

*Concise Guide to  
the Management  
of Heart Failure*

WORLD HEALTH  
ORGANIZATION/COUNCIL  
ON GERIATRIC CARDIOLOGY  
TASK FORCE ON HEART  
FAILURE EDUCATION

# CONTENTS

<b>WHO/CGC TASK FORCE ON HEART FAILURE EDUCATION.....</b>	<b>4</b>
<b>OBJECTIVE OF GUIDELINE .....</b>	<b>5</b>
<b>DEFINITIONS OF HEART FAILURE .....</b>	<b>5</b>
Pathophysiological Definition .....	5
Clinical Definition.....	5
<b>CLINICAL DIAGNOSIS OF HEART FAILURE .....</b>	<b>6</b>
Diagnostic Algorithm .....	6
Clinical History and Examination.....	7
Investigations .....	7
12-lead ECG .....	8
Chest Radiograph.....	9
Echocardiogram .....	9
<b>DIAGNOSIS AS THE BASIS OF TREATMENT.....</b>	<b>10</b>
<b>SUMMARY OF THE TYPES OF HEART FAILURE AND THEIR TREATMENT .....</b>	<b>10</b>
Aetiology and Pathophysiology .....	10
Treatments in Common Practice .....	10
<b>TREATMENT OF HEART FAILURE DUE TO LEFT VENTRICULAR SYSTOLIC DYSFUNCTION.....</b>	<b>12</b>
Treatment Algorithm .....	12
Nonpharmacological Treatment/Lifestyle Modification .....	13
Diuretics .....	14
Angiotensin Converting Enzyme (ACE) Inhibitors .....	15
Digoxin.....	19
Other Vasodilators .....	19
Other Drugs .....	20
Aspirin .....	20
Warfarin.....	20
Beta adrenoceptor antagonists.....	20
Apparently Intractable Heart Failure .....	20

## **OTHER ASPECTS OF MANAGEMENT .....21**

Co-Prescribing .....21

Non-adherence .....22

Management of Concomitant Problems .....22

## **PREVENTION OF HEART FAILURE .....24**

## **CONCLUSION .....25**

## **BIBLIOGRAPHY .....25**

### **FIGURES**

Figure 1 Diagnostic Algorithm .....6

Figure 2 Treatment Algorithm .....12

Figure 3 Initiation of an ACE inhibitor  
in Heart Failure .....16

### **TABLES**

Table I ECG findings in patients with  
suspected heart failure .....8

Table II Summary of the types of heart failure  
and their treatments .....10

Table III High-risk conditions for which specialist  
assessment is desirable.....17

### **PRINCIPAL AUTHOR:**

John McMurray, Consultant, Department of Cardiology, Western General Hospital, Edinburgh, Scotland

# WHO/CGC TASK FORCE ON HEART FAILURE EDUCATION

## *Representing every continent except Antarctica*

### C O - C H A I R S

---

#### ***Dr. Ivan Gyárfás***

Chief, Cardiovascular Disease Unit, WHO  
Geneva, Switzerland

#### ***Professor Nanette K. Wenger***

Professor of Medicine (Cardiology)  
Emory University School of Medicine  
Atlanta, Georgia, USA

### M E M B E R S

---

#### ***Dr. M. M. Al Nozha***

Professor of Medicine, Consultant Cardiologist  
King Saud University  
Riyadh, Saudi Arabia

#### ***Professor Dr. Bernardo Boskis***

Professor Dr., Cardiology Institute  
Favaloro Foundation  
Buenos Aires, Argentina

#### ***Dr. Michael Bristow***

Professor, Medicine  
University of Colorado Health Sciences Center  
Denver, Colorado, USA

#### ***Dr. Mireille Brochier***

Emeritus Prof. University of Cardiology  
Residence du Lac, Tours, France

#### ***Professsor Jean Paul Broustet***

Chief, Cardiology Service  
Cardiology Hospital, Haut Leveque, Pessac  
France

#### ***Dr. Oon Chong Hau***

Consultant Physician  
Mount Elizabeth Medical Center  
Singapore

#### ***Dr. Jay N. Cohn***

Head, Cardiovascular Division  
Professor of Medicine  
University of Minnesota Medical School, USA

#### ***Professor Azhar M. A. Faruqui***

Professor of Cardiology  
National Institute of Cardiovascular Diseases  
Karachi, Pakistan

#### ***Dr. Alan Goble***

Heart Research Centre  
Melbourne, Australia

#### ***Dr. Ivan Gyárfás***

Chief, Cardiovascular Disease Unit  
WHO, Geneva, Switzerland

#### ***Professor Peter Mathes***

Professor of Cardiology  
Hoehenried Clinic for Cardiovascular Diseases  
Bernried, Germany

#### ***Dr. John McMurray***

Consultant, Department of Cardiology  
Western General Hospital  
Edinburgh, Scotland

#### ***Professor Walinjom F. T. Muna***

Acting Director, Chief of Medicine  
General Hospital  
Yaounde, Cameroon

#### ***Professor Rodolfo Paoletti***

President, Italian Heart Foundation  
University di Milano  
Milan, Italy

#### ***Dr. J. Papp***

President, Hungarian Society of Cardiology  
Szeged, Hungary

#### ***Dr. Marc A. Pfeffer***

Cardiology Department  
Brigham & Women's Hospital  
Harvard Medical School  
Boston, Massachusetts, USA

#### ***Professor Philip Poole-Wilson***

Royal Brompton Hospital  
National Heart & Lung Institute  
London, UK

#### ***Professor Luigi Tavazzi***

Fondazione Clinica del Lavoro  
Pavia, Italy

#### ***Professor Nanette K. Wenger***

Professor of Medicine (Cardiology)  
Emory University School of Medicine  
Atlanta, Georgia, USA

## OBJECTIVE OF GUIDELINE

Heart failure is a major and growing public health problem worldwide. It is common, costly, disabling and deadly. Early diagnosis and effective treatment reduce morbidity, mortality, and cost. The aim of these guidelines is to provide a concise summary, for primary care physicians (general practitioners), of the modern diagnostic and therapeutic approach to a patient with suspected heart failure.

## DEFINITIONS OF HEART FAILURE

### *Pathophysiological Definition*

Cardiac failure is an inability of the heart to deliver blood (and therefore oxygen) at a rate commensurate with the requirements of the metabolising tissues at rest or during light exercise. This leads to characteristic systemic pathophysiological responses (neural, hormonal, renal and others), symptoms and signs.

### *Clinical Definition*

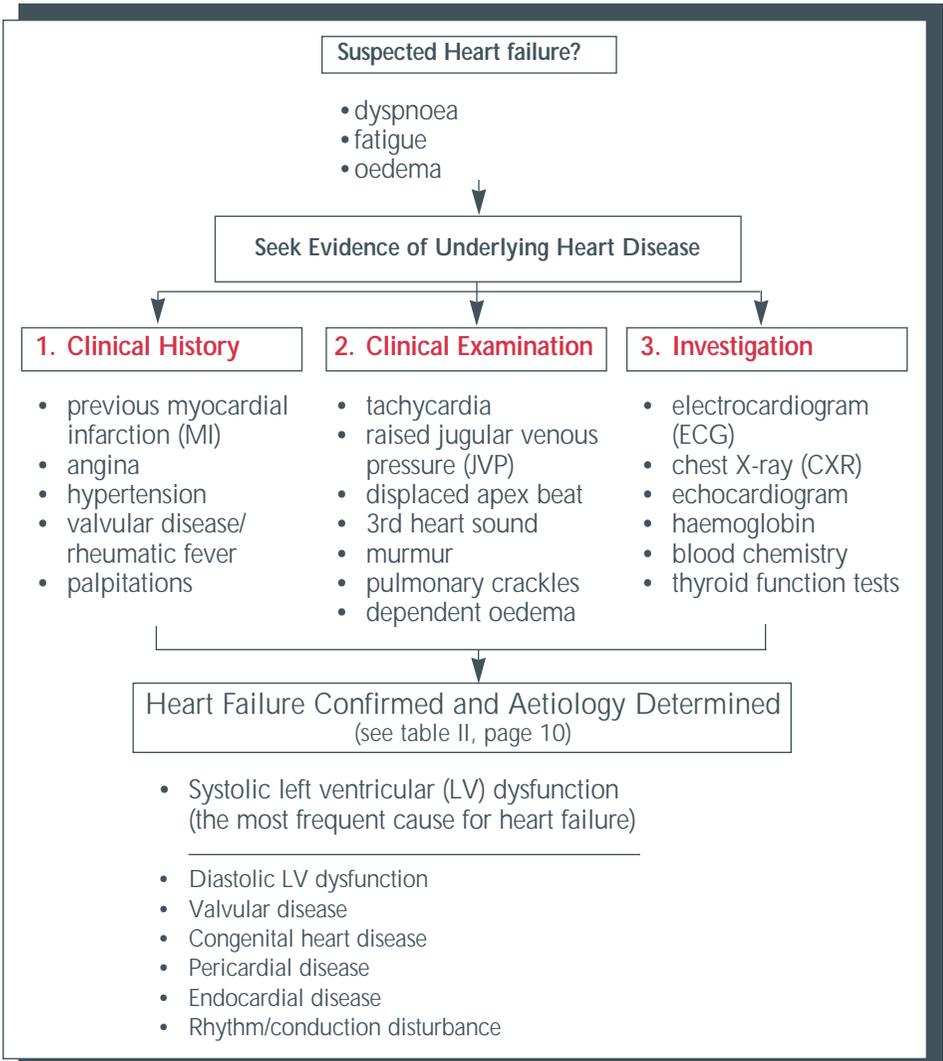
Clinically the term “heart failure” is applied to the syndrome of breathlessness and fatigue associated with cardiac disease. It is often accompanied by fluid retention (“congestion”), as indicated by an elevated jugular venous pressure and oedema. Conditions leading to a mismatch between tissue oxygen delivery and demand (eg. anemia) may mimic the clinical signs of heart failure as may conditions causing fluid retention (eg. renal and hepatic failure). *The clinical diagnosis of heart failure, therefore, necessitates both the presence of significant cardiac disease and typical symptoms and signs.*

# CLINICAL DIAGNOSIS OF HEART FAILURE

The clinical assessment of the patient with suspected heart failure seeks to answer two questions: (Figure 1; Diagnostic Algorithm)

- Are the patient's symptoms cardiac or non-cardiac in origin, i.e. is heart disease present?
- Where there is cardiac disease, what is the precise nature of the cardiac problem?

**FIGURE 1: Diagnostic Algorithm**



### **1. *Clinical history***

Although dyspnoea and fatigue are the hallmarks of heart failure, they are also common in other conditions (eg. respiratory disease, obesity). Knowledge of a pre-existing myocardial (eg. past myocardial infarction) or valvular problem increases the probability that the patient's symptoms are due to heart failure. A history of angina, hypertension, rheumatic fever or previous cardiac surgery is also helpful. Palpitations may indicate a cardiac rhythm or conduction disorder that may be the cause (or result) of heart failure. Conversely, a history of other relevant medical problems (eg. anaemia, pulmonary, renal or hepatic disease) may reduce the probability of heart failure.

### **2. *Clinical examination***

Many patients with heart failure have few and/or subtle clinical signs. Conversely, some physical signs, such as ankle oedema, are very non-specific and may be seen in patients without cardiac disease. A raised jugular venous pressure (in the absence of anaemia, pulmonary, renal or hepatic disease), a rapid low amplitude pulse, a third heart sound and displacement of the apex beat are specific signs of cardiac disease.

Blood pressure is usually normal or low for the patient's age provided that hypertensive heart disease is not the cause of the heart failure. Pulmonary crackles are non-specific in the absence of other signs of cardiac disease.

Conversely, dyspnoea in the absence of cardiac signs as mentioned above is more suggestive of pulmonary or other disease.

### **3. *Investigations***

The purpose of investigation is to:

- 1.) Confirm the diagnosis of heart failure by demonstrating underlying cardiac disease
- 2.) Define the cause of heart failure by characterizing the underlying cardiac problem
- 3.) Assist in the choice of optimal therapy (and avoid inappropriate treatment) by defining the precise cause of heart failure
- 4.) Obtain prognostic information
- 5.) Provide a reference point from which to measure the effects of treatment

Blood tests help exclude anaemia, thyroid, hepatic and renal disease. The most commonly used cardiac investigations are the 12 lead electrocardiogram (ECG), the chest radiograph ("X-ray") and, where available, the echocardiogram.

## CLINICAL DIAGNOSIS OF HEART FAILURE

### *12 lead ECG*

A completely normal 12 lead ECG is uncommon in a patient with heart failure. Even in pericardial disease the QRS complexes are usually of low voltage and the patient often has atrial fibrillation. However, a breathless patient with an abnormal ECG may not necessarily have heart failure. **Table I** shows how the ECG can help in defining the cause of heart failure.

**TABLE I: ECG Findings In Patients With Suspected Heart Failure**

Finding	Significance
Q-waves; poor R wave progression	Indicates previous MI; LV systolic dysfunction probable.
Left ventricular hypertrophy (LVH)	May be due to hypertension, aortic stenosis, hypertrophic or dilated cardiomyopathy. May have either systolic or diastolic LV dysfunction.
Left bundle-branch block (LBBB)	Usually indicates underlying heart disease
Right bundle-branch block (RBBB)	May not denote underlying heart disease. Incomplete RBBB may indicate an atrial septal defect. RBBB and left anterior hemiblock (LAHB) are common in Chagas disease.
Atrial fibrillation	Common in old age. May be caused by any cardiac disease. Should specifically consider mitral stenosis, pulmonary embolism, and thyrotoxicosis. If ventricular rate is very rapid may have rate related heart failure despite normal myocardial and valve function.
Bradyarrhythmias	Heart failure may be rate related
Atrioventricular block	Heart failure may be rate related. May be present in Chagas disease.
Low voltage QRS complexes	May indicate pericardial constriction or effusion, infiltrative disease.

## *Chest radiograph*

In acute, or decompensated chronic, heart failure the chest x-ray may show florid alveolar pulmonary oedema, interstitial pulmonary oedema, basal pleural effusions or pulmonary venous engorgement. In older patients the most common finding is cardiac enlargement. Cardiomegaly is indicative of significant cardiac disease though it does not define the precise cardiac problem. For example, conditions as diverse as pericardial effusion, cor pulmonale, left ventricular aneurysm and mitral stenosis all cause radiographic cardiomegaly.

It is important to realise, however, that significant left ventricular dysfunction can occur in the absence of radiographic cardiomegaly.

## *Echocardiogram*

An important investigation in a patient with suspected heart failure is the echocardiogram. This ultrasonic examination visualises the cardiac chambers and valves. Systolic and diastolic ventricular contractile function can be measured, as can chamber size and wall thickness. Similarly, Doppler ultrasound enables valvular stenosis and regurgitation to be detected and quantified. Congenital heart defects, valvular vegetations, intracardiac tumours and intracavitary thrombus can also be detected.

Ideally all patients with suspected heart failure should have an echocardiogram though this investigation is often not available. If a definite diagnosis of heart failure can be made clinically, eg. in a patient who has had a large myocardial infarction in the past or who has the characteristic auscultatory findings of mitral stenosis, echocardiography is not essential if access is limited. On the other hand echocardiography is strongly recommended where there is diagnostic uncertainty on clinical grounds (see pages 10-11).

## DIAGNOSIS AS THE BASIS OF TREATMENT

Optimal treatment is based on accurate diagnosis. Enough diagnostic information to enable appropriate treatment may be available from the history, examination and simple investigations. For example, a patient presenting with breathlessness for a number of months or years after myocardial infarction, and who has Q waves on the ECG, will almost certainly have heart failure due to left ventricular systolic dysfunction. The probability is even

TABLE II:

### SUMMARY OF THE TYPES OF HEART FAILURE AND

<b>AETIOLOGY AND PATHOPHYSIOLOGY</b>	<b>TREATMENTS IN COMMON PRACTICE</b>
<p><b>Myocardial Systolic Failure</b></p> <p>Heart failure is most commonly due to systolic dysfunction where the myocardium fails to contract normally; the left ventricle is usually dilated. Previous myocardial infarction, chronic hypertension, dilated cardiomyopathy, viral myocarditis, Chagas' disease and alcoholic heart disease are common causes of this type of heart failure.</p>	<p>It is important to identify these patients, because prognosis in systolic heart failure is improved if an angiotensin converting enzyme (ACE) inhibitor is given in addition to diuretic and/or digoxin. Heart failure in patients with alcoholic cardiomyopathy often improves or resolves if they stop drinking.</p>
<p><b>Myocardial Diastolic Failure</b></p> <p>Heart failure is sometimes due to diastolic ventricular dysfunction, where the myocardium is stiff, often because of hypertrophy, and fails to relax normally. This problem seems to be more common in the elderly and may have a better prognosis than systolic heart failure. Hypertension can cause this type of heart failure.</p>	<p>The optimal treatment for diastolic heart failure has yet to be determined. Underlying problems should be treated appropriately, eg., antihypertensive therapy should be given to lower elevated blood pressure, aiming to induce regression of left ventricular hypertrophy. "Congestion" should be relieved with diuretics.</p>
<p><b>Valvular Disease</b></p> <p>Valvular disease remains a common cause of heart failure in areas of the world where rheumatic fever is prevalent. Calcific aortic stenosis is also a frequent problem in elderly patients.</p>	<p>Surgery and other interventional procedures such as balloon valvuloplasty are of potentially great benefit. Inoperable regurgitant valvular disease may be helped by vasodilators.</p>

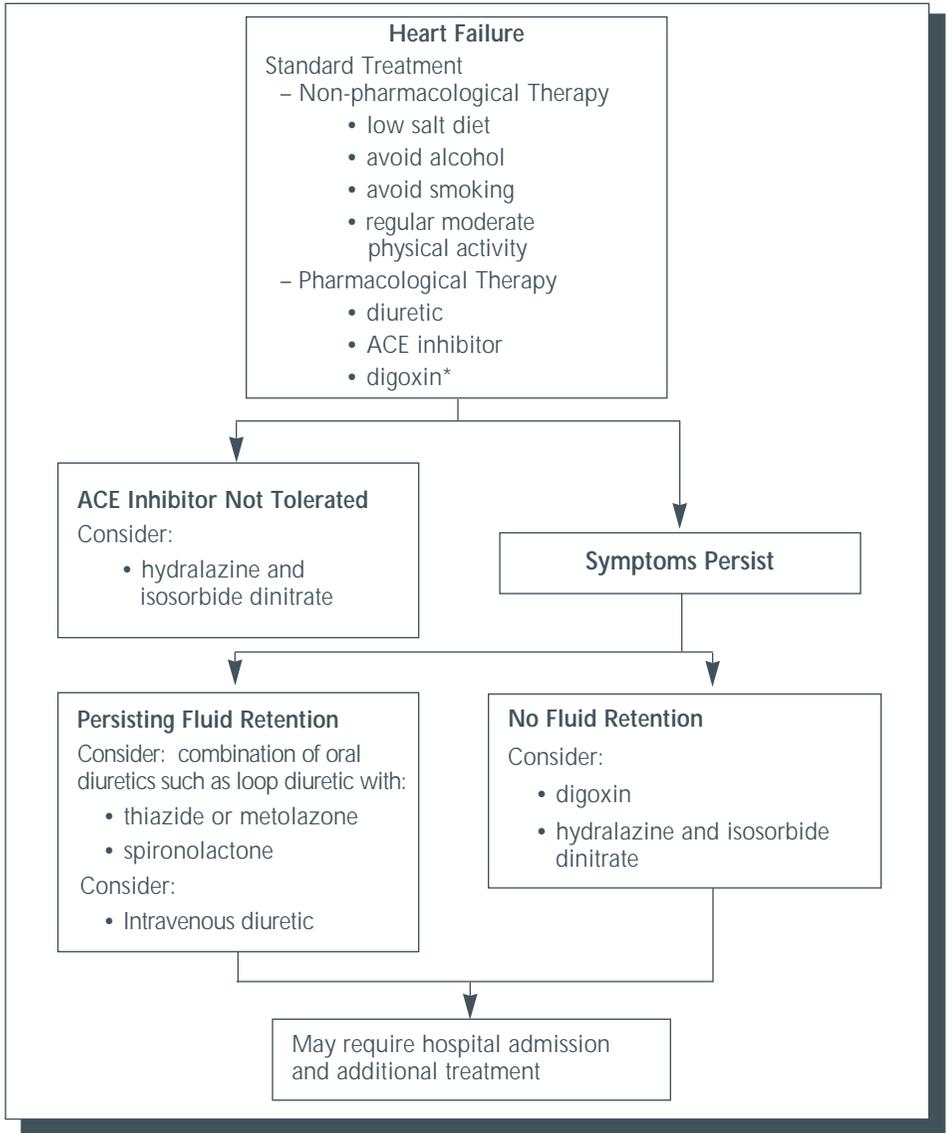
greater if the chest x-ray shows cardiomegaly and/or pulmonary congestion. Other patients may need more thorough investigation, possibly necessitating referral to a cardiologist. Ultimately the precise cause of each patient's heart failure should be ascertained as different causes of heart failure require different treatments (Table II – pages 10,11 and Figures 2 and 3, pages 12 and 16).

## THEIR TREATMENTS

AETIOLOGY AND PATHOPHYSIOLOGY	TREATMENTS IN COMMON PRACTICE
<p><b>Pericardial Disease</b></p> <p>Pericardial constriction and effusion, for example, due to tuberculosis or viral disease may compromise pump function. Cardiac tamponade should be considered.</p>	<p>If conservative treatment fails, pericardiocentesis, balloon pericardiectomy and surgical pericardiectomy may be of benefit.</p>
<p><b>Endocardial Disease</b></p> <p>Endocardial or endomyocardial fibrosis and its variant, Löffler's disease (endocarditis parietalis fibroplastica), cause a form of diastolic, or restrictive, heart failure.</p>	<p>The pathophysiology of heart failure due to these conditions is poorly understood and its treatment is not well studied. Diuretics and digoxin are commonly given for symptomatic relief.</p>
<p><b>Congenital Heart Disease</b></p> <p>Many forms of congenital heart disease may cause heart failure in infancy or childhood. Some types (eg. atrial septal defect and aortic stenosis) may not present until late in life as heart failure.</p>	<p>Surgical as well as medical treatment is often required.</p>
<p><b>Metabolic Heart Disease</b></p> <p>Thyroid disease causes heart failure. Thiamine deficiency (beri beri) may cause heart failure in specific populations. Iron overload (haemochromatosis and haemosiderosis) may also cause myocardial injury.</p>	<p>Replacement or removal of the relevant nutritional, hormonal or metabolic factor is usually curative.</p>

# TREATMENT OF HEART FAILURE DUE TO LEFT VENTRICULAR SYSTOLIC DYSFUNCTION

FIGURE 2: Treatment Algorithm



\* Some physicians use digoxin as “first line” therapy for heart failure, with diuretics and ACE inhibitors, whereas others reserve its use to those patients with atrial fibrillation or those patients whose symptoms persist.

## ***NON-PHARMACOLOGICAL TREATMENT/LIFE-STYLE MODIFICATION***

### **Diet**

All patients need support and dietary advice regarding maintenance of optimal weight. Obesity increases the workload on the heart, especially during physical activity. Weight reduction, through restriction of dietary fat and calories is imperative for those who are obese, and is advised for those who are overweight. In patients with coronary heart disease and raised lipids, a low fat diet may delay recurrence of significant cardiovascular events. Conversely, maintenance or improvement of the nutritional status in wasted, undernourished or alcoholic patients is also important.

Salt intake should be restricted as this may aggravate a patient's condition. Salt should not be added during cooking or at the table.

### **Fluid intake**

Patients with heart failure often have an intense thirst, which can lead to excessive fluid intake and hyponatraemia. Fluid intake should be limited where possible, to about 2 liters a day for most patients. During periods of hot weather, diarrhoea, vomiting or fever, fluid intake may be increased or the dose of diuretic reduced.

### **Alcohol intake**

Alcohol can damage the myocardium and precipitate arrhythmias. It should be avoided or used only in moderation.

### **Smoking**

Smoking increases the risk of many cardiovascular, pulmonary and other problems, including cancers, and must be avoided at all costs.

### **Exercise**

Bed rest is an important part of the treatment of acute heart failure or decompensated chronic heart failure, though early mobilization is important. Otherwise regular, and moderate physical activity for the condition of the patient, should be encouraged. This has significant symptomatic and

## TREATMENT OF HEART FAILURE DUE TO LEFT VENTRICULAR SYSTOLIC DYSFUNCTION

other benefits in patients with heart failure. Dynamic exercise activities such as walking, cycling, swimming, bowling, gardening, etc. should be continued at a pace that is comfortable for the patient.

### Vaccination

Heart failure may predispose to and be exacerbated by pulmonary infection, which is a common cause of hospitalization. Therefore, influenza and pneumococcal vaccinations are recommended.

### *DIURETICS*

For the patient with heart failure and fluid retention there is no more effective symptomatic treatment than a diuretic. Normally diuretics are used in combination with an ACE inhibitor and/or digoxin (see footnote, page 12). Four main principles underlie the use of diuretics in heart failure (see below). Loop diuretics are commonly used though in mild heart failure thiazide diuretics may suffice. The effective daily dose of frusemide is 40 mg (equivalent to 1 mg of bumetanide), but a reduced response may lead to a need for 80 to 120 mg daily.

Overtreatment can cause hypovolaemia, hypotension and renal impairment.

#### Principles of using diuretics for heart failure

- Use in moderation; avoid excessive doses of any single drug
- Make use of synergy between different classes of drugs, especially in cases of diuretic resistance (the principle of sequential nephron blockade)
- Monitoring of blood chemistry may help to avoid uraemia, hypokalaemia, and hyponatraemia
- Use in combination with an angiotensin converting enzyme (ACE) inhibitor and/or digoxin (see footnote, page 12), unless this is not tolerated

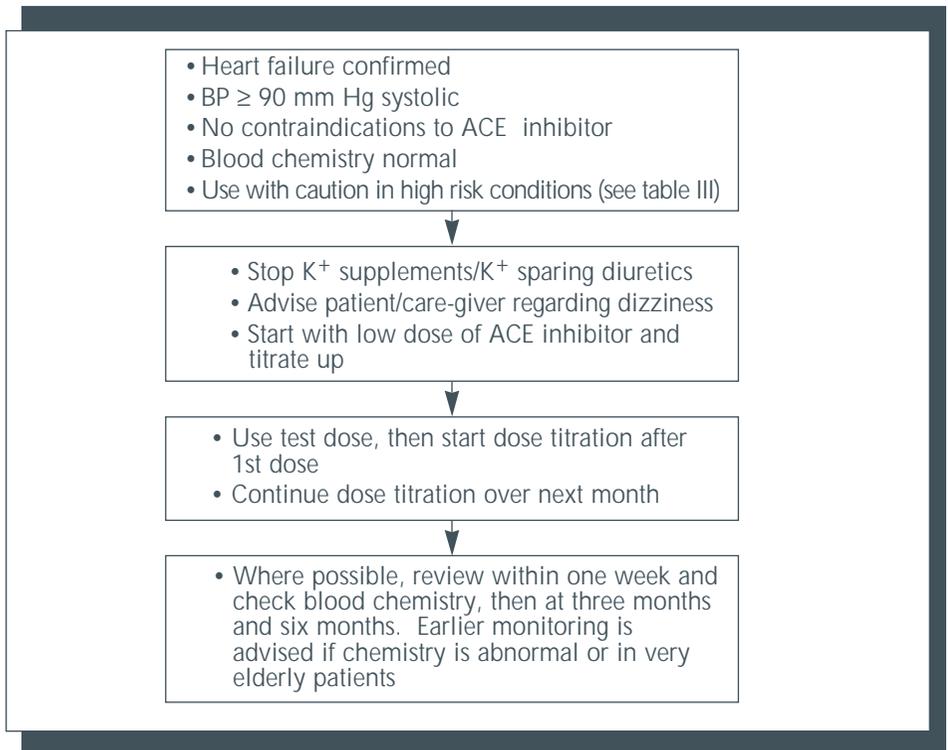
### *Patient Guidelines for Use*

All diuretics cause inconvenience for patients who usually have to organize their daily activities around the period of most intense diuresis. Thiazide diuretics cause a prolonged mild diuresis whereas loop diuretics cause a shorter, more vigorous diuresis. The effect of loop diuretics usually diminishes four hours after dosage. Patients should be informed that there is generally no fixed time of day that diuretics must be taken and, according to individual circumstances, the dose may be taken in the morning, afternoon or evening (but not too late as the diuresis may interrupt sleep). The patient may also be flexible with the diuretic dose according to need. Patients can be instructed to record their daily weight (on rising, after voiding, before breakfast) and, if there is a consistent (more than three consecutive days) increase in weight of more than 0.5 kg., they are advised to increase the diuretic dose until 'dry weight' is regained. If the weight gain or symptoms worsen, the patient should be instructed to seek medical help.

### ***ANGIOTENSIN CONVERTING ENZYME (ACE) INHIBITORS*** *(see figure 3 and table III)*

ACE inhibitors have been shown to be of benefit in all symptomatic classes of heart failure due to left ventricular systolic dysfunction. ACE inhibitors reduce vasoconstriction, improve pump function, and increase renal and skeletal muscle blood flow in heart failure. When given with diuretics, ACE inhibitors improve the symptoms and signs of all classes of heart failure and improve exercise tolerance. Increased severity of heart failure and need for hospital admission are reduced. Survival is improved in all classes of heart failure with ACE inhibitor treatment. The risk of myocardial infarction may also be reduced.

**FIGURE 3: Initiation of an ACE Inhibitor in Heart Failure**



### ***Guidelines for use***

Certain precautions should be taken before treatment is started. Potassium supplements and potassium sparing diuretics should be withdrawn. It is desirable that a baseline measurement of blood chemistry is made. The patient should be observed for two to four hours after the first dose. A low dose should be given initially - for example, enalapril 2.5 mg or captopril 6.25 mg - and regular treatment can then usually be started at an intermediate dose - enalapril 2.5 mg twice daily or captopril 12.5 mg three times daily. It is desirable that the patient should be reviewed after one or two weeks to check blood chemistry and for symptoms of hypotension; the drug dose should be modified accordingly. Provided the patient has not experienced significant hypotensive symptoms or a significant rise in serum creatinine or potassium concentration ( $>200$  mmol/l or 5.5 mmol/l respectively), the dose of ACE inhibitor should be increased as tolerated. Larger doses such as enalapril 10 mg given twice daily or captopril 50 mg three times daily are recommended as these dosages have been shown to be ben-

eficial in clinical trials. The correct dose of ACE inhibitors in heart failure should be guided by clinical trials and individual patient response. For certain patients at high risk (Table III), specialist assessment is desirable and hospital admission may be advisable.

**TABLE III**

**High-risk conditions for which specialist assessment is desirable**

- Severe heart failure (New York Heart Association class III or IV – shortness of breath on slight effort or at rest); patients with a dose of 80 mg of frusemide or equivalent
- Low systolic blood pressure (<90 mmHg)
- Low serum concentration of sodium (<130 mmol/l) or high potassium concentration >5.5 mmol/L
- Existing renal dysfunction (serum creatinine concentration [2.26 mg%] >200µmol/L)
- Severe generalized atherosclerosis (especially if intermittent claudication and arterial bruits are present) ie., risk of renal artery stenosis
- Severe chronic obstructive airways disease and pulmonary heart disease (cor pulmonale) ie., risk of fixed pulmonary hypertension

***Adverse effects of angiotensin converting enzyme inhibitors***

**Hypotension**

Some reduction in blood pressure is expected but it usually induces no symptoms. However symptomatic hypotension may occur in a small percentage of patients. If it does occur, the patient may be hypovolemic, in which case treatment can often be restarted after correction of dehydration. Ensure that obstructive valve disease is not present, and that the patient does not have diastolic rather than systolic left ventricular dysfunction.

**Renal dysfunction**

In patients with mild and moderate heart failure in clinical trials only small changes in serum creatinine and urea concentration (8.8 µmol/l [0.10 mg%] and 1.2 mmol/l [3.2 mg%] respectively) occurred after treatment. Among patients with severe heart failure, many of whom had abnormal baseline blood chemistry, serum creatinine concentration was as likely to fall as it was to increase after starting ACE inhibitor treatment. As with symptomatic hypotension, renal dysfunction is often exacerbated by dehydration. Non-steroidal anti-inflammatory drugs (NSAIDs) may also cause

renal dysfunction and should be avoided if possible in patients receiving ACE inhibitors. Patients should be advised not to purchase and use “over the counter” NSAIDs. See co-prescribing, page 21.

### **Hyperkalaemia**

Few patients with mild and moderate heart failure develop worrisome hyperkalaemia ie.,  $K^+ > 5.5$  mmol/l. This has rarely been a cause of withdrawal in the large trials using an ACE inhibitor. Dehydration, NSAIDs, and potassium-sparing diuretics increase the risk of hyperkalaemia. If these are not responsible the dose of ACE inhibitor should be reduced and  $K^+$  monitored carefully.

### **Cough**

Cough is common in patients with heart failure and pulmonary oedema/congestion should always be excluded. ACE inhibitors can also cause cough, though this was only troublesome enough to cause treatment withdrawal in a very small percentage of patients in the large ACE inhibitor clinical trials.

### ***Advice to the patient and care-givers***

Symptomatic patients should be informed that they are likely to notice a gradual improvement in their symptoms, and that this may take some weeks to develop fully. Patients who become asymptomatic should be informed that their treatment is being continued to keep them well. Patients can also be advised that future hospitalization is less likely and that life expectancy is improved by treatment with an ACE inhibitor.

Patients should be warned that dizziness may occur initially, after starting treatment, though this is usually transient and resolves with lying down. If it is persistent and troublesome, a doctor should be notified before further doses are taken. If patients become dehydrated (eg, due to diarrhoea and vomiting or a hot climate), dizziness may occur. A temporary increase in fluid intake and/or reduction in diuretic dose usually results in resolution.

Cough and, less commonly, taste disturbance may occur within the first few weeks of starting treatment. If the adverse effect is not particularly troublesome, patients may be willing to accept it in light of the substantial benefits of ACE inhibitor therapy.

## ***DIGOXIN***

Digoxin should be used to control the ventricular rate, where necessary, in patients with heart failure and atrial fibrillation. Digoxin is also of benefit in patients with heart failure who are in sinus rhythm.

Although usually considered a positive inotropic agent, digoxin is known to have other important effects in heart failure. These include neuroendocrine suppression, especially sympathetic nervous system inhibition, and arterial vasodilatation. Digoxin also has complex direct and indirect electrophysiological effects.

Digoxin is of symptomatic benefit in patients with heart failure in sinus rhythm though survival data will not be available until the DIG (Digitalis Investigation Group) Trial reports in 1996. Digoxin is also of symptomatic benefit when given with an ACE inhibitor and diuretic and this is its main indication in patients with heart failure who are in sinus rhythm.

Most trials showing clinical benefit have used daily doses between 0.125 and 0.375 mg, though a lower dose may be required in elderly patients and those with impaired renal function.

The incidence of digoxin toxicity in outpatients appears to be low, about one episode for every 20 years of treatment. This is supported by the recent large digoxin trials where the incidence of adverse effects with digoxin has been no different from that with placebo. However, the presence of renal insufficiency augments the risk of toxicity. Some potential drug interactions are relevant to heart failure. Hypokalaemia (caused by diuretics) increases the risk of digoxin toxicity. Amiodarone and quinidine increase serum digoxin concentrations due to a pharmacokinetic interaction.

## ***OTHER VASODILATORS***

### **Hydralazine and isosorbide dinitrate**

This combination improves symptoms, exercise tolerance, and survival in patients with heart failure. The combination is not as widely used as ACE inhibitors because it has more side effects and less survival benefit. It is, however, indicated where ACE inhibitors are not tolerated. Hydralazine - isosorbide dinitrate may also be used in addition to ACE inhibitors in the patient who remains symptomatic. The target daily dose in divided doses should be 300 mg hydralazine and 80-160 mg isosorbide dinitrate.

## ***OTHER DRUGS***

### **Aspirin**

Patients with heart failure due to coronary artery disease or who have concomitant peripheral or cerebrovascular disease may benefit from low dose (75mg -325 mg) aspirin, because of its platelet antiaggregant property.

### **Warfarin**

Patients with atrial fibrillation and heart failure should always be considered for warfarin treatment. Any other patient who has had a thromboembolic episode or who has been shown to have intracardiac thrombus should be considered for treatment with warfarin. The place of anticoagulation in patients with heart failure who are in sinus rhythm and who do not have intracardiac thrombus or a history of thromboembolism is uncertain.

### **Beta Adrenoreceptor Antagonists**

Initiation of conventional doses of beta blockers in patients with heart failure can cause profound haemodynamic and clinical deterioration. There is, however, some evidence that cautious introduction of a very low dose of beta blocker, under careful observation, followed by gradual dose titration may lead to symptomatic and, possibly, survival benefit. At present the precise role of beta blockers in the treatment of heart failure is uncertain and the results of ongoing trials are awaited.

## ***APPARENTLY INTRACTABLE HEART FAILURE (also see Figure 2 – page 12)***

Patients who do not respond to standard therapy with a diuretic and ACE inhibitor should be referred for specialist assessment. Adding digoxin and/or the combination of hydralazine and isosorbide dinitrate may help. If there is persisting fluid retention, the addition of a thiazide diuretic or metolazone may induce diuresis. The addition of spironolactone may also initiate a diuresis. Each of these strategies merits careful

monitoring of the blood chemistry. Short term use (a few days to a week) of additional diuretic therapy is usually all that is required. Intravenous diuretic may be necessary in the patient with very resistant oedema or persistent symptoms.

Many patients who do not respond to standard treatment are best referred to a cardiologist for hospital admission and some combination of bed rest, fluid restriction, intravenous diuretic, dobutamine, sodium nitroprusside or dopamine. Invasive haemodynamic monitoring is often helpful in establishing treatment goals and efficacy. Cardiac transplantation may be considered in selected cases.

In patients with severe diuretic resistant heart failure, careful nursing attention is important. Sleeping with the head elevated in bed or in a comfortable chair may prevent distressing nocturnal breathlessness.

### ***OTHER ASPECTS OF MANAGEMENT***

#### **CO-PRESCRIBING**

Care in co-prescribing cannot be over-emphasized. The following drugs should be used with caution and usually avoided:

- NSAIDs
- Calcium channel blockers (except possibly amlodipine)
- Antiarrhythmics (except amiodarone)
- Beta blockers (see page 20)
- Corticosteroids
- Tricyclic antidepressants
- Lithium
- Carbenoxolone

## ***NON-ADHERENCE***

Careful advice about the rationale behind treatment, especially diuretic treatment, and an explanation about flexible timing of doses may help to prevent non-compliance. When ACE inhibitors are prescribed for patients rendered asymptomatic by diuretics the patient should be told of their prophylactic benefit in maintaining stability, preventing hospitalisation and improving survival.

## ***MANAGEMENT OF CONCOMITANT PROBLEMS***

Many patients with heart failure have concomitant problems which either reflect the underlying cause of their heart failure (e.g., angina) or are a consequence of it (e.g., ventricular arrhythmias). The management of these concomitant problems in patients with heart failure is often different from that in patients who do not have heart failure. This section briefly highlights the concomitant problems typically present in patients with heart failure.

### **ATRIAL FIBRILLATION**

Up to 30 percent of patients with heart failure have concomitant atrial fibrillation. Five questions should be asked before management is started (see below). Control of ventricular rate is usually achieved with digoxin; if there is difficulty, consider amiodarone but remember that digitalis toxicity may develop. Thromboembolism should be prevented, and recent trials have shown substantial benefit from treatment with warfarin. Cardioversion, possibly preceded and followed by treatment with amiodarone, should be considered as, ideally, sinus rhythm should be restored.

#### **Issues affecting management of atrial fibrillation in patients with heart failure**

- Is atrial fibrillation the cause or consequence of heart failure?
- Could the patient have mitral valve disease?
- Could the patient have thyrotoxicosis?
- Is atrial fibrillation part of sick sinus syndrome? (Bradycardia may aggravate heart failure, and digoxin may aggravate bradycardia.)
- Are there any contraindications to the use of warfarin?

## ANGINA

As the commonest cause of heart failure is coronary artery disease, many patients also have angina. Coronary artery bypass grafting should be considered if the patient is otherwise suitable for surgery. Coronary angioplasty or other transcatheter revascularization procedure may also be appropriate. Prognosis may be improved by surgery in patients with extensive coronary artery disease and left ventricular dysfunction. Advanced age (>75 years) and severe left ventricular dysfunction (left ventricular ejection fraction <20%) are relative contraindications. The only antiischaemic drugs available that do not exacerbate pump dysfunction are the nitrates and possibly amlodipine (see beta blockers, page 20).

## VENTRICULAR ARRHYTHMIA

Patients with symptoms of palpitations, dizziness, and blackouts should be investigated for arrhythmias, since symptomatic ventricular arrhythmia requires treatment. Before an antiarrhythmic drug is given, possible precipitating or aggravating factors must be excluded. (see below). The drug to consider is amiodarone; others are likely to worsen a patient's overall condition and even the arrhythmia. Beta blockers may be useful, if tolerated. The role of implantable pacemaker and defibrillator devices in patients with heart failure is not yet clear.

### Possible precipitating or aggravating factors for ventricular arrhythmia

- Electrolyte disturbance, eg. hypokalaemia, hypomagnesaemia, hyperkalaemia
- Digoxin toxicity
- Drugs exacerbating pump dysfunction, eg. most antiarrhythmic drugs and some calcium channel blockers
- Drugs causing electrical instability, eg. most antiarrhythmic drugs (except amiodarone) and antidepressants
- Recurrent myocardial ischaemia
- Respiratory disease, infection, hypoxaemia, hyperthyroidism

## PREVENTION OF HEART FAILURE

Prevention of heart failure is a major aim of modern cardiological practice because the burden of symptoms is so high and prognosis is so poor once overt cardiac failure is established. This aim can be achieved by a) preventing the development of causal heart disease, eg. myocardial infarction, hypertensive heart disease and b) preventing the progression of established cardiac disease to heart failure.

The role of smoking, cholesterol, sedentary lifestyle and other factors in promoting the development of coronary heart disease (CHD) are well recognised and can be altered. Hypertension also increases the risk of developing CHD and the risk of developing heart failure through direct, chronic, myocardial damage. Antihypertensive therapy has been clearly shown to reduce the risk of developing heart failure. Improved socio-economic conditions and antimicrobial therapy have reduced the incidence of rheumatic heart disease in many societies.

Once cardiac disease is established its progression to heart failure can also be reduced. Infarct size can be limited by thrombolytic therapy and reinfarction reduced by aspirin, beta blockers, and, possibly, ACE inhibitors. In asymptomatic patients with substantial impairment of left ventricular function prophylactic ACE inhibitor therapy has been shown to reduce the risk of developing heart failure and to improve survival.

## CONCLUSION

In a patient with suspected heart failure, precise diagnosis of the underlying cardiac problem is the basis of optimal treatment. Non-pharmacological, pharmacological, and surgical treatments are available. With modern treatment, both morbidity and mortality from heart failure can be substantially reduced.

## BIBLIOGRAPHY

1. Cohn JN, Archibald DG, Ziesche S, Franciosa JA, Harston WE, Tristani FE, *et al*. Effect of vasodilator therapy on mortality in chronic congestive heart failure. Results of a Veterans Affairs Administration Cooperative study. *N Engl J Med* 1986;314:1547-52.
2. CONSENSUS Trial Study Group. Effects of enalapril on mortality in severe congestive heart failure. Results of the Cooperative North Scandinavian Enalapril Survival Study. *N Engl J Med* 1987;316:1429-35.
3. The SOLVD Investigators. Effect of enalapril on survival in patients with reduced left ventricular ejection fractions and congestive heart failure. *N Engl J Med* 1991;325:293-302.
4. Cohn JN, Johnson G, Ziesche S, Cobb F, Francis G, Tristani F, *et al*. A comparison of enalapril with hydralazine-isosorbide dinitrate in the treatment of chronic congestive heart failure. *N Engl J Med* 1991;325:303-10.
5. The SOLVD Investigators. Effect of enalapril on mortality and the development of heart failure in asymptomatic patients with reduced left ventricular ejection fractions. *N Engl J Med* 1992;327:685-91.
6. Pfeffer MA, Braunwald E, Moye LA, Basta L, Brown EJ Jr, Cuddy TE, *et al* for the SAVE investigators. Effect of captopril on mortality and morbidity in patients with left ventricular dysfunction after myocardial infarction. Results of the Survival and Ventricular Enlargement trial. *N Engl J Med* 1992;327:669-77.
7. The Captopril-digoxin Multicenter Research Group. Comparative effects of therapy with captopril and digoxin in patients with mild to moderate heart failure. *JAMA* 1988;259:530-44.
8. Kleber FX, Niemöller L, Doering W. Impact of converting enzyme inhibition on progression of chronic heart failure: results of the Munich mild heart failure trial. *Br Heart J* 1992;67:289-96.
9. Mujais SK, Nora NA, Levin ML. Principles and clinical uses of diuretic therapy. *Prog Cardiovasc Dis* 1992;35:221-45.
10. Smith TW. Digoxin in heart failure. *N Engl J Med* 1993;329:51-3.
11. Packer M, Gheorghade M, Young JB, Constantini PJ, Adams KF, Cody RJ, *et al* for the RADIANCE study. Withdrawal of digoxin from patients with chronic heart failure treated with angiotensin-converting enzyme-inhibitors. *N Engl J Med* 1993;329:1-7.

WORLD HEALTH ORGANIZATION/COUNCIL ON GERIATRIC CARDIOLOGY TASK FORCE  
ON HEART FAILURE EDUCATION

8-00-RNT-95-W-13309-G-SBI

*Concise Guide to  
the Management  
of Heart Failure*

WORLD HEALTH  
ORGANIZATION/COUNCIL  
ON GERIATRIC CARDIOLOGY  
TASK FORCE ON HEART  
FAILURE EDUCATION