National Guidelines for the
Diagnosis and Management of Heart Failure in Adults

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Brunei Darussalam

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Message from the Minister of Health Brunei Darussalam

The Government of His Majesty, the Sultan and Yang Di-Pertuan of Brunei Darussalam is committed to achieve high standards of curative and preventive health care. This has also been enshrined in the National Health Care Plan 2000-2010 of the Ministry of Health. Improved management of patients with heart failure is critical in the light of the extreme economic burden, unacceptable high mortality, and severe impact on the quality of life. The Ministry of Health provides a forum to promote research related to heart failure. It also facilitates education and training for physicians and other care givers.

Brunei Darussalam has been experiencing tremendous developmental success in all spheres of life. Changes in lifestyle and environment have also resulted in a substantial rise in non-communicable diseases such as cardiovascular disease, stroke, cancers, diabetes, hypertension, accidents and other conditions. As the population ages, more people will survive heart attacks but are left with damaged hearts which increases the incidence of heart failure. It is important for physicians to know and recognize early symptoms of heart failure as treatment can begin in the early stages to prevent progression and allow patients to enjoy a more normal lifestyle and life expectancy.

I appreciate the hard work put in by the working committee and congratulate the Cardiology Department for actively pursuing the vision and mission of the Ministry of Health. The National Guidelines for the Management of Heart Failure is a right step in this right direction.

Yang Berhormat Pehin Orang Kaya Indera Pahlawan Dato Seri Setia Hj Suyoi Bin Hj Osman

Message from the Director General of Medical Services Brunei Darussalam

Heart failure is an emerging epidemic. The disease usually develops slowly as the heart gradually weakens and works less efficiently. However, many individuals are present with symptoms that are mistaken for signs of aging or other conditions. Heart failure is a serious chronic condition that can shorten a patient’s life. The aging of population, the increasing number of diabetic patients and high incidence of hypertension are major contributors to the rise in heart failure. In fact, heart failure is the only major cardiovascular disease that is increasing in incidence the world over. The number of deaths in this disease has increased considerably.

With proper management and active self-care, patients can feel better, decrease chances of being in the hospital, and live longer. Advances in treatment can slow, stop, or in some cases reverse the progression of heart failure. Tremendous medical progress has been made, to prolong and improve quality of life, and to keep people out of the hospital. However, even with the best medical care, heart failure may progress over time. Therefore the importance of early detection and prevention cannot be over emphasized.

The National Guidelines for the Management of Heart Failure is an important document for all health care professionals to help recognize early heart failure signs and symptoms, learn about new treatments, and how to manage this large group of patients who often have other existing medical conditions. This document is also a good guide to therapy, exercise and dietary need for patients with heart failure. As Chairman of the advisory committee I wish to congratulate all the members of the working group for their sincere and dedicated efforts in preparing and publishing this document.

Dr Haji Affendy Bin POKSM DSP Haji Abidin
Message from Chairman, Working Committee Brunei Darussalam

The present National Guidelines for the Management of Heart Failure aims at promoting early detection and prompt treatment of heart failure in Brunei Darussalam. These were formulated keeping in mind the growing number of patients with heart failure. It is an attempt to create awareness, educate health care personnel and provide them with evidence-based methods of practice. Experts were drawn from all walks of specializations and different parts of the country. The information supplied is comprehensive, evidence based and commonly practiced in most parts of the world.

Besides prevention and early detection, drugs are also important in the management of heart failure. They stabilize heart functions, help patients live longer, improve symptoms, increase a patient’s activity level, and reduce hospital admissions. Digoxin helps the heart pump better and diuretics remove extra fluid. These two drugs, however, do not improve survival. Doctors are now prescribing newer classes of drugs that help patients live longer and keep them out of the hospital. These drugs are ACE inhibitors, ARB and beta-blockers, which have been shown to slow disease progression and work by blocking certain hormones in the body that are believed to be responsible for the progression of heart failure. Despite these known benefits, ACE inhibitors, ARB and beta-blockers are dramatically underused.

Even though there is no current cure for heart failure, early diagnosis and prompt treatment can significantly slow the progression of disease and improve morbidity and mortality. At the same time, due to a variety of treatment options and medical devices, heart failure patients can still do activities they enjoy. I hope the present guidelines will help improve further the standard of care for heart failure patients in Brunei Darussalam.

Dr Hj Nazar Luqman

Preface

Heart diseases like coronary artery disease, hypertensive heart disease and atrial fibrillation are on the increase in our day-to-day practice. The common end point of these diseases is heart failure. In the light of available updated worldwide evidence, it has become imperative to effectively manage these risk factors and diseases to prevent heart failure. The outcome of established heart failure has improved considerably with the advent of newer pharmacological, electrical and mechanical therapies. The burden of heart failure can be reduced substantially if we adopt the currently available measures diligently.

This document has been prepared after going through evidence available from scientific publications and guidelines produced by various sources in the literature. We have attempted to customize and simplify the guidelines according to the needs of medical professionals at various levels.

We hope that this will enhance the understanding of the concepts of heart failure and lead to better management.

Dr TC Ramachandran Nair
Organizing Secretary
National Committee for Developing Guidelines for Management of Heart Failure
1. Introduction

Heart failure (HF) is a common and serious problem and is the end result of many cardiac diseases. The incidence of heart failure is 5 per 1,000/year in the general population but increases steeply to 30 cases per 1,000/year among people aged 75 years or above. The incidence of heart failure is increasing in South East Asia because the most common forerunners of HF viz. hypertension, diabetes, coronary artery disease and atrial fibrillation (AF) have a high prevalence in this region.

In Brunei too, all these risk factors that lead to HF are common. The First National Nutritional Survey and studies published in Brunei International Journal show that 30% of adults over 40 years have hypertension, and its incidence increases with age. The association of hypertension with renal disease, coronary artery disease and HF is quite well known. Diabetes and coronary artery disease are common in Brunei. Prevalence of diabetes is 12.5% in males and 13% in females over 40 years of age and cardiovascular disease remains the main cause of mortality in diabetic patients in Brunei Darussalam. It is evident from day-to-day clinical observations that atrial fibrillation is quite common here. Therefore it is not surprising that the incidence of HF is high in Brunei.

The prognosis of HF is poor; it debilitates the life of the patient, leads to recurrent hospitalization and accounts for high mortality. One year mortality rate in stage C and stage D HF can be up to 50%. The aim of treatment of HF is to improve the quality of life and prevent the morbidity and mortality associated with it. There has been considerable development in treatment strategies which include both pharmacological and non-pharmacological approaches. Based on the evidence available, a global consensus has evolved in the management of HF. Over the last decade there has been a paradigm shift in the management of HF. The management concepts for prevention and treatment of asymptomatic and symptomatic HF have been unified to give a stage-based approach.
The principles of evaluation and management of HF is based on evidence published worldwide. The level of evidence and classifications of recommendations used in this document are given below:

**Level of Evidence**

**Level of Evidence A**
Data are derived from multiple randomized clinical trials or meta-analyses.

**Level of Evidence B**
Data are derived from a single randomized trial, or nonrandomized studies.

**Level of Evidence C**
Only consensus opinion of experts, case studies, or standard of care.

**Classifications of Recommendations**

Class I: Conditions for which there is evidence and/or general agreement that a given procedure/therapy is beneficial, useful, and/or effective.

Class II: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure/therapy.
   a: Weight of evidence/opinion is in favor of usefulness/efficacy.
   b: Usefulness/efficacy is less well established by evidence/opinion.

Class III: Conditions for which there is evidence and/or general agreement that a procedure/therapy is not useful/ effective and in some cases may be harmful.

**Note:** The guidelines written in this document are based on Class I and Class IIa recommendations of AHA/ACC.

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### 2. The Clinical Syndrome of Heart Failure

Heart failure is a complex clinical syndrome that can result from any structural or functional cardiac disorder that impairs the ability of the ventricle to fill with or eject blood. At the onset of HF, neurohormononal activation which is an adaptive mechanism maintains cardiac output and tissue perfusion to within normal limits. In the long term this becomes detrimental to the myocardial function and leads to worsening ventricular function and increase in the clinical features of HF. The clinical syndrome of HF occurs from disorders of the pericardium, myocardium, endocardium or great vessels but commonly it is due to impairment of the left ventricular (LV) myocardial function.

The functional abnormalities of LV have a wide range. These may be:
   a) Markedly dilated LV with low ejection fraction (Systolic HF)
   b) Normal sized LV and normal ejection fraction (Diastolic HF)

### 3. Cardiac Remodeling

Left ventricular dysfunction begins with some injury or stress on the myocardium and is a progressive process manifesting as either dilatation or hypertrophy. This process is known as cardiac remodeling. Cardiac remodeling generally precedes the development of symptoms. The development of heart failure has four stages where remodeling has a critical role to play.

The abnormalities of diastolic and systolic function co-exist in a majority of patients. The above features can occur either in isolation or together leading to functional impairment and reduced quality of life.

### 4. Stages of Development of Heart Failure

**Stage A:** High risk of developing heart failure (no cardiac remodeling)

**Stage B:** Cardiac remodeling but no heart failure

**Stage C:**
   (i) Current or prior symptoms of heart failure and low ejection fraction (EF)
   (ii) Heart failure and normal EF (diastolic HF)

**Stage D:** Patients with end stage heart failure
5. Clinical Assessment of Patients with Heart Failure

Heart failure is a clinical diagnosis based on careful history and physical examination.

The common features are:
- Dyspnea
- Fatigue
- Pulmonary congestion
- Peripheral edema

History

A thorough history and physical examination should be obtained from patients who are present with HF to identify cardiac and non cardiac disorders or behaviors that might cause or accelerate the development of HF.

The following are the most common causes and risk factors of HF (Level of Evidence C).

- Hypertension
- Diabetes
- High lipid levels
- Smoking
- Obesity
- Coronary artery disease
- Rheumatic fever and valvular heart disease
- Cardiomyopathy
- Sleep apnea
- Exposure to cardio-toxic drugs
- Current and past alcohol consumption
- Collagen vascular disease
- AIDS
- Thyroid disorder

Family history

- MI/stroke/peripheral vascular disease
- Sudden cardiac death
- Cardiomyopathy
- Conduction system disease [need for pacemaker]
- Tachyarrhythmia
- Skeletal myopathies

Assessment of functional status

The approach commonly used to quantify functional impairment is based on the New York Heart Association classification.

- Although the progress of the disease process does not strictly follow functional class and its correlation is weak, it is still a useful measure in assessing the patient.

- NYHA Class I: Symptoms occurring at limit of exertion in normal people
- NYHA Class II: Symptoms on ordinary exertion
- NYHA Class III: Symptoms occurring at less than ordinary exertion
- NYHA Class IV: Symptoms occurring at rest

Measure of volume status and examination of the CVS/other systems (Level of Evidence C)

- Weight, height & BMI
- JVP & peripheral edema
- Blood pressure including orthostatic changes
- Lung congestion
- Apical impulse shift
- Precordial pulsation

Investigations (Level of Evidence C)

ECG

The following points should be looked into:

- Rate and rhythm
- Q waves may suggest past myocardial infarction
- LVH may suggest hypertensive heart disease/hypertrophic cardiomyopathy
- ST depression may point to ongoing ischemia
- QRS duration

X-ray Chest

- Heart size assessment to look for cardiomegaly (PA view)
- Lung fields to look for pulmonary congestion/edema
- Aortic enlargement (essential hypertension/aneurysm)
- Pulmonary artery enlargement (pulmonary hypertension)
- Other pulmonary diseases (i.e. restrictive diseases)
Echo with Doppler (Level of Evidence C)

Points for consideration:
- Chamber dimensions
- LVEF [normal >50%]
- Wall motion abnormality
- Valve stenosis/regurgitation
- Cardiac output
- Pulmonary artery pressure
- LVH and morphology

Assessment of effort tolerance/diagnosis of CAD

- Treadmill test for preliminary evaluation of possible CAD and assessment of effort tolerance
- Six-minute walk test (when patient is unfit to undergo treadmill test)

Holter recording

- Evaluation of atrial fibrillation
- Other supraventricular arrhythmias
- Ventricular arrhythmias
- Silent myocardial ischemia
- Bradyarrhythmia
- Intraventricular conduction defects

Laboratory testing (Level of Evidence C)

- Complete blood count
- Urine analysis
- Electrolytes
- Calcium
- Magnesium
- Blood urea & creatinine
- FBS & Hb A1c
- Lipid profile
- LFT
- Thyroid function test

BNP (Level of Evidence C)

- A peptide produced in the ventricles in higher concentrations in HF
- Useful modality to r/o HF in the emergency room
- Levels <100 pg/ml practically rules out HF
- Levels >400 pg/ml is virtually diagnostic of significant HF
- Higher levels may suggest worsening HF

Non-invasive testing (radionuclide/stress echo) (Level of Evidence C)

Dobutamine stress/radionuclide stress to detect fresh/reversible myocardial ischemia in patients who have known CAD and no angina.

Coronary angiography (Level of Evidence B)

It is indicated in:
- Patients with HF who have angina/objective evidence of ischemia
- Patients with past history of CAD and HF who have a recent deterioration
- Also indicated in patients with a strong clinical suspicion of CAD

6. Assessment during Follow Up (Level of Evidence C)

- Routine follow up should be done once in three to six months if the patient is asymptomatic/stable
- Patient may have to be reviewed earlier, if he/she is symptomatic
- Compliance to diet and drugs therapy has to be assessed
- Adequacy of diabetic control by evaluating blood sugar/Hb A1c routinely
- Optimal control of blood pressure needs evaluation
- Control of hyperlipidemia by lipid profile evaluation
The following factors may point to worsening disease process/ inadequate therapy:

- Rising level of JVP
- Increasing peripheral edema
- Increasing body weight
- Worsening renal parameters
- Excessive loss of weight (Cachexia)
- Narrow pulse pressure
- Cool extremities
- Resting Tachycardia

**Lab testing** (Level of Evidence C)

- Serum potassium should be checked once in three to six months in all stable patients
- Potassium abnormalities needs emergent attention
- Hypokalemia can lead to serious arrhythmias and digitalis toxicity
- Hyperkalemia may be a complication of ACEI/ARB
- The dosage of these drugs has to be adjusted accordingly
- Worsening renal function may require adjustment of diuretics, ACEI/ARB digoxin, etc
- Serial measurement of BNP can help to assess efficacy of the treatment of heart failure if available
- If there is a change in clinical status, serial measurement of EF can be used to assess the improvement/deterioration of the disease process

7. **Therapy for Various Stages of Heart Failure**

**Stage A** (Patients with high risk of developing heart failure but with no remodeling)

Management is directed towards prevention of HF (Drugs as per Appendix B)

**Treatment of hypertension** (Level of Evidence A)
- Elevated levels of systolic and diastolic blood pressure are major risk factors for remodeling and future HF
- Optimal control of blood pressure reduces HF by 50%
- Target level of blood pressure is <140/90 mm Hg
- Target level is <130/80 in patients with diabetes and renal failure
- ACEI/ARB and beta-blockers are equally effective in preventing HF
- In patients with diabetes, ACEI and ARB are superior for prevention of coronary artery disease and HF
- Combination therapy with multiple drugs may be required for optimal control

**Salt restriction and exercise training** (Appendix A)
- Sodium restriction and exercise can enhance the effects of drugs to control blood pressure in patients with hypertension which may prevent remodeling and HF

**Treatment for diabetes**
- Optimal control of diabetes will prevent or delay the occurrence of HF (Level of Evidence A)
- ACEI/ARB reduces end organ damage/MI/HF (Level of Evidence A)

**Treatment of coronary artery disease and other atherosclerotic diseases** (Level of Evidence A)
- Optimal management of coronary disease and other vascular diseases is essential for prevention of HF
- Intensive medical therapy including statins/antiplatelets and ACEI are known to prevent remodeling and future HF
- Revascularization, if indicated should be done as early as possible

**Smoking/alcohol/drug abuse** (Level of Evidence C)
- Smoking cessation is very important as a preventive measure of coronary artery disease and cor pulmonale
- Counseling and pharmacologic methods, when necessary, need to be used to attain smoking cessation
- Heavy alcohol consumption can lead to dilated cardiomyopathy and HF
- Avoid alcohol consumption as it may predispose to remodeling and HF in patients with hypertension
- Avoid drugs like amphetamines/cocaine/ephedrine, which can predispose to HF
Stage B (Patients with remodeling [hypertrophy/dilatation])
All recommendations for Stage A are applicable for patients in Stage B
- Even though patients have developed structural changes, they are asymptomatic; hence the aim of the therapy is to reverse remodeling and prevent HF

Patients with coronary artery disease
- All patients with acute MI should be treated with fibrinolysis/angioplasty whenever possible which may prevent cardiac failure in the future
- Beta-blockers and ACEI/ARB should be used in patients with acute myocardial infarction and in patients with chronic LV dysfunction (Level of Evidence A)
- Coronary revascularization should be done when indicated in patients with chronic LV dysfunction (Level of Evidence A)

Patients with valvular diseases
- Patients with significant valvular stenosis and/or regurgitation should undergo corrective surgery before they develop HF (Level of Evidence B)

Patients with LVH
- Optimal control of blood pressure may lead to reversal of LVH
- ACEI/ARB and diuretics have been found to be effective agents in reversing LVH (Level of Evidence A)

Atrial fibrillation (Level of Evidence B)
- Atrial fibrillation may precede or occur after the development of HF
- Control of ventricular rate by drugs like beta-blockers/calcium channel blockers and digoxin
- Amiodarone can be tried for rate control when the above agents are ineffective or are not tolerated
- Conversion to normal sinus rhythm should be attempted by drugs or electrical cardioversion when indicated
- Anticoagulation should be started in all patients
- Warfarin is the drug of choice
- Target INR is 2-2.5

Stage C (Patients with current or prior HF)
1. Heart failure with low ejection fraction

General measures
- Salt and fluid restriction as per guidelines in Appendix B, is essential (Level of Evidence C)
- Abstinence from alcohol
- Moderate amount of physical activity, after evaluation (Appendix C)
- Avoid NSAIDS & Class 1A and Class IC antiarrhythmics (Level of Evidence C)
- Ca-blockers: verapamil and diltiazem are to be avoided, amlopidine can be used

Drug therapy (See Appendix B for dose and other details)

Diuretics

Loop Diuretics (Level of Evidence C)
- Most common drug used; they produce high sodium and water clearance
- Efficiently relieve peripheral and pulmonary congestion
- Furosemide is the most commonly used agent
- Start therapy with lower doses unless in severe failure
- Target a weight loss of 0.5 to 1kg per day. Avoid overdiuresis and dehydration
- Consider parenteral therapy in patients with severe HF as intestinal absorption is sub-optimal
- In resistant cases, combine diuretics with different mechanisms of action (metolazone)
- Dopamine/Dobutamine may be added to overcome diuretic resistance
- Watch for hypokalemia and hypomagnesaemia to prevent arrhythmic complications

ACEI/ARB
(See Appendix B for dose and other details) (Level of Evidence A)

ACEI are the drugs of choice for the management of HF. ARB should be employed only if the patient is intolerant to ACEI.
• Reduce afterload and preload, by suppressing production of angiotensin II
• Have an antiproliferative effect in the vasculature
• All patients should be on these agents unless contra-indicated or not tolerated
• ACEI/ARB should be combined with diuretics and beta-blockers
• Treatment should begin at low doses and optimal dosing should be achieved over a period of four weeks
• The maximal recommended dosage should be prescribed for optimal benefits
• Should be avoided if systolic pressure is <80 mm Hg
• Should be avoided if serum K+ is >5.5 mmol/L or if serum creatinine is more than 200 mmol/L
• First dose hypotension is common and should be watched for
• If creatinine goes above 20%, withdrawal may be required
• Persistent dry cough is common in 20% of patients on ACEI
• Changeover to ARB may be required if cough is distressing
• Cough is less common with ARB
• Angioedema is a life threatening condition and ACEI should be withdrawn
• ARB can also cause angioedema in rare cases

Aldosterone antagonists (Level of Evidence B)
(See Appendix B for dose and other details)
• The addition of aldosterone antagonists has been shown to improve outcome
• They should be used only after initiation of ACEI/ARB and diuretics
• They should be used only if symptoms persist after initiation of ARB/ACEI
• Patients should be monitored for hyperkalemia and worsening of renal failure
• Dosage should be carefully titrated

Beta-blockers (Level of Evidence A)
• Beta-blockers inhibit the adverse effect of sympathetic system in patients with HF
• Only carvedilol, bisoprolol, metoprolol (extended release) are effective in reducing mortality
• Beta-blockers should be started only when features of pulmonary and systemic congestion disappear after treatment with diuretics
• All patients should receive these drugs if not contraindicated
• Start with very low doses
• Slow optimization over a period of 4–6 weeks
• Vigilance against worsening HF is important
• Excessive bradycardia should be watched for
• Patients with COPD/bronchial asthma may not tolerate beta-blockers

Digoxin (Level of Evidence B)
• Should only be used as an additional drug
• Effective only in patients with dilated LV and low EF
• Useful in reducing number of hospital admissions
• Only maintenance dosage is required
• Digitalis toxicity should be monitored for
• Administer carefully in patients with renal failure

Hydralazine plus Isosorbide Nitrate (Level of Evidence A)
• The above group of drugs is effective in reducing mortality
• Should be used as first choice only in patients with intolerance to ACEI/ARB
• Can be added in addition to ACEI/ARB in resistant cases
• Useful in patients with severe renal impairment

Anticoagulation in HF
Indicated in:
• Patients with atrial fibrillation/flutter
• Patients with past history of thrombo-embolism or intracardiac thrombus detected on echocardiography
• Can be considered in patients with large hearts and very low EF (<30%) in sinus rhythm
• Warfarin is the drug commonly used
• Target INR is 2–2.5
• Contraindications like GI bleed, active duodenal ulcer and blood dyscrasias should be looked for

Exercise training (See Appendix C) (Level of Evidence B)
• It is an important adjunctive therapy
• It is recommended in ambulatory patients
• Assessment is required before starting the programme
2. Heart failure with normal ejection fraction (Diastolic HF)

General Information
- About 30% belong to this group
- Heart size is normal with a normal ejection fraction
- Symptoms are due to impaired LV relaxation leading to pulmonary venous congestion
- Outlook may be better than patients with low EF
- Echo is the cornerstone of diagnosis
- BNP levels may assist in diagnosis
- Principles of treatment are similar
- Only lower doses of diuretics are needed
- Coronary revascularization should be considered in patients who have indication
- Use of ARB/ACEI/beta-blockers/Ca channel blockers may improve LV relaxation (Level of Evidence C)

Differential diagnosis in a patient with features of HF with normal EF

Incorrect diagnosis of HF
Inaccurate measurement of LVEF
Primary Valvular Disease
Restrictive (infiltrative) Cardiomyopathies: amyloidosis, sarcoidosis, hemochromatosis
Pericardial constriction
Episodic or reversible LV systolic dysfunction
Severe hypertension/myocardial ischemia
HF associated with high metabolic demand
Anemia, thyrotoxicosis, arteriovenous fistulae
COPD with right HF
Pulmonary hypertension
Atrial myxoma
Obesity

Stage D (Patients with end stage heart failure)

General issues
- Meticulous management of fluid retention is a critical step (Level of Evidence A)
- Large doses of loop diuretics may be required
- Addition of other classes of diuretics is usually needed
- Mechanical removal of fluid by ultrafiltration may be required
- If tolerated, ACEI/ARB and beta-blockers can be utilized
- Short infusions of dopamine and/or dobutamine may be necessary to improve cardiac output (Level of Evidence C)
- Cardiac resynchronization therapy (CRT), cardiac transplantation or implantation of permanent LV assist devices (LVAD) may be required (Level of Evidence A)

Other Advanced Therapeutic Options:

Cardiac Resynchronization Therapy (CRT)
Approximately one third of patients with low EF and NYHA class III-IV symptoms manifest a QRS duration of more than 120ms. This ECG change is a sign of asynchronous LV contraction leading to inefficient LV contraction and low cardiac output. Such asynchronous contraction can be addressed by electrically activating the RV and LV in a synchronized manner by biventricular pacemaker. This process is known as CRT. Careful assessment is required. CRT improves LV contractility and cardiac output. It improves the functional class and mortality is improved by 25-35%.

It is indicated in patients with low EF with NYHA class III-IV symptoms with the following characteristics:
- QRS duration more than 120ms
- LBBB pattern
- Echo evidence of asynchrony

LVAD/Cardiac Transplantation/Stem Cell Therapy
- Cardiac transplantation is an option for patients with end stage HF
- Permanent left ventricular assist device (LVAD) is an alternative to transplantation in selected cases (destination therapy)
- Stem cell therapy and gene therapy are yet to achieve full recognition
Implantable Cardioverter-Defibrillator (ICD)

Patients with asymptomatic LV dilatation/HF have a high incidence of malignant ventricular arrhythmias and sudden cardiac death. ICD has proved in large trials to prevent sudden cardiac death.

- It is indicated in patients with a history of SCD/sustained ventricular arrhythmia
- Can be considered in patients with very low EF (<30%) as a prophylactic measure against sudden cardiac death (SCD)

Special Circumstances

HF in Elderly

- Only lower doses of drugs are needed
- Very sensitive to medications
- Postural fall of BP is common
  - Diastolic heart failure is common
- Monitor closely for renal failure and hyperkalemia as elderly people as a group are pre-disposed to these problems

Anemia and HF

- Very low hemoglobin (<5g) can cause high output failure
- Patients with HF can also have anemia due to other reasons
- Treatment of anemia is important as an overall approach in patients with HF

Pregnancy and HF

- Peripartum cardiomyopathy (dilated) can complicate pregnancy in rare cases
- Principles of therapy are similar
- ACEI/ARB are contraindicated
- Digoxin, diuretics & a combination of hydralazine and nitrates can be used
- Beta-blockers are to be used with caution

Appendix

Appendix A

Non-pharmacological Management of Congestive Heart Failure

The combination of reduced nutrient intake and increased requirements places the person with heart failure at risk of malnutrition. The therapeutic aims of dietary management are to:

- Reduce the workload for the heart
- Provide a nutritionally adequate diet
- Be appropriate for the management of any underlying disease processes as well as heart failure

The principle dietary features are likely to include:

- **Sodium restriction**: This can be confined to the avoidance of high salt foods and not adding salt to food. In some circumstances further restrictions may be necessary but should not be imposed lightly because of the reduction in dietary palatability and possible compromised intake of energy as well as essential nutrients. Sodium restriction can be classified as:

  1. **No added salt**: 80-100mmol (1.8-2.3g) sodium/day: salt or soy sauce must not be added to food and only a minute amount is allowed in cooking. The level of consumption of some salt-rich foods is restricted (see table below).

  2. **Low salt**: 40mmol (approx 1g) sodium/day: no salt is added to foods either at the table or in cooking. Additional food restrictions apply (see table below).

- **Fluid restriction**: Patients who require fluid restriction are often anorexic, and the combination of the two increases the risk of nutritional needs not being met.

- **Maintaining an appropriate energy intake**: Energy intake needs to be sufficient to meet nutritional needs and prevent deterioration in nutritional status. However, excessive body mass increases the cardiac workload and weight gain from increased fat stores should be avoided. Reduced calorie diet for gradual weight loss with a goal of being within 10 percent of ideal body weight should be encouraged.
Maintaining nutritional adequacy: Particular attention should be paid to micronutrient intake as the use of diuretic and other drugs may result in significant urinary losses of potassium, water-soluble vitamins, etc. Since appetite is often poor, diet may need to be dense in nutrients and meal frequency increased.

Restriction of alcohol consumption

Salt Restricted Diets:
No added salt diet
This restricts sodium intake to less than 100mmol Na/day. Foods should be lightly salted in cooking, but none should be added to food at the table. Use only a small amount of one of the following flavouring per dish – salt, MSG, fish/oremba/soya sauce, fermented or black bean sauce.

The following foods must be avoided:
- Bacon, ham, canned fish, meat and vegetables
- Preserved meat, vegetable and fruits
- Pickled vegetables and fruits
- Salted fish, egg and vegetable
- Canned and packet soups
- Canned tomato and vegetable juice
- Salted nuts, crackers, crisps and “keropok”
- Cheese (except low sodium cheese)

40mmol sodium diet
In addition to the foods listed above, the following restrictions apply:
- No salt or sauces are to be used in cooking or at the table
- Consume regular bread, cereals, margarine and milk in limited amount

### Appendix B

<table>
<thead>
<tr>
<th>Class of Drugs</th>
<th>Initial Dose</th>
<th>Max Dose</th>
<th>Cautions</th>
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<tbody>
<tr>
<td>Loop Diuretics</td>
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<td></td>
</tr>
<tr>
<td>Furosemide (Frusemide)</td>
<td>20-40mg od/bd</td>
<td>600mg</td>
<td>Lower doses of diuretics should be used in elderly as they are more susceptible to the side effects</td>
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<td>Thiazide Diuretics</td>
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<tr>
<td>Bendroflumethiazide</td>
<td>2.5mg od</td>
<td>5mg</td>
<td>Care to be taken in fluid and electrolytes imbalances</td>
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<tr>
<td>(Bendrofluazide)</td>
<td>2.5mg od</td>
<td>10mg</td>
<td></td>
</tr>
<tr>
<td>Metolazone</td>
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<tr>
<td>Combination of Potassium Sparing Diuretics with other Diuretics</td>
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<td></td>
<td>Risk of hyperkalaemia if concomitant administration of ACEI and potassium-sparing diuretics</td>
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<tr>
<td>Dyazide – [Triamterene 50mg + Hydrochlorothiazide 25mg]</td>
<td>1 tablet bd</td>
<td>4 tablets</td>
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<td>Moduretic – [Amlodine 5mg + Hydrochlorothiazide 50mg]</td>
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</tr>
<tr>
<td>Angiotensin Converting Enzyme Inhibitors (ACEI)</td>
<td></td>
<td></td>
<td>Rapid fall in blood pressure can occur in volume-depleted patients (those on concomitant diuretics), should be initiated under close medical supervision</td>
</tr>
<tr>
<td>Perindopril</td>
<td>2mg od</td>
<td>8mg</td>
<td></td>
</tr>
<tr>
<td>Captopril</td>
<td>6.25-12.5mg tds</td>
<td>50mg tds</td>
<td></td>
</tr>
<tr>
<td>Enalapril</td>
<td>2.5-5mg bd</td>
<td>40mg</td>
<td></td>
</tr>
<tr>
<td>Ramipril*</td>
<td>2.5mg od</td>
<td>10mg</td>
<td></td>
</tr>
<tr>
<td>Angiotensin II Receptor Blockers (ARB)</td>
<td></td>
<td></td>
<td>Same as ACE inhibitors</td>
</tr>
<tr>
<td>Candesartan</td>
<td>4mg od</td>
<td>32mg od</td>
<td></td>
</tr>
<tr>
<td>Losartan</td>
<td>25mg od</td>
<td>100mg od</td>
<td></td>
</tr>
<tr>
<td>Irbesartan</td>
<td>150mg od</td>
<td>300mg od</td>
<td></td>
</tr>
<tr>
<td>Valcartan*</td>
<td>40mg bd</td>
<td>160mg bd</td>
<td></td>
</tr>
</tbody>
</table>
For short term treatment of severe heart failure

**Inotropic Agents (IV)**
- Dobutamine: Initial Dose 0.5-1mcg/kg/min, Infusion Rate 2-20mcg/kg/min, Max Daily Dose 40mcg/kg/min #
- Dopamine: 0.5-2mcg/kg/min, 1-5mcg/kg/min, 0.375-0.75mcg/kg/min, 1.13mcg/kg
- Milrinone*: 50mcg/kg over 10 minutes

* Named-Patient Basis
# hemodynamic end-point should be employed to optimize therapy. Hemodynamic monitoring targets achievement of normal cardiac output for optimal organ perfusion

**Aldosterone antagonists**
- Spironolactone: 12.5mg od, 25mg od
- Eplerenone*: 25mg od

**Beta-blockers**
- Carvedilol: 3.125mg bd, 12.5mg bd, 12.5mg od
- Metoprolol: 25mg bd, 200mg od, 10mg od
- Bisoprolol: Can cause bradycardia

**Digoxin**
- 62.5mcg od, 250mcg od
- Toxicity in elderly and those with hypokalemia

**Vasodilators**
- Hydralazine: 25mg tid, 100mg tid

**Nitrates**
- Bosorbidone dinitrate: 30mg, 160mg in divided dose

For the side effects of individual drugs, please refer to BNF or Martindale.

### Appendix C

**Exercise Training In Heart Failure Patients**

Exercise training has increasingly been recognized as important in the comprehensive care of stable heart failure patients. The following F.I.T.T. (Frequency, Intensity, Time, and Type) principle serves as a guideline for the exercise prescription in stable heart failure patients:

**F.I.T.T.**

**FREQUENCY:**
- More compromised patients: Shorter multiple daily sessions
- Good functional capacity patients: 3 to 5 times/week

**INTENSITY:**
- Dependent on assessment findings and patient’s stage of heart failure
- 40-80% of Maximum Heart Rate (MHR)**
- 12-13 RPE (Borg Scale)*
- 3 stages of progression:
  - Initial stage: Intensity is kept at a low level (e.g. 40-50% peak VO2 and 40-50% MHR), increasing exercise duration from 5-15 minutes
  - Improvement stage: The gradual increase of intensity (50% → 60% → 70% and even 80% of peak VO2 and MHR if tolerated) is the primary aim; prolongation of a session for 15-20 minutes, and tolerated up to 30 minutes
  - Maintenance stage: 6 months after training; continuing exercise training to maintain overall health and well being
- Exercise duration and frequency of training are increased as according to symptoms and clinical status of individual patients

**TIME:**
- More compromised patients: 5-10 minutes per session
- Good functional capacity patients: 20-30 minutes per session

**TYPE:**
- Aerobic, CV endurance/conditioning training
- Involving large muscle groups and low skills
- Amenable to standardised prescription (Swedberg, 2005)
**Target Heart Rate (THR)**

1. \( 220 - \text{age} \) = Maximum Heart Rate (MHR)

<table>
<thead>
<tr>
<th>HR Max</th>
<th>30</th>
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<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
<th>65</th>
<th>70</th>
<th>75</th>
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<tbody>
<tr>
<td>100%</td>
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<td>62</td>
<td>60</td>
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<td>56</td>
<td>54</td>
</tr>
</tbody>
</table>

**Note:**

It is highly recommended that stable heart failure patients attend a cardiac rehabilitation program under close supervision and monitoring by cardiac rehabilitation staff.

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### References

1. ACC/AHA 2005 Guideline Update for the Diagnosis and Management of Chronic Heart Failure in the Adult. J Am Coll Cardiol, 2005 (46): 1116-1143

**Note:**

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![Continuum of Heart Failure Diagram](image)
### Approach to Management of Chronic Heart Failure

#### At Risk for Heart Failure

**Stage A**
- At risk of HF but no structural changes or HF symptoms.
- Eg: HT, CAD, DM, F/H, CMP

#### Therapy
- Treat risk factors:
  - Hypertension
  - Diabetes
  - Hyperlipidemia
  - Obesity
- Smoking cessation
- Regular exercise
- Discourage alcohol, illicit drug use

#### Structural Heart Disease

**Stage B**
- Structural cardiac changes but no HF symptoms.
- Eg: Old MI, LVH, Asymptomatic valvular disease

#### Therapy
- Measures of Stage A
- ACE inhibitors or ARB in appropriate patients (ACE intolerant)
- Beta-blockers if not contraindicated (Carvedilol or Metoprolol XL)

#### Development of Symptoms of HF

**Stage C**
- Structural cardiac changes & past/present HF symptoms.
- Systolic HF or diastolic HF

#### Therapy
- Measures of Stage A & Stage B
- ACEI & Beta-blockers as in Stage B
- Salt restriction
- Diuretics
- If symptoms persist:
  - Aldosterone antagonists
  - ARB to add with ACEI
  - Digitalis (low doses)
  - Hydralazine/Nitrates
- Selected Cases
  - Devices: CRT, ICD
  - Surgery/valvuloplasty

#### Intractable Symptoms of HF at rest

**Stage D**
- Refractory HF requiring specialized interventions.
- Marked symptoms despite max med therapy

#### Therapy
- Measures of Stage A, Stage B & Stage C
- Salt restriction
- Drugs as in Stage C
- Continuous/Short IV inotrope infusion
- Ultrafiltration
- Devices in appropriate patients: CRT, ICD
- Other Options:
  - Mechanical Assit Device
  - Heart Transplant
  - Experimental Therapies
  - Stem Cell Transplant
  - End-of-life Hospice Care

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*Adapted from recommendations from ACC/AHA Guidelines for Management of Chronic Heart Failure, 2006.*