercise testing is not recommended as part of routine evaluation in patients with HF. Specific circumstances in which maximal exercise testing with measurement of expired gases should be considered include: • Assessing disparity between symptomatic limitation and objective indicators of disease severity • Distinguishing non−HF-related causes of functional limitation, specifically cardiac versus pulmonary • Considering candidacy for cardiac transplantation or mechanical intervention • Determining the prescription for cardiac rehabilitation • Addressing specific employment capabilities Exercise testing for inducible abnormality in myocardial perfusion or wall motion abnormality should be considered to screen for the presence of coronary artery disease with inducible ischemia. (Strength of Evidence = C)	Exercise testing for functional capacity is not recommended as part of routine evaluation in patients with HF. Specific circumstances in which maximal exercise testing with measurement of expired gases should be considered include: • Assessing disparity between symptomatic limitation and objective indicators of disease severity • Distinguishing non HF-related causes of functional limitation, specifically cardiac versus pulmonary • Considering candidacy for cardiac transplantation or mechanical circulatory support • Determining the prescription for cardiac rehabilitation • Addressing specific employment capabilities (Strength of Evidence = C)	Modification of wording and deletion of recommendation for exercise testing for inducible abnormality in myocardial perfusion or wall motion abnormality
4.18 (previous 4.17)	No changes		
4.19 (previous 4.18)	It is recommended that clinical evaluation at each followup visit include the assessments listed in Table 4.9. (Strength of Evidence = B) These assessments should include the same symptoms and signs assessed during the initial evaluation. (Strength of Evidence = C)	It is recommended that clinical evaluation at each follow-up visit include determination of the elements listed in Table 4.9. (Strength of Evidence = B). These assessments should include the same symptoms and signs assessed during the initial evaluation. (Strength of Evidence = B)	Change (in second part of recommendation) Strength of Evidence from C to B

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Appendix A. (*continued*)

	2006 Guideline Recommendation	2010 Guideline Recommendation	Comments
4.20 (previous 4.19)	Routine reevaluation of cardiac function by noninvasive or invasive methods is not recommended. Repeat measurements of ventricular volume and EF should be considered under limited circumstances: • After at least 3 months of medical therapy when prophylactic ICD placement is being considered to confirm that EF criteria are still met. (Strength of Evidence = B) • In patients who show substantial clinical improvement (for example, in response to b-blocker treatment). Such change may denote improved prognosis, although it does not in itself mandate alteration or discontinuation of specific treatments. (Strength of Evidence = C) Repeat determination of EF is usually unnecessary in patients with previously documented LV dilation and low EF who manifest worsening signs or symptoms of HF. Repeat measurement should be considered when it is likely to prompt a change in patient management, such as cardiac transplantation. (Strength of Evidence = C)	In the absence of deteriorating clinical presentation, repeat measurements of ventricular volume and LVEF should be considered in these limited circumstances: • When a prophylactic implantable cardioverter defibrillator (ICD) or CRT device and defibrillator (CRT-D) placement is being considered in order to determine that LVEF criteria for device placement are still met after medical therapy (Strength of Evidence = B) • When patients show substantial clinical improvement (for example, in response to beta blocker treatment or following pregnancy in patients with peripartum cardiomyopathy). Such change may denote improved prognosis, although it does not in itself mandate alteration or discontinuation of specific treatments (see Section 7). (Strength of Evidence = C) • In alcohol and cardiotoxic substance abusers who have discontinued the abused substance. (Strength of Evidence = C) • In patients receiving cardiotoxic chemotherapy. (Strength of Evidence = B) Repeat determination of LVEF is usually unnecessary in patients with previously documented LV dilatation and low LVEF who manifest worsening signs or symptoms of HF, unless the information is needed to justify a change in patient management (such as surgery or device implantation). (Strength of Evidence = C)	Modifications of recommendation throughout
4.21 (previous 4.20)	It is recommended that reevaluation of electrolytes and renal function occur at least every 6 months in clinically stable patients and more frequently after changes in therapy or with evidence of change in volume status. More frequent assessment of electrolytes and renal function is recommended in patients with severe HF, those receiving high doses of diuretics, and those who are clinically unstable. (Strength of Evidence = C) (See Section 7 for recommendations regarding patients on angiotensin receptor blockers.)	It is recommended that reevaluation of electrolytes and renal function occur at least every 6 months in clinically stable patients and more frequently following changes in therapy or with evidence of change in volume status. More frequent assessment of electrolytes and renal function is recommended in patients with severe HF, those receiving high doses of diuretics, those on aldosterone antagonists, and those who are clinically unstable. (Strength of Evidence = C) (See Section 7 for recommendations regarding patients on angiotensin receptor blockers.)	Addition of aldosterone antagonists to list of patients in whom more frequent assessment of electrolytes and renal function is recommended.
	Section 5: Management of Asymptomatic Patients with Reduced LVEF		
5.1	It is recommended that all patients with ALVD exercise regularly according to a physician-directed prescription to avoid general deconditioning; to improve weight, blood pressure, and diabetes control; and to reduce cardiovascular risk. (Strength of Evidence = C)	It is recommended that all patients with ALVD exercise regularly according to a physician-directed prescription to avoid general deconditioning; to optimize weight, blood pressure, and diabetes control; and to reduce cardiovascular risk. (Strength of Evidence = C)	Minor wording modification
5.2	No changes		
5.3	It is recommended that alcohol consumption be discouraged in patients with ALVD. Abstinence is recommended if there is a current habit or history of excessive alcohol intake. (Strength of Evidence = C)	Alcohol abstinence is recommended if there is current or previous history of excessive alcohol intake. (Strength of Evidence = C)	Deleted phrase discouraging alcohol use in ALVD. Other minor wording modifications.
5.4	It is recommended that all patients with ALVD with hypertension have aggressive blood pressure control. (Strength of Evidence = B)	It is recommended that all patients with ALVD with hypertension achieve optimal blood pressure control. (Strength of Evidence = B)	Aggressive blood pressure control changed to optimal blood pressure control
5.5	No changes		

5.6	ARBs are recommended for asymptomatic patients with reduced LVEF who are intolerant of ACE inhibitors because of cough or angioedema. (Strength of Evidence = C) Routine use of the combination of ACE inhibitors and ARBs for prevention of HF is not recommended in this population. (Strength of Evidence = C)	ARBs are recommended for asymptomatic patients with reduced LVEF who are intolerant of ACE inhibitors from cough or angioedema. (Strength of Evidence = C) Routine use of the combination of ACE inhibitors and ARBs for prevention of HF is not recommended in this population. (Strength of Evidence = C)	Minor wording modification
5.7	It is recommended that beta blocker therapy be administered to asymptomatic patients with reduced LVEF. (Post MI, Strength of Evidence = B; non−Post MI, Strength of Evidence = C)	Beta blocker therapy should be considered in asymptomatic patients with reduced LVEF. (post-MI, Strength of Evidence = B; non post-MI, Strength of Evidence = C)	Changed from ''is recommended'' to ''should be considered''
	Section 6: Nonpharmacologic Management and Health Care Maintenance in Patients with Chronic Heart Failure		
6.1	Dietary instruction regarding sodium intake is recommended in all patients with HF. Patients with HF and diabetes, dyslipidemia, or obesity should be given specific instructions regarding carbohydrate or caloric constraints. (Strength of Evidence = B)	Dietary instruction regarding sodium intake is recommended in all patients with HF. Patients with HF and diabetes, dyslipidemia, or severe obesity should be given specific dietary instructions. (Strength of Evidence = B)	Minor wording modification
6.2	No changes		
6.3	No changes		
6.4	It is recommended that specific attention be paid to nutritional management of patients with advanced HF and unintentional weight loss or muscle wasting (cardiac cachexia). Measurement of nitrogen balance, caloric intake, and prealbumin may be useful in determining appropriate nutritional supplementation. Caloric supplementation is recommended. Anabolic steroids are not recommended for such patients. (Strength of Evidence = C)	It is recommended that specific attention be paid to nutritional management of patients with advanced HF and unintentional weight loss or muscle wasting (cardiac cachexia). Measurement of nitrogen balance, caloric intake, and prealbumin may be useful in determining appropriate nutritional supplementation. Caloric supplementation is recommended. Anabolic steroids are not recommended for cachexic patients. (Strength of Evidence = C)	Minor wording modification
6.5	No changes		
6.6	Documentation of the type and dose of nutraceutical products used by patients with HF is recommended. (Strength of Evidence = C) Nutraceutical use is not recommended for relief of symptomatic HF or for the secondary prevention of cardiovascular events. Patients should be instructed to avoid using natural or synthetic products containing ephedra (ma huang), ephedrine, or its metabolites because of an increase risk of mortality and morbidity. Products should be avoided that may have significant drug interactions with digoxin, vasodilators, beta blockers, antiarrhythmic drugs, and anticoagulants. (Strength of Evidence = B)	Documentation of the type and dose of naturoceutical products used by patients with HF is recommended. (Strength of Evidence = C) Naturoceutical use is not recommended for relief of symptomatic HF or for the secondary prevention of cardiovascular events. Patients should be instructed to avoid using natural or synthetic products containing ephedra (ma huang), ephedrine, or its metabolites because of an increased risk of mortality and morbidity. Products should be avoided that may have significant drug interactions with digoxin, vasodilators, beta blockers, antiarrhythmic drugs, and anticoagulants. (Strength of Evidence = B)	Modification of terminology (nutraceutical to naturoceutical)
6.7	No changes		
6.8	No changes		
6.9	No changes		
6.10	It is recommended that screening for endogenous or prolonged reactive depression in patients with HF be conducted after diagnosis and at periodic intervals as clinically indicated. For pharmacologic treatment, selective serotonin receptor uptake inhibitors are preferred over tricyclic antidepressants, because the latter have the potential to cause ventricular arrhythmias, but the potential for drug interactions should be considered. (Strength of Evidence = B)	It is recommended that screening for endogenous or prolonged reactive depression in patients with HF be conducted following diagnosis and at periodic intervals as clinically indicated. For pharmacologic treatment, selective serotonin reuptake inhibitors are preferred over tricyclic antidepressants, because the latter have the potential to cause ventricular arrhythmias, but the potential for drug interactions should be considered. (Strength of Evidence = B)	Minor wording modification

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	2006 Guideline Recommendation	2010 Guideline Recommendation	Comments
6.11	No changes		
6.12	No changes		
6.13	No changes		
6.14	No changes		
6.15	Endocarditis prophylaxis is not recommended based on the diagnosis of HF alone. Prophylaxis for dental and other procedures should be given according to standard clinical indications. (Strength of Evidence = C)	Endocarditis prophylaxis is not recommended based on the diagnosis of HF alone. Consistent with the AHA recommendation, 'prophylaxis should be given for only specific cardiac conditions, associated with the highest risk of adverse outcome from endocarditis.' These conditions include: 'prosthetic cardiac valves; previous infective endocarditis; congenital heart disease (CHD)' such as: 'unrepaired cyanotic CHD, including palliative shunts and conduits; completely repaired congenital heart defect with prosthetic material or device, whether placed by surgery or by catheter intervention, during the first six months after the procedure; repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch or prosthetic device (which inhibit endothelialization); cardiac transplantation recipients who develop cardiac valvulopathy.' (Strength of Evidence = C)	Addition of criteria for endocarditis prophylaxis
6.16	No changes		
6.17	No changes		
6.18	No changes		
6.19		It is recommended that patients with HF undergo exercise testing to determine suitability for exercise training (patient does not develop significant ischemia or arrhythmias). (Strength of Evidence = B) If deemed safe, exercise training should be considered for patients with HF in order to facilitate understanding of exercise expectations (heart rate ranges and appropriate levels of exercise training), to increase exercise duration and intensity in a supervised setting, and to promote adherence to a general exercise goal of 30 minutes of moderate activity/exercise, 5 days per week with warm up and cool down exercises. (Strength of Evidence = B)	New recommendation
	Section 7: Heart Failure in Patients with Reduced Ejection Fraction		
7.1	No changes		
7.2	It is recommended that other therapy be substituted for ACE inhibitors in the following circumstances: • In patients who cannot tolerate ACE inhibitors because of cough, ARBs are recommended. (Strength of Evidence = A) • The combination of hydralazine and an oral nitrate may be considered in such patients not tolerating ARB therapy. (Strength of Evidence = C) • Patients intolerant to ACE inhibitors because of hyperkalemia or renal insufficiency are likely to experience the same side effects with ARBs. In these cases, the combination of hydralazine and an oral nitrate should be considered. (Strength of Evidence = C)	It is recommended that other therapy be substituted for ACE inhibitors in the following circumstances: • In patients who cannot tolerate ACE inhibitors due to cough, ARBs are recommended. (Strength of Evidence = A) • The combination of hydralazine and an oral nitrate may be considered in such patients not tolerating ARB therapy. (Strength of Evidence = C) • Patients intolerant to ACE inhibitors from hyperkalemia or renal insufficiency are likely to experience the same side effects with ARBs. In these cases, the combination of hydralazine and an oral nitrate should be considered. (Strength of Evidence = C)	Minor wording modification

7.3 (previous 7.10)	No changes		
7.4 (previous 7.12)	ARBs should be considered in patients experiencing angioedema while on ACE inhibitors based on their underlying risk and with recognition that angioedema has been reported infrequently with these agents. (Strength of Evidence = B) The combination of hydralazine and oral nitrates may be considered in this setting for patients who do not tolerate ARB therapy. (Strength of Evidence = C)	ARBs should be considered in patients experiencing angioedema while on ACE inhibitors based on their underlying risk and with recognition that angioedema has been reported infrequently with ARBs. (Strength of Evidence = B) The combination of hydralazine and oral nitrates may be considered in this setting for patients who do not tolerate ARB therapy. (Strength of Evidence = C)	Minor wording modifications
7.5 (previous 7.11)	Individual ARBs may be considered as initial therapy rather than ACE inhibitors for patients with the following conditions: • HF post MI (Strength of Evidence = A) • Chronic HF and systolic dysfunction (Strength of Evidence = B)	Individual ARBs may be considered as initial therapy rather than ACE inhibitors for patients with the following conditions: • HF Post-MI (Strength of Evidence = A) • Chronic HF and reduced LVEF (Strength of Evidence = B)	Terminology modification (changed "systolic dysfunction" to "reduced LVEF)
7.6 (previous 7.3)	No changes		
7.7 (previous 7.4)	No changes		
7.8 (previous 7.5)	Beta blocker therapy is recommended for patients with a recent decompensation of HF after optimization of volume status and successful discontinuation of intravenous diuretics and vasoactive agents, including inotropic support. Whenever possible, beta blocker therapy should be initiated in the hospital setting at a low dose before discharge in stable patients. (Strength of Evidence = B)	Beta blocker therapy is recommended for patients with a recent decompensation of HF after optimization of volume status and successful discontinuation of intravenous diuretics and vasoactive agents, including inotropic support. Whenever possible, beta blocker therapy should be initiated in the hospital setting at a low dose prior to discharge in stable patients. (Strength of Evidence = B)	Minor wording modifications
7.9 (previous 7.6)	Beta blocker therapy is recommended in the great majority of patients with LV systolic dysfunction, even if there is concomitant diabetes, chronic obstructive lung disease, or peripheral vascular disease. Beta blocker therapy should be used with caution in patients with diabetes with recurrent hypoglycemia, asthma, or resting limb ischemia. Considerable caution should be used if beta blockers are initiated in patients with marked bradycardia (<55 beats/min) or marked hypotension (systolic blood pressure <80 mm Hg). Beta blockers are not recommended in patients with asthma with active bronchospasm. (Strength of Evidence = C)	Beta blocker therapy is recommended in the great majority of patients with HF and reduced LVEF, even if there is concomitant diabetes, chronic obstructive lung disease, or peripheral vascular disease. Beta blocker therapy should be used with caution in patients with diabetes with recurrent hypoglycemia, with asthma, or with resting limb ischemia. Considerable caution should be used if beta blockers are initiated in patients with marked bradycardia (<55 beats/min) or marked hypotension (systolic blood pressure <80 mm Hg). Beta blockers are not recommended in patients with asthma with active bronchospasm. (Strength of Evidence = C)	Modification of terminology ("LV systolic dysfunction" changed to "reduced LVEF")
7.10 (previous 7.7)	It is recommended that b-blockade be initiated at low doses and uptitrated gradually, typically no sooner than at 2-week intervals. Doses found to be effective in HF trials generally are achieved in 8 to 12 weeks. Patients developing worsening HF symptoms or other side effects during titration may require a dosage adjustment of diuretic or concomitant vasoactive medications. If side effects resolve with medication adjustment, patients can subsequently be titrated to target or maximally tolerated doses. Some patients may require a more prolonged interval during uptitration, a temporary reduction in b-blocker dose, or, in rare cases, withdrawal of therapy. (Strength of Evidence = B)	It is recommended that beta blockade be initiated at low doses and uptitrated gradually, typically at 2-week intervals in patients with reduced LVEF, and after 3-10 day intervals in patients with reduced LVEF following newly diagnosed MI. (Strength of Evidence = B)	Deleted information related to beta blocker management

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Appendix A. (*continued*)

	2006 Guideline Recommendation	2010 Guideline Recommendation	Comments
7.11 (previous 7.8)	It is recommended that beta blocker therapy be continued in most patients experiencing a symptomatic exacerbation of HF during chronic maintenance treatment. (Strength of Evidence = C) A temporary reduction of dose in this setting may be considered. Abrupt discontinuation in patients with symptomatic exacerbation should be avoided. (Strength of Evidence = C) If discontinued or reduced, beta blockers should be reinstated or the dose should be gradually increased before the patient is discharged.	It is recommended that beta blocker therapy be continued in most patients experiencing a symptomatic exacerbation of HF during chronic maintenance treatment, unless they develop cardiogenic shock, refractory volume overload, or symptomatic bradycardia (Strength of Evidence = C) A temporary reduction of dose (generally by one-half) in this setting may be considered. Abrupt discontinuation in patients with symptomatic exacerbation should be avoided, unless the situation is life-threatening. (Strength of Evidence = C) If discontinued or reduced, beta blockers should be reinstated before the patient is discharged. In general, doses should be uptitrated to the previous well-tolerated dose as soon as safely possible (Strength of Evidence =B)	Addition of criteria for beta blocker discontinuation and reinstitution
7.12 (previous 7.13)	The routine administration of an ARB is not recommended in addition to ACE inhibitor and beta blocker therapy in patients with recent acute MI and LV dysfunction. (Strength of Evidence = A)	The routine administration of an ARB is not recommended in addition to ACE inhibitor and beta blocker therapy in patients with a recent acute MI and reduced LVEF. (Strength of Evidence = A)	Modification of terminology (''LV dysfunction'' changed to ''reduced LVEF'')
7.13		The addition of an ARB should be considered in patients with HF due to reduced LVEF who have persistent symptoms or progressive worsening despite optimized therapy with an ACE inhibitor and beta blocker. (Strength of Evidence = A)	New recommendation
7.14	Administration of an aldosterone antagonist is recommended for patients with NYHA class IV or class III, previously class IV, HF from LV systolic dysfunction (LVEF ≤35%) while receiving standard therapy, including diuretics. (Strength of Evidence = A)	Administration of an aldosterone antagonist is recommended for patients with NYHA class IV (or class III, previously class IV) HF from reduced LVEF (<35%) while receiving standard therapy, including diuretics. (Strength of Evidence = A)	Modification of terminology (''LV systolic dysfunction'' changed to ''reduced LVEF'')
7.15	Administration of an aldosterone antagonist should be considered in patients after an acute MI, with clinical HF signs and symptoms and an LVEF <40%. Patients should be on standard therapy, including an ACE inhibitor (or ARB) and a b-blocker. (Strength of Evidence = A)	Administration of an aldosterone antagonist should be considered in patients following an acute MI, with clinical HF signs and symptoms or history of diabetes mellitus, and an LVEF <40%. Patients should be on standard therapy, including an ACE inhibitor (or ARB) and a beta blocker. (Strength of Evidence = A)	Addition of history of diabetes mellitus to criteria for therapy
7.16	No changes		
7.17	No changes		
7.18	No changes		
7.19	A combination of hydralazine and isosorbide dinitrate is recommended as part of standard therapy in addition to beta blockers and ACE inhibitors for African Americans with LV systolic dysfunction. • NYHA III or IV HF (Strength of Evidence = A) • NYHA II HF (Strength of Evidence = B) (See Section 15 Special Populations)	A combination of hydralazine and isosorbide dinitrate is recommended as part of standard therapy in addition to beta blockers and ACE inhibitors for African Americans with HF and reduced LVEF. • NYHA III or IV HF (Strength of Evidence = A) • NYHA II HF (Strength of Evidence = B) (See Section 15: Special Populations)	Modification of terminology (''LV systolic dysfunction'' changed to ''reduced LVEF'')
7.20	A combination of hydralazine and isosorbide dinitrate may be considered in non−African American patients with LV systolic dysfunction who remain symptomatic despite optimized standard therapy. (Strength of Evidence = C)	A combination of hydralazine and isosorbide dinitrate may be considered in non-African-American patients with HF and reduced LVEF who remain symptomatic despite optimized standard therapy. (Strength of Evidence = C)	Modification of terminology (''LV systolic dysfunction'' changed to ''reduced LVEF'')

7.21	Additional pharmacologic therapy should be considered in patients with HF due to systolic dysfunction who have persistent symptoms or progressive worsening despite optimized therapy with an ACE inhibitor and beta blocker. The choice of specific agent will be influenced by clinical considerations, including renal function status, chronic serum potassium concentration, blood pressure, and volume status. The triple combination of an ACE inhibitor, an ARB, and an aldosterone antagonist is not recommended because of the high risk of hyperkalemia. (Strength of Evidence = C) • Addition of an ARB. (Strength of Evidence = A) • Addition of an aldosterone antagonist: ○ For severe HF (Strength of Evidence = A) ○ For moderate HF (Strength of Evidence = C) • Addition of the combination of hydralazine/isosorbide dinitrate: ○ For African Americans (Strength of Evidence =A) ○ For others (Strength of Evidence = C)	Additional pharmacologic therapy should be considered in patients with HF and reduced LVEF who have persistent symptoms or progressive worsening despite optimized therapy with an ACE inhibitor and beta blocker. The choice of specific agent will be influenced by clinical considerations, including renal function status, chronic serum potassium concentration, blood pressure, and volume status. The triple combination of an ACE inhibitor, an ARB, and an aldosterone antagonist is not recommended because of the high risk of hyperkalemia. (Strength of Evidence = C) • Addition of an ARB. (Strength of Evidence = A) • Addition of an aldosterone antagonist: ○ for severe HF (Strength of Evidence =A) ○ for moderate HF (Strength of Evidence = C) ○ for post-MI HF (Strength of Evidence = A) • Addition of the combination of hydralazine/isosorbide dinitrate: ○ for African Americans (Strength of Evidence = A) ○ for others (Strength of Evidence = C)	Modification of terminology (''systolic dysfunction'' changed to ''reduced LVEF''); addition of post-MI HF under aldosterone antagonists
7.22	Additional pharmacological therapy should be considered in patients with HF due to systolic dysfunction who are unable to tolerate a beta blocker and have persistent symptoms or progressive worsening despite optimized therapy with an ACE inhibitor. The choice of specific agent will be influenced by clinical considerations, including renal function status, chronic serum potassium concentration, blood pressure and volume status. The triple combination of an ACE inhibitor, an ARB, and an aldosterone antagonist is not recommended due to the high risk of hyperkalemia. (Strength of Evidence = C) • Addition of an ARB. (Strength of Evidence = C) • Addition of an aldosterone antagonist: ○ for severe HF (Strength of Evidence = C) ○ for moderate HF (Strength of Evidence = C) • Addition of the combination of hydralazine/isosorbide dinitrate: ○ For African-Americans (Strength of Evidence = C) ○ for others (Strength of Evidence = C)	Additional pharmacological therapy should be considered in patients with HF and reduced LVEF *who are unable to tolerate a beta blocker* and have persistent symptoms or progressive worsening despite optimized therapy with an ACE inhibitor. The choice of specific agent will be influenced by clinical considerations, including renal function status, chronic serum potassium concentration, blood pressure and volume status. The triple combination of an ACE inhibitor, an ARB, and an aldosterone antagonist is not recommended due to the high risk of hyperkalemia. (Strength of Evidence = C) • Addition of an ARB. (Strength of Evidence = C) • Addition of an aldosterone antagonist: ○ for severe HF (Strength of Evidence = C) ○ for moderate HF (Strength of Evidence = C) • Addition of the combination of hydralazine/isosorbide dinitrate: ○ for African Americans (Strength of Evidence = C) ○ for others (Strength of Evidence = C)	Modification of terminology (''systolic dysfunction'' changed to ''reduced LVEF'')
7.23	No changes		
7.24	The initial dose of diuretic may be increased as necessary to relieve congestion. Restoration of normal volume status may require multiple adjustments over many days and occasionally weeks in patients with severe fluid overload evidenced by massive edema or ascites. After a diuretic effect is achieved with short acting loop diuretics, increasing administration frequency to twice or even 3 times per day will provide more diuresis with less physiologic perturbation than larger single doses. (Strength of Evidence = B) Oral torsemide may be considered in patients in whom poor absorption of oral medication or erratic diuretic effect may be present, particularly those with right-sided HF and refractory fluid retention despite high doses of other loop diuretics. (Strength of Evidence = C) Intravenous administration of diuretics may be necessary to relieve congestion. (Strength of Evidence = A) Diuretic refractoriness may represent patient noncompliance, a direct effect of diuretic use on the kidney, or progression of underlying cardiac dysfunction.	The initial dose of diuretic may be increased as necessary to relieve congestion. Restoration of normal volume status may require multiple adjustments over many days and occasionally weeks in patients with severe fluid overload evidenced by massive edema or ascites. After a diuretic effect is achieved with short-acting loop diuretics, increasing administration frequency to twice or even 3 times per day will provide more diuresis with less physiologic perturbation than larger single doses. (Strength of Evidence = B) Oral torsemide may be considered in patients in whom poor absorption of oral medication or erratic diuretic effect may be present, particularly those with right-sided HF and refractory fluid retention despite high doses of other loop diuretics. (Strength of Evidence = C) Intravenous administration of diuretics may be necessary to relieve congestion. (Strength of Evidence = A) Diuretic refractoriness may represent patient nonadherence, a direct effect of diuretic use on the kidney, or progression of underlying cardiac dysfunction.	Modification of terminology (''noncompliance'' changed to ''nonadherence'')

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Appendix A. (*continued*)

	2006 Guideline Recommendation	2010 Guideline Recommendation	Comments
7.25	No changes		
7.26	Careful observation for the development of side effects, including electrolyte abnormalities, symptomatic hypotension, and renal dysfunction, is recommended in patients treated with diuretics, especially when used at high doses and in combination. Patients should undergo routine laboratory studies and clinical examination as dictated by their clinical response. (Strength of Evidence = B)	Careful observation for the development of side effects, including electrolyte abnormalities, symptomatic hypotension, renal dysfunction, or worsening renal function, is recommended in patients treated with diuretics, especially when used at high doses and in combination. Patients should undergo routine laboratory studies and clinical examination as dictated by their clinical response. (Strength of Evidence = B)	Addition of worsening renal function to list of potential side effects
7.27	No changes		
7.28	No changes		
7.29	Digoxin should be considered for patients with LV systolic dysfunction (LVEF ≤40%) who have signs or symptoms of HF while receiving standard therapy, including ACE inhibitors and beta blockers: NYHA class II-III (Strength of Evidence = A) NYHA class IV (Strength of Evidence = B)	Digoxin may be considered to improve symptoms in patients with reduced LVEF (LVEF ≤40%) who have signs or symptoms of HF while receiving standard therapy, including ACE inhibitors and beta blockers: • NYHA class II-III (Strength of Evidence = B) • NYHA class IV (Strength of Evidence = C)	Modification from ''should be considered'' to ''may be considered'', and change in Strength of Evidence
7.30	It is recommended that the dose of digoxin, which should be based on lean body mass, renal function and concomitant medications, should be 0.125 mg daily in the majority of patients and the serum digoxin level should be <1.0 ng/mL. (Strength of Evidence = C)	It is recommended that the dose of digoxin, which should be based on lean body mass, renal function, and concomitant medications, should be 0.125 mg daily in the majority of patients and the serum digoxin level should be <1.0 ng/mL, generally 0.7-0.9 ng/mL. (Strength of Evidence = B)	Addition of a lower serum concentration range (0.7-0.9 ng/ml), and change in strength of evidence from C to B
7.31	Adequate control of the ventricular response to atrial fibrillation in patients with HF is recommended. (Level of Evidence = B)	Digoxin should be considered for achieving adequate control of the ventricular response to atrial fibrillation in patients with HF. (Strength of Evidence = B)	Modification from ''is recommended'' to ''should be considered''
7.32	No changes		
7.33	Treatment with warfarin (goal INR 2.0−3.0) is recommended for all patients with HF and chronic or documented paroxysmal atrial fibrillation (Strength of Evidence = A) or a history of systemic or pulmonary emboli, including stroke or transient ischemic attack, (Strength of Evidence = C) unless contraindicated.	Treatment with warfarin (goal international normalized ratio [INR] 2.0-3.0) is recommended for all patients with HF and chronic or documented paroxysmal, persistent, or long-standing atrial fibrillation (Strength of Evidence = A) or a history of systemic or pulmonary emboli, including stroke or transient ischemic attack (Strength of Evidence = C), unless contraindicated.	Addition of persistent or long-standing atrial fibrillation
7.34	No changes		
Previous 7.35			Deleted from current guideline
7.35 (previous 7.36)	Long-term treatment with an antithrombotic agent is recommended for patients with HF from ischemic cardiomyopathy, whether or not they are receiving ACE inhibitors. (Strength of Evidence = B) Aspirin is recommended in most patients for whom anticoagulation is not specifically indicated because of its proven efficacy in non-HF patients with ischemic heart disease, its convenience, and lower cost. Lower doses of aspirin (75 or 81 mg) may be preferable because data from 2 trials suggest more frequent worsening of HF at higher doses. (Strength of Evidence = C) Warfarin (goal INR 2.0−3.5) and clopidogrel (75 mg) have also prevented vascular events in post MI patients and may be considered as alternatives to aspirin. (Strength of Evidence = B)	Long-term treatment with an antiplatelet agent, generally aspirin in doses of 75 to 81 mg, is recommended for patients with HF due to ischemic cardiomyopathy, whether or not they are receiving ACE inhibitors. (Strength of Evidence = B) Warfarin (goal INR 2.0-3.0) and clopidogrel (75 mg) also have prevented vascular events in post-MI patients and may be considered as alternatives to aspirin. (Strength of Evidence = B)	Modification of terminology from ''antithrombotic'' to ''antiplatelet''; addition of recommended doses for aspirin. INR range changed to 2.0-3.0

7.36 (previous 7.37)	Routine use of aspirin is not recommended in patients with HF not from ischemic cardiomyopathy and without other evidence of atherosclerotic vascular disease. (Strength of Evidence = C)	Routine use of aspirin is not recommended in patients with HF without atherosclerotic vascular disease. (Strength of Evidence = C)	Modification of terminology
Previous 7.38			Deleted from current guideline; addressed in recommendation 7.35
7.37 (previous 7.39)	No changes		
7.38 (previous 7.40)	In patients with HF and an implantable cardioverter defibrillator (ICD), amiodarone may be considered to reduce the frequency of repetitive discharges. (Strength of Evidence = C)	In patients with HF and an ICD, amiodarone may be considered to reduce the frequency of recurrent symptomatic arrhythmias causing ICD shocks. (Strength of Evidence = C)	Modification of wording
7.39 (previous 7.41)	It is recommended that patients taking amiodarone therapy and digoxin or warfarin generally have their maintenance doses of many commonly used agents, such as digoxin, warfarin, and statins, reduced when amiodarone is initiated and then carefully monitored for the possibility of adverse drug interactions. Adjustment in doses of these drugs and laboratory assessment of drug activity or serum concentration after initiation of amiodarone is recommended. (Strength of Evidence = A)	It is recommended that when amiodarone therapy is initiated, the potential for interactions with other drugs be reviewed. The maintenance doses of digoxin, warfarin, and some statins should be reduced when amiodarone is initiated and then carefully monitored. Adjustment in doses of these drugs and laboratory assessment of drug activity or serum concentration after initiation of amiodarone is recommended. (Strength of Evidence = A)	Modification of wording
7.40		Routine use of amiodarone therapy for asymptomatic arrhythmias that are not felt to contribute to HF or ventricular dysfunction is not recommended. (Strength of Evidence = B)	New recommendation
7.41		n-3 polyunsaturated fatty acids (PUFA) may be considered to reduce mortality in HF patients with NYHA class II-IV symptoms and reduced LVEF. (Strength of Evidence = B)	New recommendation
	Section 8: Disease Management, Advance Directives, and End-of-Life Care in Heart Failure		
8.1	It is recommended that patients with HF and their family members or caregivers receive individualized education and counseling that emphasizes self-care. This education and counseling should be delivered by providers using a team approach in which nurses with expertise in HF management provide the majority of education and counseling, supplemented by physician input and, when available and needed, input from dietitians, pharmacists, and other health care providers. All HF patients benefit from education and counseling, but patients in NYHA functional class III or IV need the most intensive education, whereas patients in NYHA I or II need less intensive education. (Strength of Evidence = B) Teaching is not sufficient without skill building and specification of critical target behaviors. Essential elements of patient education to promote self-care with associated skills are shown in Table 8.1. (Strength of Evidence = B)	It is recommended that patients with HF and their family members or caregivers receive individualized education and counseling that emphasizes self-care. This education and counseling should be delivered by providers using a team approach in which nurses with expertise in HF management provide the majority of education and counseling, supplemented by physician input and, when available and needed, input from dietitians, pharmacists, and other health care providers. (Strength of Evidence = B) Teaching is not sufficient without skill building and specification of critical target behaviors. It is recommended that essential elements of patient education (with associated skills) are utilized to promote self-care as shown in Table 8.1. (Strength of Evidence = B)	Deletion of NYHA specific portion of the recommendation; modification of wording

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Appendix A. (*continued*)

	2006 Guideline Recommendation	2010 Guideline Recommendation	Comments
8.2	It is recommended that patients' literacy, cognitive status, psychologic state, culture, and access to social and financial resources be taken into account for optimal education and counseling. Because cognitive impairment and depression are common in HF and can seriously interfere with learning, patients should be screened for these. Appropriate interventions, such as supportive counseling and pharmacotherapy, are recommended for those patients found to be depressed. Patients found to be cognitively impaired need additional support to manage their HF. (Strength of Evidence = C)	It is recommended that patients' literacy, cognitive status, psychological state, culture, and access to social and financial resources be taken into account for optimal education and counseling. Because cognitive impairment and depression are common in HF and can seriously interfere with learning, patients should be screened for these. Patients found to be cognitively impaired need additional support to manage their HF. (Strength of Evidence = B)	Deletion of description of interventions; modification of Strength of Evidence from C to B
8.3	No changes		
8.4	It is recommended that the frequency and intensity of patient education and counseling vary according to the stage of illness. Patients in advanced HF or with persistent difficulty adhering to the recommended regimen require the most eduction and counseling. Patients should be offered a variety of options for learning about HF according to their individual preferences: videotape, one-on-one or group discussion, reading materials, translators, telephone calls, mailed information, internet, visits. Repeated exposure to material is essential because a single session is never sufficient. (Strength of Evidence = B)	It is recommended that the frequency and intensity of patient education and counseling vary according to the stage of the illness. Patients in advanced HF or persistent difficulty adhering to the recommended regimen require the most education and counseling. Patients should be offered a variety of options for learning about HF according to their individual preferences: videotape, one-on-one or group discussion, reading materials, translators, telephone calls, mailed information, internet, visits. Repeated exposure to material is recommended because a single session is never sufficient. (Strength of Evidence = B)	Modification of wording
8.5	No changes		
8.6	No changes		
8.7	Patients recently hospitalized for HF and other patients at high risk should be considered for referral to a comprehensive HF disease management program that delivers individualized care. High-risk patients include those with renal insufficiency, low output state, diabetes, chronic obstructive pulmonary disease, persistent NYHA class III or IV symptoms, frequent hospitalization for any cause, multiple active comorbidities, or a history of depression, cognitive impairment, or persistent nonadherence to therapeutic regimens. (Strength of Evidence = A)	Patients recently hospitalized for HF and other patients at high risk for HF decompensation should be considered for comprehensive HF disease management. High-risk patients include those with renal insufficiency, low output state, diabetes, chronic obstructive pulmonary disease, persistent NYHA class III or IV symptoms, frequent hospitalization for any cause, multiple active comorbidities, or a history of depression, cognitive impairment, inadequate social support, poor health literacy, or persistent nonadherence to therapeutic regimens. (Strength of Evidence = A)	Addition of poor health literacy
8.8	No changes		
8.9	No changes		
8.10	No changes		
8.11	Patient and family or caregiver discussions about quality of life and prognosis are recommended as part of the disease management of HF. (Strength of Evidence = C)	It is recommended that patient and family or caregiver discussions about quality of life and prognosis be included in the disease management of HF. (Strength of Evidence = C)	Modification of wording

8.12	It is recommended that the patient's status be optimized medically and psychologically before discussing the possibility that end-of-life care is indicated. The decision to declare a patient as an appropriate candidate for end-of-life care should be made by physicians experienced in the care of patients with HF. End-of-life management should be coordinated with the patient's primary care physician. As often as possible, discussions regarding end-of-life care should be initiated while the patient is still capable of participating in decision making. (Strength of Evidence = C)	It is recommended that • Seriously ill patients with HF and their families be educated to understand that patients with HF are at high risk of death, even while aggressive efforts are made to prolong life. • Patients with HF be made aware that HF is potentially life-limiting, but that pharmacologic and device therapies and self-management can prolong life. In most cases, chronic HF pharmacologic and device therapies should be optimized as indicated before identifying that patients are near end-of-life. • Identification of end-of-life in a patient should be made in collaboration with clinicians experienced in the care of patients with HF when possible. • End-of-life management should be coordinated with the patient's primary care physician. • As often as possible, discussions regarding end-of-life care should be initiated while the patient is still capable of participating in decision-making. (Strength of Evidence = C)	Addition of criteria for end of life care
8.13	End-of-life care should be considered in patients who have advanced, persistent HF with symptoms at rest despite repeated attempts to optimize pharmacologic and nonpharmacologic therapy, as evidenced by one or more of the following: • Frequent hospitalizations (3 or more per year) • Chronic poor quality of life with inability to accomplish activities of daily living • Need for intermittent or continuous intravenous support • Consideration of assist devices as destination therapy (Strength of Evidence = C)	End-of-life care should be considered in patients who have advanced, persistent HF with symptoms at rest despite repeated attempts to optimize pharmacologic, cardiac device, and other therapies, as evidenced by 1 or more of the following: • HF hospitalization (Strength of Evidence = B) • Chronic poor quality of life with minimal or no ability to accomplish activities of daily living (Strength of Evidence = C) • Need for continuous intravenous inotropic therapy support (Strength of Evidence = B)	Addition of cardiac device to list of optimization therapies; modification of strength of evidence
8.14	It is recommended that end-of-life care strategies be individualized, include effective symptom management, and avoid unnecessary testing and interventions. (Strength of Evidence = C)	It is recommended that end-of-life care strategies be individualized and include core HF pharmacologic therapies, effective symptom management and comfort measures, while avoiding unnecessary testing. New life-prolonging interventions should be discussed with patients and care-givers with careful discussion of whether they are likely to improve symptoms. (Strength of Evidence = C)	Addition of information regarding end-of-life care strategies
8.15	It is recommended that, as part of end-of life-care, patients and their families/caregivers be given specific directions concerning their response to clinical events if they decide against resuscitation. Inactivation of an implantable defibrillation device should be discussed. (Strength of Evidence = C)	It is recommended that a specific discussion about resuscitation be held in the context of planning for overall care and for emergencies with all patients with HF. The possibility of SCD for patients with HF should be acknowledged. Specific plans to reduce SCD (for example with an ICD) or to allow natural death should be based on the individual patient's risks and preferences for an attempt at resuscitation with specific discussion of risks and benefits of inactivation the ICD. Preferences for attempts at resuscitation and plans for approach to care should be readdressed at turning points in the patient's course or if potentially life-prolonging interventions are considered. (Strength of Evidence = C)	Addition of information regarding resuscitation
8.16		It is recommended that, as part of end-of-life care, patients and their families/caregivers have a plan to manage a sudden decompensation, death, or progressive decline. Inactivation of an implantable defibrillation device should be discussed in the context of allowing natural death at end of life. A process for deactivating defibrillators should be clarified in all settings in which patients with HF receive care. (Strength of Evidence = C)	New recommendation

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	2006 Guideline Recommendation	2010 Guideline Recommendation	Comments
8.17	Patients with HF undergoing end-of-life care may be considered for hospice services that can be delivered in the home, a hospital setting, or a special hospice unit. (Strength of Evidence = C)	Patients with HF receiving end-of-life care should be considered for enrollment in hospice that can be delivered in the home, a nursing home, or a special hospice unit. (Strength of Evidence = C)	Modification from "may be considered" to "should be considered"
Previous 8.16 and 8.18			Deleted recommendations; portions of these recommendations have been incorporated into recommendations 8.15 and 8.16
	Section 9: Electrophysiology Testing and the Use of Devices in Heart Failure		
9.1	It is recommended that the decision to undertake electrophysiologic intervention be made in light of functional status and prognosis based on severity of underlying HF and comorbid conditions. If LV dysfunction is a reason for recommending electrophysiologic intervention, LV function should be re-assessed, ideally after 3−6 months of optimal medical therapy. (Strength of Evidence = C)	It is recommended that the decision to undertake electrophysiologic intervention, including ICD implantation, be made in light of functional status and prognosis based on severity of underlying HF and comorbid conditions. If an ICD is considered due to LV dysfunction which is of recent onset, LV function should be reassessed, ideally after 3-6 months of optimal medical therapy. (Strength of Evidence = C)	Modification/clarification of wording
9.2	Immediate evaluation is recommended in patients with HF who present with syncope. In the absence of a clear identifiable noncardiac cause, patients should be referred for electrophysiologic evaluation. (Strength of Evidence = C)	Immediate evaluation is recommended in patients with HF who present with syncope. In the absence of a clear identifiable noncardiac cause, consultation with an EP specialist should be obtained. (Strength of Evidence = C)	Modification/clarification of wording
9.3	No changes		
9.4	In patients with or without concomitant coronary artery disease (including a prior MI >1 month ago): a) Prophylactic ICD placement should be considered (LVEF ≤30%) and may be considered (LVEF 31−35%) for those with mild to moderate HF symptoms (NYHA II-III). (Strength of Evidence = A) See Recommendation 9.1 for additional criteria. b) Concomitant ICD placement should be considered in patients undergoing implantation of a biventricular pacing device according to the criteria in Recommendations 9.7−9.8. (Strength of Evidence = B) See Recommendation 9.1 for additional criteria.	a. Prophylactic ICD placement should be considered in patients with an LVEF ≤35% and mild to moderate HF symptoms: • Ischemic etiology (Strength of Evidence = A) • Non-ischemic etiology (Strength of Evidence = B) See Recommendation 9.1 for additional criteria. b. In patients who are undergoing implantation of a biventricular pacing device according to the criteria in recommendations 9.7-9.8, use of a device that provides defibrillation should be considered. (Strength of Evidence = B) See Recommendation 9.1 for additional criteria.	Revision of LVEF criteria and strength of evidence based on etiology
9.5	ICD placement is not recommended in chronic, severe refractory HF when there is no reasonable expectation for improvement. (Strength of Evidence = C)	ICD placement is not recommended in chronic, severe refractory HF when there is no reasonable expectation for improvement or in patients with a life expectancy of less than 1 year. (Strength of Evidence = C)	Addition of life expectancy criterion to recommendation
9.6	ICD implantation is recommended for survivors of cardiac arrest from ventricular fibrillation or hemodynamically unstable sustained ventricular tachycardia without evidence of acute MI or if the event occurs more than 48 hours after the onset of infarction in the absence of a recurrent ischemic event. (Strength of Evidence = A)	ICD implantation is recommended for survivors of cardiac arrest from ventricular fibrillation or hemodynamically unstable sustained VT that is not due to a transient, potentially reversible cause, such as acute MI. (Strength of Evidence = A)	Revision of MI criteria
9.7	Biventricular pacing therapy should be considered for patients with sinus rhythm, a widened QRS interval (≥120 ms) and severe LV systolic dysfunction (LVEF ≤35% with LV dilatation >5.5 cm) who have persistent, moderate to severe HF (NYHA III) despite optimal medical therapy. (Strength of Evidence = A)	Biventricular pacing therapy is recommended for patients in sinus rhythm with a widened QRS interval (≥120 ms) and severe LV systolic dysfunction LVEF (≤ 35%) who have persistent, moderate to severe HF (NYHA III) despite optimal medical therapy. (Strength of Evidence = A)	Modification from "should be considered" to "is recommended"; removal of LV dimension criterion

9.8		Biventricular pacing therapy may be considered for patients with atrial fibrillation with a widened QRS interval (≥120 ms) and severe LV systolic dysfunction LVEF ≤35% who have persistent, moderate to severe HF (NYHA III) despite optimal medical therapy. (Strength of Evidence = B)	New recommendation
9.9 (Previous 9.8)	Selected ambulatory NYHA IV patients may be considered for biventricular pacing therapy. (Strength of Evidence = B)	Selected ambulatory NYHA IV patients in sinus rhythm with QRS ≥ 120 ms and LV systolic dysfunction may be considered for biventricular pacing therapy. (Strength of Evidence = B)	Additional criteria for patient selection
9.10 (previous 9.9)	Biventricular pacing therapy is not recommended in patients who are asymptomatic or have mild HF symptoms. (Strength of Evidence = C)	Biventricular pacing therapy may be considered in patients with reduced LVEF and QRS ≥ 150 ms who have NYHA I or II HF symptoms. (Strength of Evidence = B)	Modification from ''is not recommended'' to ''may be considered''; modification of strength of evidence from C to B; additional criteria for patient selection
9.11		In patients with reduced LVEF who require chronic pacing and in whom frequent ventricular pacing is expected, biventricular pacing may be considered. (Strength of Evidence = C)	New recommendation
9.12 (previous 9.10)	No changes		
	Section 10: Surgical Approaches to the Treatment of Heart Failure		
10.1	No changes		
10.2	No changes		
10.3	No changes		
10.4	No changes		
10.5	No changes		
10.6	No changes		
10.7		Patients with refractory HF and hemodynamic instability, and/or compromised end-organ function, with relative contraindications to cardiac transplantation or permanent mechanical circulatory assistance expected to improve with time or restoration of an improved hemodynamic profile should be considered for urgent mechanical circulatory support as a ''bridge to decision.'' These patients should be referred to a center with expertise in the management of patients with advanced HF. (Strength of Evidence = C)	New recommendation
	Section 11: Evaluation and Management of Patients with Heart Failure and Preserved LVEF		
11.1	Careful attention to differential diagnosis is recommended in patients with HF and preserved LVEF to distinguish among a variety of cardiac disorders, because treatments may differ. These various entities may be distinguished based on echocardiography, electrocardiography, and stress imaging (via exercise or pharmacologic means using myocardial perfusion or echocardiographic imaging). See algorithm in Figure 11.1 for a detailed approach to differential diagnosis. (Strength of Evidence = C)	Careful attention to differential diagnosis is recommended in patients with HF and preserved LVEF to distinguish among a variety of cardiac disorders, because treatments may differ. These various entities may be distinguished based on echocardiography, electrocardiography, and stress imaging (via exercise or pharmacologic means, using myocardial perfusion or echocardiographic imaging) and cardiac catheterization. See Figures 11.1, 11.2, and 11.3 for guidance to a differential diagnosis. (Strength of Evidence = C)	Addition of cardiac catheterization to list of diagnostic tools, modification of Figure 11.3 and addition of Figures 11.1 and 11.2.

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	2006 Guideline Recommendation	2010 Guideline Recommendation	Comments
11.2	Evaluation for the possibility of ischemic heart disease and inducible myocardial ischemia is recommended in patients with HF and preserved LVEF. (Strength of Evidence = C)	Evaluation for ischemic heart disease and inducible myocardial ischemia is recommended in patients with HF and preserved LVEF (see Section 13). (Strength of Evidence = C)	Minor wording modifications
11.3	Aggressive blood pressure management is recommended in patients with HF and preserved LVEF (Section 14, Recommendation 14.15). (Strength of Evidence = C)	Blood pressure monitoring is recommended in patients with HF and preserved LVEF (Section 14, Recommendation 14.1). (Strength of Evidence = C)	Modification of terminology (''aggressive blood pressure management'' changed to ''blood pressure monitoring'')
11.4	No changes		
11.5	No changes		
11.6	ARBs or ACE inhibitors should be considered in patients with HF and preserved LVEF. (Strength of evidence = B) • ARBs (Strength of Evidence = B) • ACE inhibitors (Strength of Evidence = C)	In the absence of other specific indications for these drugs, ARBs or ACE inhibitors may be considered in patients with HF and preserved LVEF. • ARBs (Strength of Evidence = C) • ACE inhibitors (Strength of Evidence = C)	Modification from ''should be considered'' to ''may be considered''; modification of strength of evidence for ARBs from B to C
11.7	No changes		
11.8	No changes		
11.9	Calcium channel blockers should be considered in patients with: • Atrial fibrillation requiring control of ventricular rate in whom b-blockers have proven inadequate for this purpose because of intolerance. In these patients, diltiazem or verapamil should be considered. (Strength of Evidence = C) • Symptom-limiting angina. (Strength of Evidence = A) • Hypertension. Amlodipine should be considered. (Strength of Evidence = C)	Calcium channel blockers should be considered in patients with HF and preserved LVEF and: • Atrial fibrillation requiring control of ventricular rate and intolerance to beta blockers. In these patients, diltiazem or verapamil should be considered. (Strength of Evidence = C) • Symptom-limiting angina. (Strength of Evidence = A) • Hypertension. (Strength of Evidence = C)	Modification of wording regarding beta blocker intolerance
11.10	Measures to restore and maintain sinus rhythm should be considered in patients who have symptomatic atrial flutter-fibrillation, but this decision should be individualized. (Strength of Evidence = C)	Measures to restore and maintain sinus rhythm may be considered in patients who have symptomatic atrial flutter-fibrillation and preserved LVEF, but this decision should be individualized. (Strength of Evidence = C)	Modification from ''should be considered'' to ''may be considered''
	Section 12: Evaluation and Management of Patients with Acute Decompensated Heart Failure		
12.1	The diagnosis of decompensated HF should be based primarily on signs and symptoms. (Strength of Evidence = C) When the diagnosis is uncertain, determination of BNP or NT-proBNP concentration should be considered in patients being evaluated for dyspnea who have signs and symptoms compatible with HF. (Strength of Evidence = A) The natriuretic peptide concentration should not be interpreted in isolation, but in the context of all available clinical data bearing on the diagnosis of HF.	The diagnosis of ADHF should be based primarily on signs and symptoms. (Strength of Evidence = C) When the diagnosis is uncertain, determination of BNP or NT-proBNP concentration is recommended in patients being evaluated for dyspnea who have signs and symptoms compatible with HF. (Strength of Evidence = A) The natriuretic peptide concentration should not be interpreted in isolation, but in the context of all available clinical data bearing on the diagnosis of HF, and with the knowledge of cardiac and non-cardiac factors that can raise or lower natriuretic peptide levels.	Modification of BNP recommendation from ''should be considered'' to ''is recommended''
12.2	No changes		

12.3	No changes		
12.4	No changes		
12.5	No changes		
12.6	It is recommended that diuretics be administered at doses needed to produce a rate of diuresis sufficient to achieve optimal volume status with relief of signs and symptoms of congestion (edema, elevated JVP, dyspnea), without inducing an excessively rapid reduction in intravascular volume, which may result in symptomatic hypotension and/or worsening renal function. (Strength of Evidence = C)	It is recommended that diuretics be administered at doses needed to produce a rate of diuresis sufficient to achieve optimal volume status with relief of signs and symptoms of congestion (edema, elevated JVP, dyspnea), without inducing an excessively rapid reduction in 1) intravascular volume, which may result in symptomatic hypotension and/or worsening renal function, or 2) serum electrolytes, which may precipitate arrhythmias or muscle cramps. (Strength of Evidence = C)	Addition of serum electrolytes
12.7	No changes		
12.8	Monitoring of daily weights, intake, and output is recommended to assess clinical efficacy of diuretic therapy. Routine use of a Foley catheter is not recommended for monitoring volume status. However, placement of a catheter is recommended when close monitoring of urine output is needed. (Strength of Evidence = C)	Monitoring of daily weights, intake, and output is recommended to assess clinical efficacy of diuretic therapy. Routine use of a Foley catheter is not recommended for monitoring volume status. However, placement of a catheter is recommended when close monitoring of urine output is needed or if a bladder outlet obstruction is suspected of contributing to worsening renal function. (Strength of Evidence = C)	Addition of criterion for catheter placement
12.9	Careful observation for development of a variety of side effects, including renal dysfunction, electrolyte abnormalities and symptomatic hypotension, is recommended in patients treated with diuretics, especially when used at high doses and in combination. Patients should undergo routine laboratory studies and clinical examination as dictated by their clinical response. (Strength of Evidence = C) Serum potassium and magnesium levels should be monitored at least daily and maintained in the normal range. More frequent monitoring may be necessary when diuresis is rapid. (Strength of Evidence = C) Overly rapid diuresis may be associated with severe muscle cramps, which should be treated with potassium replacement if indicated. (Strength of Evidence = C)	Careful observation for development of a variety of side effects, including renal dysfunction, electrolyte abnormalities, symptomatic hypotension, and gout is recommended in patients treated with diuretics, especially when used at high doses and in combination. Patients should undergo routine laboratory studies and clinical examination as dictated by their clinical response. (Strength of Evidence = C) It is recommended that serum potassium and magnesium levels should be monitored at least daily and maintained in the normal range. More frequent monitoring may be necessary when diuresis is rapid. (Strength of Evidence = C) Overly rapid diuresis may be associated with severe muscle cramps. If indicated, treatment with potassium replacement is recommended. (Strength of Evidence = C)	Addition of gout as side effect Wording modified
12.10	No changes		
12.11	When congestion fails to improve in response to diuretic therapy, the following options should be considered: • Sodium and fluid restriction, • Increased doses of loop diuretic, • Continuous infusion of a loop diuretic, or • Addition of a second type of diuretic orally (metolazone or spironolactone) or intravenously (chlorothiazide). • A fifth option, ultrafiltration, may be considered. (Strength of Evidence = C)	When congestion fails to improve in response to diuretic therapy, the following options should be considered: • Re-evaluating presence/absence of congestion • Sodium and fluid restriction, • Increasing doses of loop diuretic, • Continuous infusion of a loop diuretic, or • Addition of a second type of diuretic orally (metolazone or spironolactone) or intravenously (chlorothiazide). Another option, ultrafiltration, may be considered. (Strength of Evidence = C)	Addition of re-evaluation of congestion
12.12	A low-sodium diet (2 g daily) is recommended, as is supplemental oxygen, as needed for hypoxemia. (Strength of Evidence = C) In patients with recurrent or refractory volume overload, stricter sodium restriction may be considered. (Strength of Evidence = C)	A low sodium diet (2 g daily) is recommended for most hospitalized patients. (Strength of Evidence = C) In patients with recurrent or refractory volume overload, stricter sodium restriction may be considered. (Strength of Evidence = C)	Deletion of supplemental oxygen (moved to recommendation 12.14)

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Appendix A. (*continued*)

	2006 Guideline Recommendation	2010 Guideline Recommendation	Comments
12.13	No changes		
12.14	Routine administration of supplemental oxygen in the absence of hypoxia is not recommended. (Strength of Evidence = C)	Routine administration of supplemental oxygen in the presence of hypoxia is recommended. (Strength of Evidence = C) Routine administration of supplemental oxygen in the absence of hypoxia is not recommended. (Strength of Evidence = C)	Addition of recommendation for oxygen in the presence of hypoxemia
12.15		Use of non-invasive positive pressure ventilation may be considered for severely dyspneic patients with clinical evidence of pulmonary edema. (Strength of Evidence = A)	New recommendation
12.16		Venous thromboembolism prophylaxis with low dose unfractionated heparin, low molecular weight heparin, or fondaparinux to prevent proximal deep venous thrombosis and pulmonary embolism is recommended for patients who are admitted to the hospital with ADHF and who are not already anticoagulated and have no contraindication to anticoagulation. (Strength of Evidence = B) Venous thromboembolism prophylaxis with a mechanical device (intermittent pneumatic compression devices or graded compression stockings) to prevent proximal deep venous thrombosis and pulmonary embolism should be considered for patients who are admitted to the hospital with ADHF and who are not already anticoagulated and who have a contraindication to anticoagulation. (Strength of Evidence = C)	New recommendation
12.17 (previous 12.15)	In the absence symptomatic hypotension, intravenous nitroglycerin, nitroprusside, or nesiritide may be considered as an addition to diuretic therapy for rapid improvement of congestive symptoms in patients admitted with ADHF. Frequent blood pressure monitoring is recommended with these agents. (Strength of Evidence = B). These agents should be decreased in dosage on discontinued if symptomatic hypotension develops. (Strength of Evidence = B) Reintroduction in increasing doses may be considered once symptomatic hypotension is resolved. (Strength of Evidence = C)	In the absence of symptomatic hypotension, intravenous nitroglycerin, nitroprusside or nesiritide may be considered as an addition to diuretic therapy for rapid improvement of congestive symptoms in patients admitted with ADHF. (Strength of Evidence = B) Frequent blood pressure monitoring is recommended with these agents. (Strength of Evidence = B) These agents should be decreased in dosage or discontinued if symptomatic hypotension or worsening renal function develops. (Strength of Evidence = B) Reintroduction in increasing doses may be considered once symptomatic hypotension is resolved. (Strength of Evidence = C)	Addition of worsening renal function as potential side effect
12.18 (previous 12.16)	No changes		
12.19 (previous 12.17)	Intravenous vasodilators (nitroprusside, nitroglycerin, or nesiritide) may be considered in patients with ADHF and advanced HF who have persistent severe HF despite aggressive treatment with diuretics and standard oral therapies. (Strength of Evidence = C)	Intravenous vasodilators (nitroprusside, nitroglycerin, or nesiritide) may be considered in patients with ADHF who have persistent severe HF despite aggressive treatment with diuretics and standard oral therapies. • Nitroprusside (Strength of Evidence = B) • Nitroglycerine, Nesiritide (Strength of Evidence = C)	Modification of strength of evidence for nitroprusside from C to B

12.20 (previous 12.18)	Intravenous inotropes (milrinone or dobutamine) may be considered to relieve symptoms and improve end-organ function in patients with advanced HF characterized by LV dilation, reduced LVEF, and diminished peripheral perfusion or end-organ dysfunction (low output syndrome), particularly if these patients have marginal systolic blood pressure (<90 mm Hg), have symptomatic hypotension despite adequate filling pressure, or are unresponsive to, or intolerant of, intravenous vasodilators. (Strength of Evidence = C) These agents may be considered in similar patients with evidence of fluid overload if they respond poorly to intravenous diuretics or manifest diminished or worsening renal function. (Strength of Evidence = C) When adjunctive therapy is needed in other patients with ADHF, administration of vasodilators should be considered instead of intravenous inotropes (milrinone or dobutamine). (Strength of Evidence = B) Intravenous inotropes (milrinone or dobutamine) are not recommended unless left heart filling pressures are known to be elevated based on direct measurement or clear clinical signs. (Strength of Evidence = B) Administration of intravenous inotropes (milrinone or dobutamine) in the setting of ADHF should be accompanied by continuous or frequent blood pressure monitoring and continuous monitoring of cardiac rhythm. (Strength of Evidence = C) If symptomatic hypotension or worsening tachyarrhythmias develop during administration of these agents, discontinuation or dose reduction should be considered. (Strength of Evidence = C)	Intravenous inotropes (milrinone or dobutamine) may be considered to relieve symptoms and improve end-organ function in patients with advanced HF characterized by LV dilation, reduced LVEF, and diminished peripheral perfusion or end-organ dysfunction (low output syndrome), particularly if these patients have marginal systolic blood pressure (< 90 mm Hg), have symptomatic hypotension despite adequate filling pressure, or are unresponsive to, or intolerant of, intravenous vasodilators. (Strength of Evidence = C) These agents may be considered in similar patients with evidence of fluid overload if they respond poorly to intravenous diuretics or manifest diminished or worsening renal function. (Strength of Evidence = C) When adjunctive therapy is needed in other patients with ADHF, administration of vasodilators should be considered instead of intravenous inotropes (milrinone or dobutamine). (Strength of Evidence = C) Intravenous inotropes (milrinone or dobutamine) are not recommended unless left heart filling pressures are known to be elevated or cardiac index is severely impaired based on direct measurement or clear clinical signs. (Strength of Evidence = C) It is recommended that administration of intravenous inotropes (milrinone or dobutamine) in the setting of ADHF be accompanied by continuous or frequent blood pressure monitoring and continuous monitoring of cardiac rhythm. (Strength of Evidence = C) If symptomatic hypotension or worsening tachyarrhythmias develop during administration of these agents, discontinuation or dose reduction should be considered. (Strength of Evidence = C)	Modification of strength of evidence from B to C for portions of this recommendation Wording modified
12.21 (previous 12.19)	No changes		
12.22 (previous 12.20)	Invasive hemodynamic monitoring should be considered in a patient: Who is refractory to initial therapy, Whose volume status and cardiac filling pressures are unclear, Who has clinically significant hypotension (typically systolic blood pressure <80 mm Hg) or worsening renal function during therapy, or In whom documentation of an adequate hemodynamic response to the inotropic agent is necessary when chronic outpatient infusion is being considered. (Strength of Evidence = C)	Invasive hemodynamic monitoring should be considered in a patient: • who is refractory to initial therapy, • whose volume status and cardiac filling pressures are unclear, • who has clinically significant hypotension (typically SBP < 80mm Hg) or worsening renal function during therapy, or • who is being considered for cardiac transplant and needs assessment of degree and reversibility of pulmonary hypertension, or • in whom documentation of an adequate hemodynamic response to the inotropic agent is necessary when chronic outpatient infusion is being considered. (Strength of Evidence = C)	Addition of cardiac transplant as criterion for invasive hemodynamic monitoring
12.23 (previous 12.21)	No changes		
12.24 (previous 12.22)	It is recommended that every effort be made to use the hospital stay for assessment and improvement of patient compliance via patient and family education and social support services (Section 8). (Strength of Evidence = C)	It is recommended that every effort be made to use the hospital stay for assessment and improvement of patient adherence via patient and family education and social support services (see Section 8). (Strength of Evidence = B)	Modification of strength of evidence from C to B; change in terminology (“compliance” to “adherence”)

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Appendix A. (*continued*)

	2006 Guideline Recommendation	2010 Guideline Recommendation	Comments
12.25 (previous 12.23)	No changes		
12.26 (previous 12.24)	Discharge planning is recommended as part of the management of patients with ADHF. Discharge planning should address the following issues: • Details regarding medication, dietary sodium restriction, and recommended activity level • Follow-up by phone or clinic visit early after discharge to reassess volume status • Medication and dietary compliance • Monitoring of body weight, electrolytes, and renal function • Consideration of referral for formal disease management (Strength of Evidence = C)	Discharge planning is recommended as part of the management of patients with ADHF. Discharge planning should address the following issues: • Details regarding medication, dietary sodium restriction, and recommended activity level • Follow-up by phone or clinic visit early after discharge to reassess volume status • Medication and dietary compliance • Alcohol moderation and smoking cessation • Monitoring of body weight, electrolytes and renal function • Consideration of referral for formal disease management (Strength of Evidence = C)	Addition of alcohol moderation and smoking cessation
	Section 13: Evaluation and Therapy for Heart Failure in the Setting of Ischemic Heart Disease		
13.1	Assessment for risk factors for CAD is recommended in all patients with chronic HF regardless of EF. (Strength of Evidence = A) The diagnostic approach for CAD should be individualized based on patient preference and comorbidities, eligibility and willingness to perform revascularization. (Strength of Evidence = C)	Ongoing assessment for risk factors for CAD is recommended in all patients with chronic HF regardless of LVEF. (Strength of Evidence = A)	Moved diagnostic portion of recommendation to 13.2
13.2		It is recommended that the diagnostic approach for CAD be individualized based on patient preference and comorbidities, eligibility, symptoms suggestive of angina and willingness to undergo revascularization. (Strength of Evidence = C)	Previously part of 13.1
13.3 (previous 13.2)	It is recommended that patients with HF and angina undergo cardiac catheterization with coronary angiography to assess for potential revascularization. (Strength of Evidence = B)	It is recommended that patients with HF and symptoms suggestive of angina undergo cardiac catheterization with coronary angiography to assess for potential revascularization. (Strength of Evidence = B)	Modification of wording
13.4 (previous 13.3)	It is recommended that patients with HF, no angina, and known CAD should undergo noninvasive stress imaging and/or coronary angiography to assess severity of coronary disease and the presence of ischemia. (Strength of Evidence = C)	It is recommended that, at the initial diagnosis of HF and any time symptoms worsen without obvious cause, patients with HF, no angina, and known CAD should undergo risk assessment that may include noninvasive stress imaging and/or coronary angiography to assess severity of coronary disease and the presence of ischemia. (Strength of Evidence = C)	Clarification of type and timing of risk assessments
13.5 (previous 13.4)	No changes		
13.6 (previous 13.5)	No changes		

13.7 (previous 13.6)	Any of the following imaging tests may be used to identify inducible ischemia or viable but noncontractile myocardium: • Exercise or pharmacologic stress myocardial perfusion imaging • Exercise or pharmacologic stress echocardiography • Cardiac magnetic resonance imaging • Positron emission tomography scanning (Strength of Evidence = B)	Any of the following imaging tests should be considered to identify inducible ischemia or viable myocardium: • Exercise or pharmacologic stress myocardial perfusion imaging • Exercise or pharmacologic stress echocardiography • Cardiac magnetic resonance imaging • Positron emission tomography scanning (Strength of Evidence = B)	Modification of wording
13.8 (previous 13.7)	No changes		
13.9 (previous 13.8)	Antiplatelet therapy is recommended in patients with HF and CAD unless contraindicated. (Aspirin, Strength of Evidence = B; Clopidogrel, Strength of Evidence = C)	Antiplatelet therapy is recommended to reduce vascular events in patients with HF and CAD unless contraindicated. (aspirin, Strength of Evidence = A; clopidogrel, Strength of Evidence = B)	Addition of indication for antiplatelet therapy, and modification of strength of evidence
13.10 (previous 13.9)	ACE inhibitors are recommended in all patients with systolic dysfunction or preserved systolic function after an MI. (Strength of Evidence = A)	ACE inhibitors are recommended in all patients with either reduced or preserved LVEF after an MI. (Strength of Evidence = A)	Modification of terminology (''systolic dysfunction'' changed to ''reduced LVEF'')
13.11 (previous 13.10)	No changes		
13.12 (previous 13.11)	It is recommended that ACE-inhibitor and beta blocker therapy be initiated early (<48 hours) during hospitalization in hemodynamically stable post MI patients with LV dysfunction or HF. (Strength of Evidence = A)	It is recommended that ACE-inhibitor and beta blocker therapy be initiated early (<48 hours) during hospitalization in hemodynamically stable post-MI patients with reduced LVEF or HF. (Strength of Evidence = A)	Modification of terminology (''LV dysfunction'' changed to ''reduced LVEF'')
13.13 (previous 13.12)	No changes		
13.14 (previous 13.13)	Calcium channel blockers should be considered in patients with HF who have angina despite the optimal use of beta blockers and nitrates. Amlodipine and felodipine are the preferred calcium channel blockers in patients with angina and decreased systolic function. (Strength of Evidence = C)	Calcium channel blockers may be considered in patients with HF who have angina despite the optimal use of beta blockers and nitrates. Amlodipine and felodipine are the preferred calcium channel blockers in patients with angina and decreased systolic function. Based on available data, first generation calcium channel blockers (i.e. diltiazem, verapamil) should be avoided in patients with CAD, HF, and LVEF <40, unless necessary for heart rate control or other indications. (Strength of Evidence = C)	Addition of calcium channel blockers that should be avoided
13.15 (previous 13.14)	No changes		
13.16 (previous 13.15)	No changes		
	Section 14: Managing Patients with Hypertension and Heart Failure		
14.1	It is recommended that blood pressure be aggressively treated to lower systolic and usually diastolic levels. Target resting levels should be <130/<80 mm Hg, if tolerated. (Strength of Evidence = C)	It is recommended that blood pressure be optimally treated to lower systolic and usually diastolic levels. More than 1 drug may be required. Target resting levels should be <130/<80 mm Hg, if tolerated. (Strength of Evidence = A)	Modification of wording and change in strength of evidence from C to A

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	2006 Guideline Recommendation	2010 Guideline Recommendation	Comments
Previous 14.2			Deleted
14.2 (previous 14.3)	No changes		
14.3 (previous 14.4)	No changes		
14.4 (previous 14.5)	If BP remains >130/80 mm Hg then the addition of a diuretic is recommended, followed by a calcium antagonist or other antihypertensive drugs. (Strength of Evidence = C)	If blood pressure remains >130/80 mm Hg then the addition of a thiazide diuretic is recommended, followed by a dihydropyridine calcium antagonist (eg, amlodipine or felodipine) or other antihypertensive drugs. (Strength of Evidence = C)	Modified to specify thiazide diuretic or dihydropyridine calcium channel antagonist
14.5 (previous 14.6)	No changes		
14.6 (previous 14.7)	If blood pressure remains >130/80 mm Hg, a noncardiac-depressing calcium antagonist (eg, amlodipine) may be considered or other antihypertensive medication doses increased. (Strength of Evidence = C)	If blood pressure remains >130/80 mm Hg, a dihydropyridine calcium antagonist (eg, amlodipine or felodipine) may be considered or other antihypertensive medication doses increased. (Strength of Evidence = C)	Modified to specify dihydropyridine
	Section 15: Management of Heart Failure in Special Populations		
15.1	No changes		
15.2	No changes		
15.3	No changes		
15.4	No changes		
15.5	No changes		
15.6		ARBs are recommended for administration to symptomatic and asymptomatic women with an LVEF ≤ 40% who are intolerant to ACE inhibitors for reasons other than hyperkalemia or renal insufficiency. (Strength of Evidence = A)	New recommendation
15.7		The combination of hydralazine/isosorbide dinitrate is recommended as standard therapy for African American women with moderate to severe HF symptoms who are on background neurohormonal inhibition. (Strength of Evidence = B)	New recommendation
15.8 (previous 15.6)	No changes		

15.9 (previous 15.7)	No changes	
15.10 (previous 15.8)	No changes	
15.11 (previous 15.9)	No changes	
	Section 16: Myocarditis: Current Treatment	
16.1	No changes	
16.2	No changes	
	Section 17: Genetic Evaluation of Cardiomyopathy	New section

Appendix B. Acronyms

Acronym	Meaning
ACE	angiotensin converting enzyme
ADA	American Diabetes Association
ADHF	acute decompensated heart failure
AF	atrial fibrillation
AHA/ACC	American Heart Association/American College of Cardiology
ALVD	asymptomatic left ventricular dysfunction
ARB	angiotensin receptor blocker
ARVD/C	arrhythmogenic right ventricular dysplasia/ cardiomyopathy
AV	arteriovenous
BMI	body mass index
BNP	B-type natriuretic peptide
BUN	blood urea nitrogen
CABG	coronary artery bypass graft
CAD	coronary artery disease
CHD	congenital heart disease
CI	confidence interval
CK-MM	creatinine kinase MM isoenzyme
COPD	chronic obstructive pulmonary disease
COX-2	cyclooxygenase-2
CPAP	continuous positive airway pressure
CPR	cardiopulmonary resuscitation
CR/XL	controlled release/extended release
CREST	a limited cutaneous form of scleroderma defined by calsinosis, Raynaud's syndrome, esophageal dysmotility, sclerodactyly, and telangiectasia
CRT	cardiac resynchronization therapy
CRT-D	cardiac resynchronization therapy device and defibrillator
CTR	cardiothoracic ratio
DASH	Dietary Approaches to Stop Hypertension
DBP	diastolic blood pressure
DCM	dilated cardiomyopathy
DNR	do not resuscitate
DVT	deep venous thrombosis
ECG	electrocardiogram
ED	emergency department
EP, EPS	electrophysiology, electrophysiology study
EVCPP	endoventricular circular patch plasty
FDC	familial dilated cardiomyopathy
GFR, eGFR	glomerular filtration rate, estimated glomerular filtration rate
HCM	hypertrophic cardiomyopathy
HF	heart failure
HFSA	Heart Failure Society of America
HR	hazard ratio
ICD	implantable cardioverter defibrillator
INR	international normalized ratio
JVP	jugular venous pressure
LA	left atrial
LMWH	low molecular weight heparin
LV	left ventricular
LVAD	left ventricular assist device
LVEF	left ventricular ejection fraction
LVH	left ventricular hypertrophy
LVNC	left ventricular noncompaction
MI	myocardial infarction
MRI	magnetic resonance imaging
NCEP	National Cholesterol Education Program
NIV	non-invasive ventilation
NSAID	non-steroidal anti-inflammatory drug
NT-proBNP	N-terminal pro-B-type natriuretic peptide
NYHA	New York Heart Association
OMIM	Online Mendelian Inheritance in Man (online resource)
OU	observation unit
PCI	percutaneous coronary intervention
PCWP	pulmonary capillary wedge pressure
PE	pulmonary embolism
PET-CT	positron emission tomography − computed tomography
PMI	point of maximal impulse
PND	paroxysmal nocturnal dyspnea
PPAR-α	peroxisome proliferator-activated receptor-alpha
PUFA	polyunsaturated fatty acids
PVC	premature ventricular contraction
QTc	QT interval corrected for heart rate
RAAS	renin-angiotensin-aldosterone system
RCM	restrictive cardiomyopathy
RV	right ventricular
SAECG	signal-averaged electrocardiogram
SAVER	surgical anterior ventricular endocardial restoration
SBP	systolic blood pressure
SCD	sudden cardiac death
SDC	serum digoxin concentration
SPECT	single-photon emission computed tomography
SSRI	selective serotonin reuptake inhibitors
STEMI	ST-elevation myocardial infarction
TNF-α	tumor necrosis factor-alpha
UFH	unfractionated heparin
USDA	United States Department of Agriculture
VE/VCO_2	ventilation equivalent of carbon dioxide (production slope)
VF	ventricular fibrillation
VT	ventricular tachycardia
Clinical Trials	
Acronym	**Full Trial Name**
ACCOMPLISH	Avoiding Cardiovascular Events Through Combination Therapy in Patients Living with Systolic Hypertension
ADHERE	Acute Decompensated Heart Failure National Registry (Registry)
AFFIRM	Atrial Fibrillation Follow-Up Investigation of Rhythm Management
A-HeFT	African-American Heart Failure Trial
ALLHAT	Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial
ALOFT	Aliskiren Observation of Heart Failure Treatment
B-CONVINCED	Beta Blocker Continuation Versus Interruption on Patients with Congestive Heart Failure Hospitalized for a Decompensation Episode
CANPAP	Canadian Continuous Positive Airway Pressure for Patients with Central Sleep Apnea and Heart Failure
CAPRICORN	Carvedilol Post-Infarct Survival Control in Left Ventricular Dysfunction
CARE-HF	Cardiac Resynchronization-Heart Failure
CHARM	Candesartan in Heart Failure Assessment of Reduction in Mortality and Morbidity (Also CHARM-Added, CHARM-Alternative, CHARM-Preserved)
CIBIS	Cardiac Insufficiency Bisoprolol Study
COACH	Coordinating Study Evaluating Outcomes of Advising and Counseling in Heart Failure
COMET	Carvedilol or Metoprolol European Trial
COMPANION	Comparison of Medical Therapy, Pacing, and Defibrillation in Chronic Heart Failure
CONSENSUS II	Cooperative New Scandinavian Enalapril Survival Study II
COPERNICUS	Carvedilol Prospective Randomized Cumulative Survival Study
DIG	Digitalis Investigation Group
EFFECT	Enhanced Feedback for Effective Cardiac Treatment (Evaluation Tool)
EPHESUS	Epleronone Post-Acute Myocardial Infarction Heart Failure Efficacy and Survival Study
ESCAPE	Evaluation Study of Congestive Heart Failure and Pulmonary Artery Catheterization Effectiveness
EUROPA	European Trial on Reduction of Cardiac Events with Perindopril in Stable Coronary Artery Disease
FAIR-HF	Ferinject Assessment in Patients with Iron Deficiency and Chronic Heart Failure
GISSI	Gruppo Italiano Per Lo Studio Della Sopravvivenza Nell'infarto Miocardico (GISSI-Prevenzione, GISSI-HF)
GUSTO-1	Global Utilization of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries

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Appendix B. (*continued*)

HEART	Heart Failure Revascularization Trial
HELP	Hospitalized Elderly Longitudinal Project
HERS	Heart and Estrogen/Progestin Replacement Study
HF-ACTION	A Controlled Trial Investigating Outcomes of Exercise Training
HOBIPACE	Homburg Biventricular Pacing Evaluation
HOPE	Heart Outcomes Prevention Evaluation
HOT	Hypertension Optimal Treatment
INTERMACS	Interagency Registry for Mechanically Assisted Circulatory Support (Registry)
I-PRESERVE	Irbesartan in Heart Failure with Preserved Ejection Fraction
IRON-HF	Iron Supplementation in Heart Failure Patients with Anemia
ISIS-4	Fourth International Study of Infarct Survival
MADIT-CRT	Multi-Center Automatic Defibrillator Implantation Trial with Cardiac Resynchronization Therapy
MERIT-HF	Metoprolol CR?XL Randomized Intervention Trial in Congestive Heart Failure
MIRACLE	Multicenter Insync Clinical Study
MTT	Myocarditis Treatment Trial
MUSTT	Multicenter Unsustained Tachycardia Trial
NHANES	National Health and Nutrition Examination Survey Epidemiologic Follow-Up Study
OAT	Occluded Artery Trial
OPTIMAAL	Optimal Trial in Myocardial Infarction with the Angiotensin II Antagonist Losartan
OPTIME-HF	Outcomes of a Prospective Trial of Intravenous Milrinone for Exacerbations of Chronic Heart Failure
OPTIMIZE-HF	Organized Program to Initiate Lifesaving Treatment in Hospitalized Patients with Heart Failure (Registry)
PRIDE	N-Terminal Pro-BNP Investigation of Dyspnea in the Emergency Department
PRIMA	Can Pro-Brain-Natriuretic-Peptide Guided Therapy of Chronic Heart Failure Improve Heart Failure Morbidity and Mortality?
PROVED	Prospective Randomized Study of Ventricular Function and Efficacy of Digoxin
RADIANCE	Randomized Assessment of Digoxin on Inhibitors of the Angiotensin Converting System
RALES	Randomized Aldactone Evaluation Study
RED-HF	Reduction of Events with Darbepoetin Alfa in Heart Failure
REMATCH	Randomized Evaluation of Mechanical Assistance for the Treatment of Congestive Heart Failure
REVERSE	Resynchronization Reverses Remodeling in Systolic Left Ventricular Dysfunction
REVERT	Reversal of Ventricular Remodeling with Toprol-XL
SCD-HeFT	Sudden Cardiac Death in Heart Failure Trial
SENIORS	Study of the Effects of Nebivolol Intervention on Outcomes and Rehospitalization in Seniors with Heart Failure
SOLVD	Studies of Left Ventricular Dysfunction
STARS-BNP	Systolic Heart Failure Treatment Supported By BNP
STICH	Surgical Treatment for Ischemic Heart Failure
SUPPORT	Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatment
TIME-CHF	Trial of Intensified Vs Standard Medical Therapy in Elderly Patients with Congestive Heart Failure
UKPDS	United Kingdom Prospective Diabetes Study
Val-HeFT	Valsartan Heart Failure Trial
VALIANT	The Valsartan in Acute Myocardial Infarction Trial
V-HeFT	Vasodilator Heart Failure Trial
VMAC	Vasodilator in the Management of Acute Heart Failure
WASH	Warfarin/Aspirin Study in Heart Failure
WATCH	Warfarin and Antiplatelet Therapy in Chronic Heart Failure

Appendix C. Financial Disclosure

Name	Consulting Fees/Honoraria	Speaker's Bureau	Research Grants	Equity Interests/ Stock/Stock Options	Equity Interests	Royalty Income	Non-Royalty Payments	Other Financial Benefit	Salary	Intellectual Property Rights	Fellowship Support
Nancy M. Albert, R.N., Ph.D	Medtronic										
Inder S. Anand, M.D., Ph.D.	Amgen Pharmaceuticals, Boston Scientific, Corventis, CVRx, Merck, Medtronic, N30, Paracor	Novartis Pharma-ceuticals	CVRx, Novartis Pharmaceuticals, Paracor						VA Medical Center		
J. Malcolm O. Arnold, M.D.	Abbott, Boehringer Ingelheim, GlaxoSmithKline, Merck-Frosst, Novartis, Pfizer										
John P. Boehmer, M.D.	Boston, Scientific, Medtronic, St. Jude		Boston Scientific, CardioMEMS, Medtronic, Novartis, Paracor								
John C. Burnett, M.D.	Anexon, Nile Therapeutics, Otsuka		Anexon, Bayer, BioRad, Merck, Nile Therapeutics, Trevena			Anexon, Nile Therapeutics					
John Chin, M.D.	Gilead, Otsuka	Boston Scientific, Eli Lilly, Gilead, Novartis									
Jay N. Cohn, M.D.			GlaxoSmithKline	CPC, LLC	HDT, Inc.	MLHFQ, NitroMed					
Sean P. Collins, M.D., MSc	Abbott Point-of-Care, Astellas, Bayer, Corthera, The Medicines Company, Otsuka		Abbott Point-of-Care, BRAHMS Diagnostics, National Institutes of Health/NHLBI								
Justin A. Ezekowitz, MBBCh	Amgen, Bristol-Myers Squibb, Pfizer		Amgen, Bristol-Myers Squibb, Merck, Ortho-Biotech/Johnson & Johnson								
Thomas Force, M.D.		Merck Schering Plough/Merck						GlaxoSmithKline			
Bart Galle, Ph.D.	disclosures: none										

Michael M. Givertz, M.D.	Cardioxyl		Asahi Kasei								
Sarah J. Goodlin, M.D.	Servier		Boston Scientific CARE, St. Jude Medical Foundation								
Barry H. Greenberg, M.D.	Biogen Idec, CardioMEMS, Corthera, Cytokinetics, GlaxoSmithKline, Otsuka, Paracor, St. Jude, Zensun	Gilead, Merck, Novartis, sanofi-aventis									
Ray E. Hershberger, M.D.	disclosures: none										
Steven R. Houser, Ph.D.	disclosures: none										
Jonathan G. Howlett, M.D.	AstraZeneca, Merck, Novartis, Schering, Servier	AstraZeneca, Merck, Novartis, Schering, Servier	AstraZeneca, Medtronic, Merck, Novartis, Schering, Servier								
Sharon A. Hunt, M.D.	disclosures: none										
Mariell Jessup, M.D.	Medtronic	Boston Scientific									
Stuart D. Katz, M.D.	Amgen, Dura Heart Terumo, Merck, Paracor										
Marc Klapholz, M.D.	GlaxoSmithKline, Medtronic, Paracor, St. Jude, Schering	GlaxoSmithKline									
Marvin W. Kronenberg, M.D.				Cardiovascular Services of America							
JoAnn Lindenfeld, M.D.	Astellas, Boston Scientific, Forest, Medtronic, N30		Merck								
Douglas L. Mann, M.D.	ARMGO Pharmaceuticals, Medtronic, Miragen, Nile Therapeutics, PeriCor Therapeutics				Miragen						

(*continued on next page*)

Appendix C. (*continued*)

Name	Consulting Fees/Honoraria	Speaker's Bureau	Research Grants	Equity Interests/ Stock/Stock Options	Equity Interests	Royalty Income	Non-Royalty Payments	Other Financial Benefit	Salary	Intellectual Property Rights	Fellowship Support
Barry M. Massie, M.D.	ARCA, Boehringer, Bristol-Myers Squibb, Corthera, Cytokinetics, Duke Clinical Research Institute, Merck, Nile Therapeutics, Novartis, sanofi-aventis, St. Jude, Takeda, Trevena	Merck									
Mandeep R. Mehra, M.D.	Geron, Johnson & Johnson, Medtronic, Pericor, Solvay, St. Jude		National Institutes of Health								
Luisa Mestroni, M.D.		M01 RR00051-1575						University of Colorado (employee)			
Alan B. Miller, M.D.	disclosures: none										
Debra K. Moser, R.N., DNSc.	disclosures: none										
Mariann R. Piano, R.N., Ph.D.	disclosures: none										
Richard J. Rodeheffer, M.D.	disclosures: none										
Joseph G. Rogers, M.D.	Forrest Pharmaceuticals, Thoratec	Boston Scientific, Medtronic									
Christine E. Seidman, M.D.			HHMI & NIH								
Randall C. Starling, M.D., MPH	BioControl, Medtronic, Novartis		Biotronik, Medtronic, Novartis, Thoratec	CardioMEMS							Medtronic
William G. Stevenson, M.D.	disclosures: none										

Wendy Gattis Stough, Pharm.D.	ARCA Discovery, Inc., Gilead Sciences, Inc., GlaxoSmithKlline, Heart Failure Society of America, Medtronic, Otsuka, Scios										
W.H. Wilson Tang, M.D.	Medtronic, Merck & Company		Abbott Laboratories								
Matthew R.G. Taylor, M.D., Ph.D.		Genzyme Therapeutics	Muscular Dystrophy Association/March of Dimes/Genzyme Therapeutics								
John R. Teerlink, M.D.	Abbott Laboratories, BAS Medical/ Corthera, Biogen Idec, Bristol-Myers Squibb, CardioDynamics, CardioMEMS, CoGeneSys, Cytokinetics, Geron, GlaxoSmithKline, Icon Medical Imaging, Indigo Pharma, Kowa Pharma, Luitpold Pharma, Merck, Momentum Research, Nile Therapeutics, Novartis, sanofi-aventis, Scios/ Johnson & Johnson		Abbott Laboratories, BAS Medical/Corthera, Bristol-Myers Squibb, Cytokinetics, GlaxoSmithKline, Merck, National Institutes of Health, Novartis, sanofi-aventis	Cytokinetics							
Jeffery A. Towbin, M.D.	disclosure: none										
Mary N. Walsh, M.D.	ARCA, Boston Scientific, EMERGE, Medtronic, United Health Care										
Clyde W. Yancy, M.D.	disclosures: none										
Cheryl Yano	disclosures: none										
Michael R. Zile, M.D.	ABIM, BMS, CorAssist, CVRx, DC Devices, Gilead, Medtronic, Merck, N30, Novartis, OCD/J&J, sanofi-aventis, Up-To-Date		BMS, Boston, Scientific, CVRx, Department of VA, Gilead, Medtronic, Merck, National Heart, Lung and Blood Institute, Novartis, OCD/J&J, Pfizer, sanofi-aventis						Department of VA, MUSC, National Heart, Lung and Blood Institute	MUSC, OCD/ J&J	