These guidelines have been withdrawn

MOH clinical practice guidelines are considered withdrawn five years after publication unless otherwise specified in individual guidelines. Users should keep in mind that evidence-based guidelines are only as current as the evidence that supports them and new evidence can supersede recommendations made in the guidelines.

CLINICAL PRACTICE GUIDELINES

Heart Failure

Singapore Heart Foundation

Singapore Cardiac Society

Ministry of Health

National Committee on Cardiac Care

Aug 2004

MOH Clinical Practice Guidelines 7/2004

Levels of evidence and grades of recommendation

Levels of evidence

Level	Type of Evidence
Ia	Evidence obtained from meta-analysis of randomised controlled trials.
Ib	Evidence obtained from at least one randomised controlled trial.
IIa	Evidence obtained from at least one well-designed controlled study without randomisation.
IIb	Evidence obtained from at least one other type of well-designed quasi-experimental study.
III	Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies and case studies.
IV	Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities.

Grades of recommendation

Grade	Recommendation
A (evidence levels Ia, Ib)	Requires at least one randomised controlled trial, as part of the body of literature of overall good quality and consistency, addressing the specific recommendation.
B (evidence levels IIa, IIb, III)	Requires availability of well conducted clinical studies, but no randomised clinical trials on the topic of recommendation.
C (evidence level IV)	Requires evidence obtained from expert committee reports or opinions, and/or clinical experiences of respected authorities. Indicates absence of directly applicable clinical studies of good quality.
GPP (good practice points)	Recommended best practice based on the clinical experience of the guideline development group.

CLINICAL PRACTICE GUIDELINES

Heart Failure

MOH Clinical Practice Guidelines 7/2004

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Statement of Intent

These guidelines are not intended to serve as a standard of medical care. Standards of medical care are determined on the basis of all clinical data available for an individual case and are subject to change as scientific knowledge advances and patterns of care evolve.

The contents of this publication are guidelines to clinical practice, based on the best available evidence at the time of development. Adherence to these guidelines may not ensure a successful outcome in every case. These guidelines should neither be construed as including all proper methods of care, nor exclude other acceptable methods of care. Each physician is ultimately responsible for the management of his/her unique patient, in the light of the clinical data presented by the patient and the diagnostic and treatment options available.

Foreword

Congestive heart failure accounts for 4.5% of all hospital admissions and 2.5% of overall mortality in the elderly in Singapore.* Coronary artery disease is the commonest cause of heart failure, followed by other causes such as hypertension, valvular heart disease and cardiomyopathy. With advances in medical treatment, there is greater survival after conditions like heart attacks and this means an enlarged population at risk of heart failure.

This set of guidelines has sections addressing the diagnosis and management of heart failure, including drug therapy, treatment of arrhythmias, surgery and psychosocial aspects of heart failure.

I hope you will find these guidelines of assistance in managing your patients with heart failure.

PROFESSOR K SATKU
DIRECTOR OF MEDICAL SERVICES

* Ng TP, Niti M. Trends and ethnic differences in hospital admissions and mortality for congestive heart failure in the elderly in Singapore, 1991 to 1998. Heart. 2003 Aug;89(8):865-70.

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Executive summary of recommendations

Details of recommendations can be found in the main text at the pages indicated.

Diagnostic Evaluation of Heart Failure

C Tests and procedures recommended for all patients

- Comprehensive history and physical examination
- FBC, urinalysis, electrolytes, renal function, glucose, liver function
- ECG
- Chest X-ray
- Echocardiography

(pg 19) **Grade C, Level IV**

C Tests and procedures recommended for selected patient subsets

- Cardiac enzymes and troponins in acute heart failure.
- Noninvasive stress imaging in patients with suspected coronary disease.
- Coronary angiography in patients with suspected coronary artery disease but without angina.
- Specialized blood screens in patients suspected to have an uncommon cause of heart failure: thyroid screen, collagen disease screen, hemochromatosis screen, pheochromocytoma screen, HIV.
- Endomyocardial biopsy in patients with suspected myocarditis or an infiltrative disorder.

(pg 19) **Grade C, Level IV**

C **Tests and procedures not recommended**

- Routine ambulatory ECG monitoring
- Routine determination of neurohormone levels
- Coronary angiography in patients who are not candidates for revascularization
- Routine endomyocardial biopsy

(pg 20) **Grade C, Level IV**

Drug Therapy in Heart Failure

A Angiotensin-converting enzyme (ACE) inhibitors are standard therapy for patients with left ventricular dysfunction, with or without symptomatic heart failure. (pg 21)

Grade A, Level Ib

A Dosages of ACE inhibitors should be titrated to levels comparable to those used in clinical trials. (pg 21)

Grade A, Level Ib

A Patients with symptomatic heart failure who are ACE inhibitor intolerant should be treated with an angiotensin-II receptor blocker (ARB). (pg 21)

Grade A, Level Ib

A Patients with symptomatic heart failure who are treated with ACE inhibitors should be considered for additional therapy with an ARB. (pg 21)

Grade A, Level Ib

A Beta-blockers should be standard therapy for clinically stable patients with left ventricular systolic dysfunction (LVEF < 40%) and mild to moderate heart failure symptoms (NYHA class II-III). (pg 22)

Grade A, Level Ib

GPP Beta-blocker therapy should be started with low doses, and up-titrated slowly (no sooner than at 2-weekly intervals). (pg 22)

GPP

A If clinically euvolemic, patients with symptoms of heart failure at rest (NYHA class IV) can be considered for beta-blocker therapy. (pg 22)

Grade A, Level Ib

A Low dose (12.5 mg to 25 mg once daily) use of spironolactone should be considered for patients on standard therapy who have severe heart failure symptoms (NYHA class III-IV). (pg 22)

Grade A, Level Ib

A Patients with contraindications to more effective agents can be considered for treatment with the combination of hydralazine and isosorbide dinitrate. (pg 22)

Grade A, Level Ib

A Digoxin can be considered for patients with symptomatic heart failure (NYHA class II-IV) who are on standard therapy. (pg 23)

Grade A, Level Ib

A In the majority of patients, there is no need to up-titrate the dosage of digoxin according to serum digoxin concentration. (pg 23)

Grade A, Level Ib

A All patients with heart failure and atrial fibrillation should be treated with warfarin (target INR 2.0-3.0) unless contraindicated. (pg 23)

Grade A, Level Ia

B Warfarin anticoagulation may be considered for selected patients with left ventricular ejection fraction ≤ 35%.(pg 23)

Grade B, Level III

A There is no indication for the use of calcium channel antagonists to specifically treat heart failure. (pg 23)

Grade A, Level Ib

A Amlodipine may be used in patients with symptomatic heart failure who require its concomitant use for the management of angina or hypertension. (pg 23)

Grade A, Level Ib

A Other than digoxin, oral positive inotropic drugs should not be used to treat heart failure. (pg 23)

Grade A, Level Ia

A Long-term or intermittent intravenous infusions of positive inotropic drugs should not be used routinely in the treatment of heart failure. (pg 24)

Grade A, Level Ib

Therapy for Arrhythmias in Heart Failure

A In patients with atrial fibrillation and heart failure, achievement of heart rate control and full anticoagulation is recommended for optimal heart failure management. The rate can be controlled with beta-blockers, amiodarone or digoxin, either alone or in combination, or atrioventricular nodal ablation and permanent pacemaker insertion. (pg 25)

Grade A, Level Ib

A Patients with heart failure and atrial fibrillation should not be treated with class I antiarrhythmic drugs such as procainamide, quinidine, propafenone, and flecainide because of concern with pro-arrhythmia and increased mortality. Amiodarone is effective and the drug of choice for maintaining sinus rhythm after successful cardioversion. (pg 25)

Grade A, Level Ib

C In patients with atrial fibrillation and heart failure, cardioversion may be clinically indicated, after adequate anticoagulation, for control of symptoms and hemodynamic improvement. (pg 25)

Grade C, Level IV

A Patients surviving cardiac arrest or symptomatic sustained ventricular tachycardia (not within three days of acute myocardial infarction or any correctable cause) and with LVEF < 35% should be considered for an implantable cardioverter defibrillator (ICD). (pg 25)

Grade A, Level Ib

A Patients who have had previous myocardial infarction with left ventricular dysfunction (LVEF ≤ 35%) and asymptomatic spontaneous nonsustained ventricular tachycardia, and who would be suitable candidates for an ICD should undergo an invasive electrophysiological study to determine the inducibility of ventricular arrhythmias. If sustained ventricular tachycardia or ventricular fibrillation is induced, the patient should be considered for an ICD. (pg 26)

Grade A, Level Ib

A Selected patients with previous myocardial infarction and with an LVEF < 30% may be considered for an ICD. (pg 26)

Grade A, Level Ib

A For heart failure patients with symptomatic ventricular arrhythmias who do not qualify for an ICD implantation, amiodarone and beta-blockers are the current antiarrhythmic alternatives. (pg 26)

Grade A, Level Ib

A For heart failure patients with ventricular arrhythmias, class I antiarrhythmic drugs should not be used. (pg 26)

Grade A, Level Ib

A In patients with asymptomatic ventricular arrhythmia, amiodarone has little overall effect on all cause mortality or the combined risk of death or hospitalization for heart failure except possibly in patients with nonischemic cardiomyopathy. (pg 26)

Grade A, Level Ib

A Pacemakers may be used in patients who undergo atrioventricular node ablation for rapid atrial fibrillation associated with a tachycardia cardiomyopathy and heart failure. (pg 27)

Grade A, Level Ia

C Pacemakers may be used in patients with heart failure to correct a bradycardia which occurs spontaneously or while on drug therapy necessary for heart failure. (pg 27)

Grade C, Level IV

A Resynchronization therapy with biventricular pacemakers may be indicated in patients with widened QRS ≥ 130 ms, LV end diastolic diameter ≥ 55mm, and LVEF ≤ 35%, who remain symptomatic (NYHA Class III-IV), while on optimal drug therapy. (pg 27)

Grade A, Level Ib

Surgical Management of Heart Failure

B Heart transplantation is the only accepted therapeutic surgical modality for treatment of end stage heart failure. (pg 28)

Grade B, Level III

B Coronary artery bypass surgery is indicated in patients with ischemic cardiomyopathy, presenting with heart failure, provided reversibility of ischemic myocardium can be demonstrated by stress echocardiography or radio-isotope myocardial imaging. (pg 29)

Grade B, Level III

B Mitral valve repair or replacement has been shown to provide clinical and hemodynamic improvements in selected patients who develop significant mitral regurgitation secondary to left ventricular dilatation. (pg 29)

Grade B, Level III

B Left ventricular remodeling surgery, which involves excision and/or exclusion of infarcted myocardial segments, and correction of left ventricular volume and shape, may be considered in selected patients. (pg 29)

Grade B, Level III

B Mechanical ventricular assist devices may be used as a bridge to transplantation, to support patients with end stage heart failure awaiting transplantation. (pg 30)

Grade B, Level IIa

C Current indications for mechanical heart devices include cardiogenic shock following heart surgery, myocarditis, and myocardial infarction. They are used either to support the circulation until recovery, or as a bridge to transplantation provided the patients are transplantable candidates. (pg 30)

Grade C, Level IV

A An implantable left ventricular assist device is an acceptable alternative permanent therapy in selected patients who are not candidates for heart transplantation. (pg 30)

Grade A, Level Ib

Psychosocial Aspect of Heart Failure

B Depression may be identified by asking two simple screening questions: (1) In the past month, have you often been bothered by feeling down, depressed or hopeless? (2) For the past month, have you had little interest or pleasure in doing things? (pg 32)

Grade B, Level III

A Selective serotonin receptor uptake inhibitors are the drugs of choice for treatment of depression in heart failure. (pg 32)

Grade A, Level Ib

GPP Counseling patients in adaptive coping skills, providing more information about heart failure, and promoting medication compliance may improve the prognosis of patients. (pg 32)

GPP

GPP When to refer to a cardiologist

1. Presence of significant valvular heart disease
2. Presence of frequent/symptomatic arrhythmias
3. Presence of hypertrophic cardiomyopathy
4. Presence of significant/unstable angina pectoris
5. Suspected diastolic heart failure
6. Uncertainty about management

(pg 43) **GPP**

GPP When should patients be hospitalized?

1. Onset of acute myocardial ischemia
2. Pulmonary edema or acute respiratory distress
3. Generalized edema (anasarca)
4. Heart failure refractory to outpatient treatment
5. Cyanosis or desaturation not attributable to lung disease
6. Symptomatic hypotension with fluid overload

(pg 43) **GPP**

GPP Lifestyle changes and self-care for patients

1. Dietary salt restriction (2-3 grams daily)
2. Fluid management/restriction
3. Daily weight monitoring (avoid gains of > 2 kg within 1 week)
4. Exercise
   (a) regular low-moderate intensity aerobic (endurance) exercise
   (b) avoid lifting objects heavier than 10 kg
   (c) schedule adequate rest periods between exercise/work
5. General preventive strategies
   (a) scheduled medical reviews
   (b) influenza immunization
   (c) smoking cessation
   (d) alcohol cessation
   (e) stress management
   (f) reduce dietary fat and cholesterol
   (g) optimally treat comorbidities, e.g. anemia, renal impairment, diabetes

   (pg 43)
6. Learn to monitor and report signs and symptoms of deterioration
   (a) excessive weight gain (>2 kg/week)
   (b) angina pectoris
   (c) increasing breathlessness or fatigue
   (d) dizziness or fainting
   (e) swelling of legs or abdomen
   (f) excessively fast heart rate (>120/min)

   (pg 44) **GPP**

1 Overview

1.1 Definition and some causes

Heart failure is a clinical syndrome that results from any structural or functional cardiac disorder that impairs the ability of the ventricle to fill with or eject blood to adequately meet the needs of the body. The syndrome is characterized by symptoms and signs of increased tissue water and decreased tissue perfusion, chiefly edema, breathlessness, reduced exercise tolerance, and fatigue.

Heart failure may be caused by numerous diseases affecting the cardiovascular system, but the most important and common causes are coronary heart disease, hypertension, valvular heart disease, and cardiomyopathy.

1.2 Burgeoning importance

Heart failure is assuming vast importance especially in societies where the aging population is growing rapidly in size. Advances in medical treatment, leading to greater survival after conditions such as acute myocardial infarction, have enlarged the population at risk. Nearly 1% of people in their 50s and 10% of people in their 80s suffer from heart failure. These trends have a huge impact on the planning and allocation of limited health care resources. For this reason, guidelines which may help to optimize the management of heart failure among health care professionals are useful tools for improving outcomes, both medical and societal.

1.3 Impact on the individual

For the individual, the prognosis of heart failure is generally poor. Within 4 years of initial diagnosis, 52% of men and 34% of women sufferers will have died. In longevity terms, the median survival of heart failure patients is 1.7 years in men and 3.2 years in women after diagnosis. Heart failure is a common reason for hospitalization, especially in elderly patients. Furthermore, almost half of elderly patients treated for heart failure in hospital will be readmitted within 3 months of initial discharge. Heart failure greatly affects the health-related quality of life, severely impacting daily activities, work, relationships, and psychological well-being.

1.4 Social burden

Communities, with large and growing populations of persons burdened with heart failure, also carry an enormous social burden. The cost of caring for patients with heart failure in clinics, hospitals, specialized services and at home is high and increasing. This has compelled administrators and health economists to scrutinize the cost-effectiveness of new techniques, therapies and technologies before adoption and implementation.

1.5 Prognosis

For many societies, especially aging ones, the prognosis for the healthcare system in regard to the looming heart failure epidemic appears as grave as that for the disease. Unless new modalities and measures are wisely applied, to decrease morbidity and mortality at bearable costs, severe inequities and deficiencies in the management of heart failure in the community will be inevitable.

1.6 Guidelines

Clinical practice guidelines have been used as a measure with the potential to improve care by providing well-founded information on best practices. Although this potential is as yet unproven, guidelines provide clear statements to assist practitioners and patients to decide on the most appropriate management modalities for widely varying clinical situations in the real world.

For recommendations to be accepted and applied, they must be precise, clear, appropriate, practical and validated. We have leaned on the side of brevity so as to achieve greater useability, believing that it is better to make and implement a few important recommendations, than to be exhaustive.

Evidence-based clinical practice guidelines are only as current as the evidence that supports them. Users must keep in mind that new evidence could supersede recommendations in these guidelines. The workgroup advises that these guidelines be scheduled for review two to three years after publication, or if new evidence appears that requires substantive changes to the recommendations.

2 Diagnostic Evaluation of Heart Failure

Heart failure is a clinical syndrome that results from any structural or functional cardiac disorder that impairs the ability of the ventricle to fill with or eject blood to adequately meet the needs of the body. The syndrome is characterized by symptoms and signs of increased tissue water and decreased tissue perfusion, chiefly edema, breathlessness, reduced exercise tolerance, and fatigue. The diagnosis is often but not always obvious on clinical examination, and laboratory testing is frequently employed for further evaluation.

In the initial as well as ongoing clinical assessment of the patient with suspected or documented heart failure, there are three main parts:

- an assessment of functional capacity;
- an assessment of volume status;
- laboratory-based diagnostic evaluation.

The main objectives of diagnostic evaluation in heart failure are to:

- help confirm the clinical diagnosis
- identify the structural abnormality and specific etiology
- identify the type and severity of cardiac dysfunction
- provide information on prognosis
- help guide therapy

2.1 Investigations to help confirm the clinical diagnosis of heart failure

Heart failure is principally a clinical diagnosis. The patient typically presents with shortness of breath, fatigue, orthopnea, leg swelling or other evidence for fluid retention. Physical examination usually reveals one or more of the following: elevated jugular venous pressure, gallop rhythm, lung crackles, liver congestion, and dependent edema.

Important differential diagnoses include chronic obstructive lung disease, fluid overload states (e.g. chronic renal failure), and pulmonary embolism.

Left ventricular dysfunction is sometimes discovered in an asymptomatic individual who may or may not have had previous myocardial infarction. It is important to identify the asymptomatic

patient because treatment can reduce the risk of future development of heart failure and slow or reverse left ventricular dilatation.

Investigations helpful in confirming a diagnosis of heart failure include chest X-ray, echocardiography, and plasma B-type natriuretic peptide.

Chest X-ray
Pulmonary congestion (bilateral upper lobe venous diversion, interstitial edema or alveolar edema) is compatible with a diagnosis of congestive heart failure, but does not exclude fluid overload due to non-cardiac causes. These findings are present in most patients with acute heart failure but absent in many with chronic heart failure.

Echocardiography
This may show left ventricular and/or right ventricular systolic dysfunction, or diastolic dysfunction.

Plasma B-type natriuretic peptide (BNP)
BNP is a peptide hormone secreted by ventricular myocytes, which plays a key role in volume homeostasis. The plasma concentration of BNP reflects ventricular pressure, and is raised in heart failure. A rapid BNP test is now commercially available. Measurement of BNP has been shown to be helpful in excluding the diagnosis of heart failure in patients with dyspnea or fluid retention. The value of BNP may reside in its very high negative predictive value, i.e. a negative assay indicates that the cause of dyspnea is highly unlikely to be heart failure.

2.2 Investigations to identify the structural abnormality and specific etiology

A complete history and physical examination are the initial steps in evaluating the structural cause for heart failure. Confirmation of the suspected etiology will usually require cardiac imaging.

Investigations for a specific etiology of heart failure should focus on potentially reversible causes of left ventricular dysfunction. Coronary artery disease is the commonest such cause, and must be excluded in patients with atherosclerotic risk factors, regardless of symptoms. Severe left ventricular systolic dysfunction due to coronary artery

disease may reflect the reversible effects of intermittent or prolonged ischemia (myocardial “stunning" or "hibernation"). Myocardial revascularization has been shown to effect significant improvement in ejection fraction (EF) even with pre-treatment levels below 20%. Other reversible causes of heart failure include valvular heart disease and tachycardia-related cardiomyopathy (most often encountered in patients with uncontrolled atrial fibrillation rates). In the absence of an overt cause for heart failure, clinical judgment is required as to the extent to which rare diagnoses are pursued.

ECG and chest X-ray

Although frequently done, the 12-lead ECG will often not identify the underlying cardiac abnormality responsible for heart failure, being both insensitive and non-specific. Pathological Q waves may suggest coronary artery disease, but may also be present in non-ischemic cardiomyopathy. Arrhythmias identified may be the cause or precipitant of heart failure. Like the ECG, the chest X-ray will often not identify the precise etiology of heart failure.

Echocardiography

Echocardiography is readily available, relatively inexpensive, safe, and the most versatile diagnostic test for the evaluation of heart failure. Two-dimensional and Doppler echocardiography can be used to assess cardiac morphology, global and regional function, and will identify obvious causes for heart failure, whether of myocardial, valvular or pericardial origin. Exercise or pharmacologic (e.g. dobutamine) stress echocardiography is useful for detecting ischemia. Dobutamine Echo is also helpful for determining myocardial viability.

Radionuclide studies

Radionuclide imaging cannot provide detailed information on abnormalities of cardiac structure, and its main role is in detection of ischemia underlying heart failure. Treadmill stress myocardial perfusion imaging is recommended in patients able to exercise, and pharmacologic (dipyridamole or dobutamine) stress for those unable to. The distinction between ischemic and non-ischemic cardiomyopathy may not always be clear, since many patients with the latter have segmental wall motion and perfusion abnormalities. Thallium scintigraphy has an important role for assessing myocardial viability, while technetium-99m sestamibi appears less useful.

Magnetic resonance imaging (MRI)

MRI is an excellent tool for detecting cardiac structural abnormality. At present, it is the most accurate and reproducible method for measurement of cardiac volumes, wall thicknesses and left ventricular mass. MRI can be used to quantitate myocardial necrosis, perfusion and function. As MRI is much more costly than echocardiography, its routine use for investigating heart failure is not recommended. Specific conditions where MRI may provide information additional to echocardiography include cardiac masses, complex congenital heart disease, and pericardial disease. The role of MRI may expand in future.

Computed tomography (CT)

Compared to echocardiography and MRI, CT has a more limited role in the evaluation of patients with heart failure. Disadvantages include exposure to ionizing radiation and need for intravenous contrast. Its major application is in pericardial imaging, where its superior ability to detect calcification is an advantage over MRI. The ability of ultrafast CT techniques, i.e. electron beam CT (EBCT), to noninvasively detect coronary artery calcification, suggests a potential role in distinguishing ischemic from non-ischemic cardiomyopathies.

Coronary angiography and cardiac catheterization

Coronary angiography is the current gold standard method for demonstrating coronary artery disease. It is indicated in heart failure patients who have angina, previous myocardial infarction, or high risk for coronary artery disease. It is also indicated when coronary disease cannot be reliably or safely assessed by other methods. Noninvasive testing is preferred for evaluating heart failure patients who do not have angina and are at low risk for coronary disease. Cardiac catheterization is no longer routinely performed for the evaluation of structural cardiac disease, including valvulopathy, unless noninvasive testing is inconclusive.

Endomyocardial biopsy (EMB)

Although EMB is required to prove the diagnosis of acute myocarditis as a cause of heart failure, the yield of EMB is low, and the finding of active inflammation may not predict response to immunosupressive therapy. EMB is useful to diagnose some rare forms of cardiomyopathy or infiltrative heart disease.

2.3 Investigations to identify the type and severity of cardiac dysfunction

Most patients with heart failure have left ventricular systolic dysfunction, with ejection fraction below 45%. This results from any pathological process impairing myocardial contractility, most commonly coronary artery disease.

When heart failure is accompanied by a predominant or isolated abnormality of left ventricular diastolic function, the resulting syndrome is termed diastolic heart failure. Diastolic heart failure results from inability of the left ventricle to maintain normal diastolic filling to generate an appropriate stroke volume, due either to a decrease in left ventricular relaxation and/or increase in left ventricular stiffness.

Diastolic dysfunction is reportedly the primary mechanism of heart failure in up to 40% of hospitalized patients. The typical patient is an elderly female with a history of hypertension and/or coronary artery disease. Rarely, myocardial disorders causing predominant diastolic dysfunction are encountered, e.g. hypertrophic and restrictive cardiomyopathies. When restrictive cardiomyopathy is suspected, constrictive pericarditis, a surgically treatable cause of heart failure, must be excluded.

Echocardiography

Echocardiography is the most practical method for assessing global and regional left ventricular systolic function. Although there are many parameters of systolic function, ejection fraction is most frequently reported. Ejection fraction is a measure of the stroke output of the left ventricle and is used as a convenient surrogate for global myocardial contractility.

There are some important limitations in utilizing ejection fraction as a measure of severity. Since it is highly influenced by preload and afterload, the ejection fraction may be "normal" in the setting of severe mitral regurgitation when there may already be significant left ventricular dysfunction, or conversely reduced in severe aortic stenosis even though myocardial contractility is preserved. The ejection fraction has a poor correlation with the severity of heart failure symptoms. Patients with ejection fraction below 20% may be

asymptomatic, while those with preserved ejection fraction may have severe disability. This discordance may be related to the absence/presence of diastolic dysfunction.

Evaluation of diastolic dysfunction by echocardiography is complex. Guidelines for making the diagnosis have recently been published. In clinical practice, the diagnosis of diastolic heart failure is usually predicated on typical symptoms and signs of heart failure in a patient with normal ejection fraction and no valvular or pericardial abnormalities.

Radionuclide studies

Global and regional left ventricular function can be assessed using radionuclide ventriculography (MUGA scan). This provides accurate and reproducible measures of ejection fraction, and is preferred when echographic images are suboptimal.

Magnetic resonance imaging and computerized tomography

Both systolic and diastolic function can be assessed using these techniques. They are not routinely recommended for this purpose because of the greater availability and cost-efficiency of echocardiography.

Cardiac catheterization

Left ventriculography provides information on global and regional left ventricular function, and is often performed during coronary angiography. Specialized catheterization techniques also permit assessment of left ventricular diastolic function. Although invasive measures of diastolic function are still considered the gold-standard, in practice, the role of catheterization has largely been supplanted by echocardiography.

Tests with limited utility

The ECG and chest X-ray have little utility for determining cardiac function. However, it is helpful to note that patients with suspected coronary artery disease and a normal ECG are highly unlikely to have left ventricular systolic dysfunction (negative predictive value >90%). BNP levels cannot reliably distinguish systolic from diastolic heart failure.

2.4 Investigations to provide information on prognosis

Clinically-evident predictors of increased risk in heart failure are advanced age, male gender and poor exercise tolerance. Important laboratory determinants of prognosis in heart failure include left ventricular systolic dysfunction, presence of reversible ischemia and presence of viable myocardium. Tests that evaluate left ventricular function, screen for underlying coronary artery disease, and determine the extent of viable or hibernating myocardium are therefore helpful in risk stratifying patients with heart failure.

Echocardiography

Ejection fraction, assessed by echocardiography or other methods, is the most consistent and important predictor of ventricular dysrhythmia, mortality and sudden cardiac death in patients with heart failure, whether of ischemic or non-ischemic origin. Reduced ejection fraction does not however predict sudden cardiac death in all patients as factors other than myocardial damage and scarring may be important in arrhythmogenesis. Prognostication in heart failure can be refined by incorporating measures of diastolic function.

Radionuclide studies

There is a strong association between viable myocardium detected by radionuclide techniques (or dobutamine echocardiography) and improved survival after revascularization in patients with ischemic cardiomyopathy. Conversely, conservative treatment of ischemic viable myocardium is associated with poor outcomes.

Ambulatory ECG

Approximately half of heart failure related deaths are sudden, and presumably due to ventricular arrhythmias. In heart failure patients, ambulatory ECG recordings show a high prevalence of couplets and multiform ventricular ectopics (up to 85%) and non-sustained ventricular tachycardia - NSVT (55%). Whether NSVT is an independent marker of sudden cardiac death is controversial. Ambulatory ECG recordings can also provide information on heart rate variability (HRV). HRV is a marker of autonomic balance and is reduced in heart failure. Low HRV has been shown to independently predict total mortality and sudden cardiac death in both ischemic and non-ischemic dilated cardiomyopathy. While promising, the value of this test in clinical practice remains to be determined. Currently, the

use of ambulatory ECG in heart failure should be restricted to patients with symptomatic arrhythmias.

Plasma B-type natriuretic peptide (BNP)
BNP levels correlate with clinical heart failure severity scores, and independently predict mortality and sudden cardiac death.

Plasma sodium
Studies in patients with severe heart failure indicate that plasma sodium level is a strong predictor of death or cardiac transplantation.

Neurohormones
Various neurohormonal systems are activated in chronic heart failure, including the sympathetic nervous, renin-angiotensin-aldosterone and endothelin systems. Many current therapies aim to modulate their activity. Some studies have demonstrated a prognostic role for noradrenaline and endothelin assays, but their broader clinical application is precluded by inadequate predictive accuracy in individual patients, variability with age, and the confounding influence of drug therapy.

Peak exercise myocardial oxygen consumption (VO_2)
Peak VO_2 measured during exercise is a noninvasive index of peak exercise cardiac output. Peak exercise VO_2 is considered to have important prognostic value. One study suggested that cardiac transplantation can safely be deferred in ambulatory patients with severe left ventricular dysfunction and peak exercise VO_2 exceeding 14 ml/kg/min. Beta-blockers can reduce peak VO_2, and thresholds should be interpreted accordingly. In general, a peak VO_2 below 10 ml/kg/min identifies patients at high risk of adverse outcomes, and peak VO_2 above 18 ml/kg/min those at low risk. The 6-minute walk test, a simpler measure of functional capacity, correlates with peak VO_2 and predicts short-term survival in patients with moderate heart failure.

2.5 Investigations to help guide therapy

Electrophysiological study
Patients who have previous myocardial infarction, impaired left ventricular function (LVEF < 35%) and spontaneous nonsustained ventricular tachycardia, who are suitable candidates for an implantable cardioverter defibrillator, should undergo an electrophysiological

study to determine the inducibility of ventricular arrhythmias. If sustained ventricular tachycardia or ventricular fibrillation is induced, an implantable cardioverter defibrillator should be considered.

Identifying a specific etiology facilitates the direction of therapies which can potentially "cure" heart failure. When the exact cause of heart failure remains elusive after adequate investigation, management is directed at correcting the pathophysiological abnormalities in the hope of improving clinical outcomes.

2.6 Practice Points

In the initial work-up of patients with heart failure, the clinical utility of various diagnostic tests and procedures may be categorized into three groups: recommended for all patients; recommended for selected patients; and not recommended.

2.6.1 C Tests and procedures recommended for all patients[1]

- Comprehensive history and physical examination
- FBC, urinalysis, electrolytes, renal function, glucose, liver function
- ECG
- Chest X-ray
- Echocardiography

Grade C, Level IV

2.6.2 C Tests and procedures recommended for selected patient subsets[1]

- Cardiac enzymes and troponins in acute heart failure.
- Noninvasive stress imaging in patients with suspected coronary disease.
- Coronary angiography in patients with suspected coronary artery disease but without angina.

- Specialized blood screens in patients suspected to have an uncommon cause of heart failure: thyroid screen, collagen disease screen, hemochromatosis screen, pheochromocytoma screen, HIV.

- Endomyocardial biopsy in patients with suspected myocarditis or an infiltrative disorder.

Grade C, Level IV

2.6.3 C Tests and procedures not recommended[1]

- Routine ambulatory ECG monitoring

- Routine determination of neurohormone levels

- Coronary angiography in patients who are not candidates for revascularization

- Routine endomyocardial biopsy

Grade C, Level IV

3 Drug Therapy in Heart Failure

In the pharmacotherapy of heart failure, four groups of agents have been shown to significantly influence morbidity and mortality. These are the angiotensin-converting enzyme inhibitors (ACE inhibitors), the angiotensin receptor blockers (ARB), the beta-blockers (BB), and spironolactone. A similar but modest effect is also seen with a hydralazine-nitrate combination, but this is seldom used unless patients cannot tolerate the more effective agents. Digoxin has not been shown to reduce mortality from heart failure, but it may reduce symptoms and hospitalizations. Loop diuretics underpin almost all treatment regimes, and are used to relieve the consequences of fluid and salt retention such as edema and orthopnea.

Despite initial promise, calcium channel blockers such as amlodipine have no place in the treatment of heart failure. Inotropic agents when used to treat heart failure have consistently increased mortality despite short term hemodynamic improvement. The exception is digoxin which may benefit heart failure patients through its neurohumoral properties rather than its inotropic effects.

3.1. Angiotensin-converting enzyme inhibitors

3.1.1 A ACE inhibitors are standard therapy for patients with left ventricular dysfunction, with or without symptomatic heart failure.[2,3,4]

Grade A, Level Ib

3.1.2 A Dosages of ACE inhibitors should be titrated to levels comparable to those used in clinical trials.[5,6]

Grade A, Level Ib

3.2 Angiotensin-II receptor blockers (ARB)

3.2.1 A Patients with symptomatic heart failure who are ACE inhibitor intolerant should be treated with an ARB.[7]

Grade A, Level Ib

3.2.2 A Patients with symptomatic heart failure who are treated with ACE inhibitors should be considered for additional therapy with an ARB.[8]

Grade A, Level Ib

3.3 Beta-blockers

3.3.1 **A** Beta-blockers should be standard therapy for clinically stable patients with left ventricular systolic dysfunction (LVEF < 40%) and mild to moderate heart failure symptoms (NYHA class II-III).[9-12]

Grade A, Level Ib

3.3.2 **GPP** Beta-blocker therapy should be started with low doses, and up-titrated slowly (no sooner than at 2-weekly intervals).

GPP

3.3.3 **A** If clinically euvolemic, patients with symptoms of heart failure at rest (NYHA class IV) can be considered for beta-blocker therapy.[13]

Grade A, Level Ib

3.4 Spironolactone (aldosterone antagonist)

3.4.1 **A** Low dose (12.5 mg to 25 mg once daily) use of spironolactone should be considered for patients on standard therapy who have severe heart failure symptoms (NYHA class III-IV).[14]

Grade A, Level Ib

3.5 Vasodilators (hydralazine-isosorbide dinitrate combination)

3.5.1 **A** Patients with contraindications to more effective agents can be considered for treatment with the combination of hydralazine and isosorbide dinitrate.[15,16]

Grade A, Level Ib

3.6 Digoxin

3.6.1 A Digoxin can be considered for patients with symptomatic heart failure (NYHA class II-IV) who are on standard therapy.[17-19]

Grade A, Level Ib

3.6.2 A In the majority of patients, there is no need to up-titrate the dosage of digoxin according to serum digoxin concentration.[19]

Grade A, Level Ib

3.7 Anticoagulants

3.7.1 A All patients with heart failure and atrial fibrillation should be treated with warfarin (target INR 2.0-3.0) unless contraindicated.[20]

Grade A, Level Ia

3.7.2 B Warfarin anticoagulation may be considered for selected patients with left ventricular ejection fraction ≤ 35%.[21]

Grade B, Level III

3.8 Calcium channel antagonists

3.8.1 A There is no indication for the use of calcium channel antagonists to specifically treat heart failure.[22]

Grade A, Level Ib

3.8.2 A Amlodipine may be used in patients with symptomatic heart failure who require its concomitant use for the management of angina or hypertension.[23]

Grade A, Level Ib

3.9 Positive inotropic drugs

3.9.1 A Other than digoxin, oral positive inotropic drugs should not be used to treat heart failure.[24]

Grade A, Level Ia

3.9.2 **A** Long-term or intermittent intravenous infusions of positive inotropic drugs should not be used routinely in the treatment of heart failure.[25]

Grade A, Level Ib

3.10 Anti-arrhythmic drugs

See section on "Therapy for Arrhythmias in Heart Failure".

4 Therapy for Arrhythmias in Heart Failure

In treating cardiac arrhythmias associated with heart failure, it is most important to treat the underlying conditions that led to heart failure and/or evoked arrhythmias. Heart failure and arrhythmias often coexist and aggravate each other. Effective pharmacological treatments have been shown to reduce both overall mortality and sudden deaths in large randomized trials

4.1 Atrial fibrillation

4.1.1 A In patients with atrial fibrillation and heart failure, achievement of heart rate control and full anticoagulation is recommended for optimal heart failure management. The rate can be controlled with beta-blockers, amiodarone or digoxin, either alone or in combination, or atrioventricular nodal ablation and permanent pacemaker insertion.[26-28]

Grade A, Level Ib

4.1.2 A Patients with heart failure and atrial fibrillation should not be treated with class I antiarrhythmic drugs such as procainamide, quinidine, propafenone, and flecainide because of concern with pro-arrhythmia and increased mortality.[29] Amiodarone is effective and the drug of choice for maintaining sinus rhythm after successful cardioversion.[30]

Grade A, Level Ib

4.1.3 C In patients with atrial fibrillation and heart failure, cardioversion may be clinically indicated, after adequate anticoagulation, for control of symptoms and hemodynamic improvement.[1]

Grade C, Level IV

4.2 Ventricular Arrhythmias

4.2.1 A Patients surviving cardiac arrest or symptomatic sustained ventricular tachycardia (not within three days of acute myocardial infarction or any correctable cause), and with LVEF < 35% should be considered for an implantable cardioverter defibrillator (ICD).[31,32]

Grade A, Level Ib

4.2.2 A Patients who have had previous myocardial infarction with left ventricular dysfunction (LVEF ≤ 35%) and asymptomatic spontaneous nonsustained ventricular tachycardia, and who would be suitable candidates for an ICD should undergo an invasive electrophysiological study to determine the inducibility of ventricular arrhythmias. If sustained ventricular tachycardia or ventricular fibrillation is induced, the patient should be considered for an ICD.[33,34]

Grade A, Level Ib

4.2.3 A Selected patients with previous myocardial infarction and with an LVEF < 30% may be considered for an ICD.[35]

Grade A, Level Ib

4.2.4 A For heart failure patients with symptomatic ventricular arrhythmias who do not qualify for an ICD implantation, amiodarone and beta-blockers are the current antiarrhythmic alternatives.[36,37]

Grade A, Level Ib

4.2.5 A For heart failure patients with ventricular arrhythmias, class I antiarrhythmic drugs should not be used.[38,39]

Grade A, Level Ib

Randomised controlled trials of antiarrhythmic therapy with encainide, flecaninide, or maricizine were stopped early owing to excess mortality in the arntiarrhythmic arms of the trials.

4.2.6 A In patients with asymptomatic ventricular arrhythmia, amiodarone has little overall effect on all cause mortality or the combined risk of death or hospitalization for heart failure except possibly in patients with nonischemic cardiomyopathy.[40,41]

Grade A, Level Ib

4.3 Bradyarrhythmias

Pacemaker therapy is effective in patients with symptomatic bradyarrhythmias, and dual chamber or "physiological" pacing has demonstrated hemodynamic and symptomatic benefit in patients not in atrial fibrillation.

4.3.1 **A** Pacemakers may be used in patients who undergo atrioventricular node ablation for rapid atrial fibrillation associated with a tachycardia cardiomyopathy and heart failure.[42]

Grade A, Level Ia

4.3.2 **C** Pacemakers may be used in patients with heart failure to correct a bradycardia which occurs spontaneously or while on drug therapy necessary for heart failure.[43]

Grade C, Level IV

4.4 Conduction Abnormalities

Patients with heart failure often have abnormal electrical activation of the myocardium, resulting in a prolonged PR interval and/or QRS duration in the ECG (especially left bundle branch block). This electromechanical dyssynchrony may lead to suboptimal atrioventricular filling, incoordinate ventricular contraction, and mitral regurgitation, resulting in adverse hemodynamic consequences. Biventricular or multisite pacing may "resynchronize" cardiac contraction and reduce these abnormalities in the enlarged failing ventricle, and may also lead to beneficial left ventricular reverse remodeling.

4.4.1 **A** Resynchronization therapy with biventricular pacemakers may be indicated in patients with widened QRS ≥ 130 ms, LV end diastolic diameter ≥ 55mm, and LVEF ≤ 35%, who remain symptomatic (NYHA Class III-IV), while on optimal drug therapy.[44,45]

Grade A, Level Ib

5 Surgical Management of Heart Failure

5.1 Heart transplantation

End stage heart disease is present when the disease has progressed to the extent that, despite present medical or conventional surgical treatment, the end result will be death in the short term.

5.1.1 B Heart transplantation is the only accepted therapeutic surgical modality for treatment of end stage heart failure.[46]

Grade B, Level III

Heart transplantation significantly increases survival, exercise capacity and quality of life.

Donor availability is a universal limiting factor. Hence, indications and contraindications have been pragmatically defined, based on the consensus of experts, to maximize the utilization of scarce donor hearts and to obtain the best results.

The criteria for a suitable heart transplant recipient are generally:

(a) age less than 60 years; an older patient may be considered depending on the patient's general condition;

(b) irreversible end-stage heart disease, with left ventricular ejection fraction (LVEF) below 20%;

(c) New York Heart Association functional class III or worse, with low likelihood of survival for more than 1 year;

(d) normal function or reversible dysfunction of liver and/or kidneys;

(e) acceptable psychological and social background.

Potential heart transplant recipients are generally excluded if they have:

(a) significant active infection (e.g. HIV, hepatitis, tuberculosis);

(b) recent pulmonary infarction;

(c) insulin dependent diabetes mellitus;

(d) pulmonary vascular resistance over 8 Wood units and/or trans-pulmonary pressure gradient > 15 mm Hg;

(e) autoimmune antibodies;

(f) chronic gastrointestinal diseases, e.g. peptic ulcer, colitis;

(g) cancer;

(h) chronic bronchitis, emphysema;

(i) alcoholism, drug dependency, poor social support;

(j) irreversible dysfunction of liver and kidneys.

5.2 Coronary artery bypass surgery in ischemic heart failure

5.2.1 B Coronary artery bypass surgery is indicated in patients with ischemic cardiomyopathy, presenting with heart failure, provided reversibility of ischemic myocardium can be demonstrated by stress echocardiography or radio-isotope myocardial imaging.[47-49]

Grade B, Level III

5.3 Additional surgical options

5.3.1 B Mitral valve repair or replacement has been shown to provide clinical and hemodynamic improvements in selected patients who develop significant mitral regurgitation secondary to left ventricular dilatation.[50]

Grade B, Level III

5.3.2 B Left ventricular remodeling surgery, which involves excision and/or exclusion of infarcted myocardial segments, and correction of left ventricular volume and shape, may be considered in selected patients.[51]

Grade B, Level III

5.4. Mechanical heart devices

5.4.1 B Mechanical ventricular assist devices may be used as a bridge to transplantation, to support patients with end stage heart failure awaiting transplantation.[52]

Grade B, Level IIa

5.4.2 C Current indications for mechanical heart devices include cardiogenic shock following heart surgery, myocarditis, and myocardial infarction. They are used either to support the circulation until recovery, or as a bridge to transplantation provided the patients are transplantable candidates.[53]

Grade C, Level IV

5.4.3 A An implantable left ventricular assist device is an acceptable alternative permanent therapy in selected patients who are not candidates for heart transplantation.[54]

Grade A, Level Ib

6 Exercise Training for Heart Failure

Traditionally patients with heart failure have been discouraged from exercise so as to "rest the heart" and allow recovery. More recently, several studies with small numbers of patients have shown that an active physical lifestyle, with regular and incremental levels of exercise, has beneficial effects on symptoms, quality of life and muscular strength. In general, these have employed aerobic exercises to increase physical endurance. Besides symptoms, exercise may demonstrably increase exercise time and maximum VO_2. The value of resistive exercises to promote muscular strength is as yet undefined. When patients undertake an exercise program, more demanding levels of exercise should be permitted only after pre-evaluation by the attending physician or cardiologist, and a symptom-limited exercise test may be useful in prescribing the appropriate level of exercise.[55,56]

7 Psychosocial Aspect of Heart Failure

Depression commonly accompanies heart failure, occurring in about 15-40% of patients. It increases the morbidity from heart failure, being associated with a worse NYHA functional class, increased hospitalization rates and higher mortality.[57]

B Depression may be identified by asking two simple screening questions:[58] (1) In the past month, have you often been bothered by feeling down, depressed or hopeless? (2) For the past month, have you had little interest or pleasure in doing things?

Grade B, Level III

Excluding very elderly patients, positive responses to these questions may identify 85-90% of heart failure patients with significant depression. This should lead to a more detailed assessment or specialist referral to confirm the diagnosis.

A Selective serotonin receptor uptake inhibitors are the drugs of choice for treatment of depression in heart failure.[59]

Grade A, Level Ib

Tricyclic antidepressant agents increase heart rate and may be pro-arrhythmic, and are thus not recommended in heart failure.

GPP Counseling patients in adaptive coping skills, providing more information about heart failure, and promoting medication compliance may improve the prognosis of patients.

GPP

Behavioral therapy and psychotherapy are currently being reviewed as helpful tools in managing heart failure.

8 Conclusions and Future Developments

The prevalence of heart failure will increase as the population ages, as improved treatments for acute heart disease particularly myocardial infarction increase survival, and as new modalities allow earlier and wider recognition of the syndrome. Many effective treatments, evidence-based and empirical, are available. Used prudently and wisely, they can improve the quality of life and extend longevity at a reasonable cost in most instances.

Future developments will extend the therapeutic envelope for heart failure. Among these are pharmacogenetics to predict therapeutic drug responses, molecular and cell therapies for myogenesis and angiogenesis, and bioengineering products for cardiovascular assistance or replacement. Many of these will add significantly to the cost of caring for heart failure patients, and the challenge will be to validate and then appropriately employ each new treatment advance.

9 Clinical Quality Improvement

The following clinical quality improvement parameters, based on recommendations in these guidelines, are proposed:

1) Percentage of patients with left ventricular systolic dysfunction who were prescribed ACE inhibitor or angiotensin receptor blockers (if ACE inhibitor was not appropriate). (see page 22)

2) Percentage of patients with heart failure and atrial fibrillation who were prescribed warfarin. (see page 23)

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Appendix 1

Stages in the evolution and progression of heart failure (AHA)

Disease Stage	Condition (risks, dysfunction, symptoms)
Stage A	Pre-failure; at high risk for developing heart failure
Stage B	Pre-symptomatic; has left ventricular dysfunction
Stage C	Symptomatic; has current or prior symptoms
Stage D	Debilitated; advanced or refractory symptoms

New York Heart Association Functional Classification

Functional Class	Symptoms (angina, dyspnea, palpitations, fatigue)
Class I	Asymptomatic on ordinary physical activity
Class II	Moderate activity causes symptoms (walking 100 meters)
Class III	Minimal activity causes symptoms (bathing, dressing)
Class IV	Symptoms at rest

Appendix 2

GPP When to refer to a cardiologist

1. Presence of significant valvular heart disease
2. Presence of frequent/symptomatic arrhythmias
3. Presence of hypertrophic cardiomyopathy
4. Presence of significant/unstable angina pectoris
5. Suspected diastolic heart failure
6. Uncertainty about management

GPP

GPP When should patients be hospitalized?

1. Onset of acute myocardial ischemia
2. Pulmonary edema or acute respiratory distress
3. Generalized edema (anasarca)
4. Heart failure refractory to outpatient treatment
5. Cyanosis or desaturation not attributable to lung disease
6. Symptomatic hypotension with fluid overload

GPP

GPP Lifestyle changes and self-care for patients

1. Dietary salt restriction (2-3 grams daily)
2. Fluid management/restriction
3. Daily weight monitoring (avoid gains of > 2 kg within 1 week)
4. Exercise
   - (a) regular low-moderate intensity aerobic (endurance) exercise
   - (b) avoid lifting objects heavier than 10 kg
   - (c) schedule adequate rest periods between exercise/work
5. General preventive strategies
   - (a) scheduled medical reviews
   - (b) influenza immunization
   - (c) smoking cessation
   - (d) alcohol cessation
   - (e) stress management
   - (f) reduce dietary fat and cholesterol
   - (g) optimally treat comorbidities, e.g. anemia, renal impairment, diabetes

6. Learn to monitor and report signs and symptoms of deterioration

   (a) excessive weight gain (>2 kg/week)
   (b) angina pectoris
   (c) increasing breathlessness or fatigue
   (d) dizziness or fainting
   (e) swelling of legs or abdomen
   (f) excessively fast heart rate (>120/min)

GPP

Self-assessment (MCQs)

After reading the Clinical Practice Guidelines, you can claim one CME point under Category III (Self-Study) of the SMC Online CME System. Before you login to claim the CME point, we encourage you to evaluate whether you have mastered the key points in the Guidelines by completing this set of MCQs. This is an extension of the learning process and is not intended to "judge" your knowledge and is not compulsory. The answers can be found at the end of the questionnaire.

Instruction: Choose the right answer. There is only one (best) answer for each question.

1. The average survival span after diagnosis of heart failure is:

   A. Less than 2 years
   B. Less than 5 years
   C. More than 10 years
   D. More than 15 years

2. The most common cause of heart failure is:

   A. Hypertensive heart disease
   B. Valvular heart disease
   C. Coronary heart disease
   D. Idiopathic dilated cardiomyopathy

3. The most versatile diagnostic test for evaluating heart failure is:

   A. 12-lead electrocardiography
   B. Chest radiography
   C. Echocardiography
   D. Coronary angiography

4. Cardiac failure with diastolic dysfunction but normal systolic function is:

   A. Very common (>50% of patients)
   B. Fairly common (25-50% of patients)
   C. Uncommon (<10% of patients)
   D. Rare (<1% of patients)

5. A potentially useful blood test for rapidly diagnosing/excluding heart failure is:

   A. Plasma B-type natriuretic peptide
   B. Plasma aldosterone
   C. Plasma adrenaline
   D. Plasma endothelin

6. A simple functional test used to estimate short-term prognosis in patients with moderate heart failure is:

   A. 2-minute sit-up test
   B. 1 minute push-up test
   C. 30-second breath-hold test
   D. 6-minute walking test

7. Drugs which have been shown to reduce mortality when used to treat heart failure include the following except:

   A. Digoxin
   B. Beta blockers
   C. ACE inhibitors
   D. Angiotensin receptor blockers

8. In selected heart failure patient subsets, improved survival has been documented with the application of:

   A. Radiofrequency ablation
   B. Dual chamber pacing
   C. Cardiac resynchronization therapy
   D. Implantable cardioverter-defibrillators

9. In end-stage heart failure, the only accepted therapeutic surgical modality of proven survival benefit is:

   A. Cardiac transplantation
   B. Left ventricular reduction-modeling surgery
   C. Dynamic cardiomyoplasty
   D. Pericardial restraint surgery

10. The drugs of choice for treating depression in heart failure are:

A. Tricyclic antidepressants
B. Selective serotonin receptor uptake inhibitors
C. Minor tranquillizers
D. Opioids

Answer:

1. B
2. C
3. C
4. B
5. A
6. D
7. A
8. D
9. A
10. B

Workgroup Members

The members of the workgroup, who were appointed in their personal professional capacity, are:

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MOH CLINICAL PRACTICE GUIDELINES 7/2004
Heart Failure

Ministry of Health

Singapore Cardiac Society

Singapore Heart Foundation
Your Heart We Care

National Committee On Cardiac Care

Executive summary of recommendations

Details of recommendations can be found in the main text at the pages indicated.

Diagnostic Evaluation of Heart Failure

C Tests and procedures recommended for all patients

- Comprehensive history and physical examination
- FBC, urinalysis, electrolytes, renal function, glucose, liver function
- ECG
- Chest X-ray
- Echocardiography

(pg 19) **Grade C, Level IV**

C Tests and procedures recommended for selected patient subsets

- Cardiac enzymes and troponins in acute heart failure.
- Noninvasive stress imaging in patients with suspected coronary disease.
- Coronary angiography in patients with suspected coronary artery disease but without angina.
- Specialized blood screens in patients suspected to have an uncommon cause of heart failure: thyroid screen, collagen disease screen, hemochromatosis screen, pheochromocytoma screen, HIV.
- Endomyocardial biopsy in patients with suspected myocarditis or an infiltrative disorder.

(pg 19) **Grade C, Level IV**

C **Tests and procedures not recommended**

- Routine ambulatory ECG monitoring
- Routine determination of neurohormone levels
- Coronary angiography in patients who are not candidates for revascularization
- Routine endomyocardial biopsy

(pg 20)

Grade C, Level IV

Drug Therapy in Heart Failure

A Angiotensin-converting enzyme (ACE) inhibitors are standard therapy for patients with left ventricular dysfunction, with or without symptomatic heart failure. (pg 21)

Grade A, Level Ib

A Dosages of ACE inhibitors should be titrated to levels comparable to those used in clinical trials. (pg 21)

Grade A, Level Ib

A Patients with symptomatic heart failure who are ACE inhibitor intolerant should be treated with an angiotensin-II receptor blocker (ARB). (pg 21)

Grade A, Level Ib

A Patients with symptomatic heart failure who are treated with ACE inhibitors should be considered for additional therapy with an ARB. (pg 21)

Grade A, Level Ib

A Beta-blockers should be standard therapy for clinically stable patients with left ventricular systolic dysfunction (LVEF < 40%) and mild to moderate heart failure symptoms (NYHA class II-III). (pg 22)

Grade A, Level Ib

GPP Beta-blocker therapy should be started with low doses, and up-titrated slowly (no sooner than at 2-weekly intervals). (pg 22)

GPP

A If clinically euvolemic, patients with symptoms of heart failure at rest (NYHA class IV) can be considered for beta-blocker therapy. (pg 22)

Grade A, Level Ib

A Low dose (12.5 mg to 25 mg once daily) use of spironolactone should be considered for patients on standard therapy who have severe heart failure symptoms (NYHA class III-IV). (pg 22)

Grade A, Level Ib

A Patients with contraindications to more effective agents can be considered for treatment with the combination of hydralazine and isosorbide dinitrate. (pg 22)

Grade A, Level Ib

A Digoxin can be considered for patients with symptomatic heart failure (NYHA class II-IV) who are on standard therapy. (pg 23)

Grade A, Level Ib

A In the majority of patients, there is no need to up-titrate the dosage of digoxin according to serum digoxin concentration. (pg 23)

Grade A, Level Ib

A All patients with heart failure and atrial fibrillation should be treated with warfarin (target INR 2.0-3.0) unless contraindicated. (pg 23)

Grade A, Level Ia

B Warfarin anticoagulation may be considered for selected patients with left ventricular ejection fraction ≤ 35%. (pg 23)

Grade B, Level III

A There is no indication for the use of calcium channel antagonists to specifically treat heart failure. (pg 23)

Grade A, Level Ib

A Amlodipine may be used in patients with symptomatic heart failure who require its concomitant use for the management of angina or hypertension. (pg 23)

Grade A, Level Ib

A Other than digoxin, oral positive inotropic drugs should not be used to treat heart failure. (pg 23)

Grade A, Level Ia

A Long-term or intermittent intravenous infusions of positive inotropic drugs should not be used routinely in the treatment of heart failure. (pg 24)

Grade A, Level Ib

Therapy for Arrhythmias in Heart Failure

A In patients with atrial fibrillation and heart failure, achievement of heart rate control and full anticoagulation is recommended for optimal heart failure management. The rate can be controlled with beta-blockers, amiodarone or digoxin, either alone or in combination, or atrioventricular nodal ablation and permanent pacemaker insertion. (pg 25)

Grade A, Level Ib

A Patients with heart failure and atrial fibrillation should not be treated with class I antiarrhythmic drugs such as procainamide, quinidine, propafenone, and flecainide because of concern with pro-arrhythmia and increased mortality. Amiodarone is effective and the drug of choice for maintaining sinus rhythm after successful cardioversion. (pg 25)

Grade A, Level Ib

C In patients with atrial fibrillation and heart failure, cardioversion may be clinically indicated, after adequate anticoagulation, for control of symptoms and hemodynamic improvement. (pg 25)

Grade C, Level IV

A Patients surviving cardiac arrest or symptomatic sustained ventricular tachycardia (not within three days of acute myocardial infarction or any correctable cause) and with LVEF < 35% should be considered for an implantable cardioverter defibrillator (ICD). (pg 25)

Grade A, Level Ib

A Patients who have had previous myocardial infarction with left ventricular dysfunction (LVEF ≤ 35%) and asymptomatic spontaneous nonsustained ventricular tachycardia, and who would be suitable candidates for an ICD should undergo an invasive electrophysiological study to determine the inducibility of ventricular arrhythmias. If sustained ventricular tachycardia or ventricular fibrillation is induced, the patient should be considered for an ICD. (pg 26)

Grade A, Level Ib

A Selected patients with previous myocardial infarction and with an LVEF < 30% may be considered for an ICD. (pg 26)

Grade A, Level Ib

A For heart failure patients with symptomatic ventricular arrhythmias who do not qualify for an ICD implantation, amiodarone and beta-blockers are the current antiarrhythmic alternatives. (pg 26)

Grade A, Level Ib

A For heart failure patients with ventricular arrhythmias, class I antiarrhythmic drugs should not be used. (pg 26)

Grade A, Level Ib

A In patients with asymptomatic ventricular arrhythmia, amiodarone has little overall effect on all cause mortality or the combined risk of death or hospitalization for heart failure except possibly in patients with nonischemic cardiomyopathy. (pg 26)

Grade A, Level Ib

A Pacemakers may be used in patients who undergo atrioventricular node ablation for rapid atrial fibrillation associated with a tachycardia cardiomyopathy and heart failure. (pg 27)

Grade A, Level Ia

C Pacemakers may be used in patients with heart failure to correct a bradycardia which occurs spontaneously or while on drug therapy necessary for heart failure. (pg 27)

Grade C, Level IV

A Resynchronization therapy with biventricular pacemakers may be indicated in patients with widened QRS ≥ 130 ms, LV end diastolic diameter ≥ 55mm, and LVEF ≤ 35%, who remain symptomatic (NYHA Class III-IV), while on optimal drug therapy. (pg 27)

Grade A, Level Ib

Surgical Management of Heart Failure

B Heart transplantation is the only accepted therapeutic surgical modality for treatment of end stage heart failure. (pg 28)

Grade B, Level III

B Coronary artery bypass surgery is indicated in patients with ischemic cardiomyopathy, presenting with heart failure, provided reversibility of ischemic myocardium can be demonstrated by stress echocardiography or radio-isotope myocardial imaging. (pg 29)

Grade B, Level III

B Mitral valve repair or replacement has been shown to provide clinical and hemodynamic improvements in selected patients who develop significant mitral regurgitation secondary to left ventricular dilatation. (pg 29)

Grade B, Level III

B Left ventricular remodeling surgery, which involves excision and/or exclusion of infarcted myocardial segments, and correction of left ventricular volume and shape, may be considered in selected patients. (pg 29)

Grade B, Level III

B Mechanical ventricular assist devices may be used as a bridge to transplantation, to support patients with end stage heart failure awaiting transplantation. (pg 30)

Grade B, Level IIa

C Current indications for mechanical heart devices include cardiogenic shock following heart surgery, myocarditis, and myocardial infarction. They are used either to support the circulation until recovery, or as a bridge to transplantation provided the patients are transplantable candidates. (pg 30)

Grade C, Level IV

A An implantable left ventricular assist device is an acceptable alternative permanent therapy in selected patients who are not candidates for heart transplantation. (pg 30)

Grade A, Level Ib

Psychosocial Aspect of Heart Failure

B Depression may be identified by asking two simple screening questions: (1) In the past month, have you often been bothered by feeling down, depressed or hopeless? (2) For the past month, have you had little interest or pleasure in doing things? (pg 32)

Grade B, Level III

A Selective serotonin receptor uptake inhibitors are the drugs of choice for treatment of depression in heart failure. (pg 32)

Grade A, Level Ib

GPP Counseling patients in adaptive coping skills, providing more information about heart failure, and promoting medication compliance may improve the prognosis of patients. (pg 32)

GPP

GPP When to refer to a cardiologist

1. Presence of significant valvular heart disease
2. Presence of frequent/symptomatic arrhythmias
3. Presence of hypertrophic cardiomyopathy
4. Presence of significant/unstable angina pectoris
5. Suspected diastolic heart failure
6. Uncertainty about management

(pg 43) **GPP**

GPP When should patients be hospitalized?

1. Onset of acute myocardial ischemia
2. Pulmonary edema or acute respiratory distress
3. Generalized edema (anasarca)
4. Heart failure refractory to outpatient treatment
5. Cyanosis or desaturation not attributable to lung disease
6. Symptomatic hypotension with fluid overload

(pg 43) **GPP**

GPP Lifestyle changes and self-care for patients

1. Dietary salt restriction (2-3 grams daily)
2. Fluid management/restriction
3. Daily weight monitoring (avoid gains of > 2 kg within 1 week)
4. Exercise
   (a) regular low-moderate intensity aerobic (endurance) exercise
   (b) avoid lifting objects heavier than 10 kg
   (c) schedule adequate rest periods between exercise/work
5. General preventive strategies
   (a) scheduled medical reviews
   (b) influenza immunization
   (c) smoking cessation
   (d) alcohol cessation
   (e) stress management
   (f) reduce dietary fat and cholesterol
   (g) optimally treat comorbidities, e.g. anemia, renal impairment, diabetes

   (pg 43)
6. Learn to monitor and report signs and symptoms of deterioration
   (a) excessive weight gain (>2 kg/week)
   (b) angina pectoris
   (c) increasing breathlessness or fatigue
   (d) dizziness or fainting
   (e) swelling of legs or abdomen
   (f) excessively fast heart rate (>120/min)

   (pg 44) **GPP**