

**Newcastle and North Tyneside Local
Primary Care / Secondary Care Guidelines for the
Diagnosis and Management of Heart Failure and
Left Ventricular Systolic Dysfunction**

**Background notes which must be read in conjunction with the
laminated summaries**

Revised September 2005

Diagnosis and management of heart failure and left ventricular systolic dysfunction

1.1 Introduction

These notes are a revision of the previous guidance published in 2001 and are intended to summarise the main components of the management of patients with suspected and confirmed heart failure due to left ventricular systolic dysfunction, including diagnosis and chronic management as well as the immediate management of acute left heart failure.

Clinicians are directed to other guidelines for further details of the evidence base, for example, NICE clinical guidelines for the management of chronic heart failure; The Scottish Intercollegiate Guidelines Network publication number 35; and the NSF for CHD chapter 6.

Primary care clinicians may wish to review the diagnosis and management of patients with a previous diagnosis of heart failure ('the prevalent pool') as well as those with new presentation suspected or definite heart failure (incident cases).

Heart failure is a clinical syndrome characterised by a set of signs and symptoms consistent with fluid retention and impaired cardiac function. These include fatigue, dyspnoea, raised jugular venous pressure, pulmonary and peripheral oedema. It is important to:

Ensure that the diagnosis of heart failure is accurate and that there is no another explanation for the symptoms. Approximately 50% of the prevalent pool of patients in primary care labelled as having heart failure may not have left ventricular systolic dysfunction [1].

Define the aetiology. Many patients have heart failure due to left ventricular systolic dysfunction, but it is important to ensure that this is the case. It is important to remember that two conditions may occur in the same patient, for example patients with atrial fibrillation may have systolic dysfunction. Other causes of heart failure include:

- Valve disease, for example, mitral stenosis can cause heart failure, but in pure isolated mitral stenosis left ventricular systolic function is preserved (although there may be some diastolic dysfunction)
- Arrhythmias, for example patients with uncontrolled atrial fibrillation may present with heart failure
- Hypertensive heart disease with left ventricular hypertrophy and apparently normal left ventricular systolic function and diastolic dysfunction. A useful term for these conditions is heart failure with preserved left ventricular function - heart failure without systolic dysfunction may occur in the elderly and those with left ventricular hypertrophy, and is felt to be caused by impaired diastolic filling. There are no clear-cut echocardiographic criteria, and diagnosis is therefore based on clinical features of heart failure, and demonstrating improved exercise tolerance with diuretic treatment. Non-cardiac explanations for symptoms (e.g. lung disease, obesity) are common in this group, and should be excluded before making this diagnosis [2].

- Cor pulmonale – right heart failure secondary to chronic lung disease presents with right-sided heart failure.
- Other conditions e.g. pericardial disease is a rare cause.

In the case of left ventricular systolic dysfunction it is important to try and identify the underlying aetiology of this e.g. coronary heart disease (CHD), hypertension, idiopathic dilated cardiomyopathy, alcoholic cardiomyopathy, etc., etc. In patients with systolic dysfunction, a reversible cause must be excluded e.g. severe aortic or mitral regurgitation. If there is any doubt a specialist assessment should always be obtained. Anaemia and thyrotoxicosis can exacerbate heart failure.

This guidance refers to the management of heart failure due to left ventricular systolic dysfunction.

1.2 Diagnosis of heart failure

Patients presenting to primary care may be categorised following initial assessment into;

- Unlikely to have heart failure – consider other causes
- Possible heart failure
- Definite heart failure

In all patients with new onset or worsening heart failure it is important that the clinician considers why has the patient got heart failure now e.g., new onset of an arrhythmia, new coronary event, poor concordance with/change in treatment, anaemia and so on.

1.2.1 History

Patients may present to primary care with a number of symptoms which may be due to heart failure. Breathlessness, tiredness and ankle swelling are all symptoms attributable to heart failure, but are non-specific and many people with these symptoms will not have heart failure. Symptoms such as orthopnoea and paroxysmal nocturnal dyspnoea (PND) are more specific, but are only present in a small proportion of patients with heart failure [3].

	¹ Sensitivity	² Specificity
Dyspnoea	66%	52%
Othopnoea	21%	81%
PND	33%	76%
Oedema	23%	80%

Others have suggested that dyspnoea may be more sensitive and Davie et al reported a sensitivity of 100% and specificity of 17% in a primary care population with suspected heart failure secondary to left ventricular systolic dysfunction referred for open access

¹ A sensitive symptom or sign with a low specificity is one which will be found in most people with heart failure, but may also be present in many without heart failure.

² A specific clinical symptom or sign - that is, if present, heart failure is almost certainly the correct diagnosis.

echocardiography [4]. There was a consensus by the local group that ankle oedema may be less specific in an unselected primary care population. In clinical practice it is the *combination* of symptoms and signs, and the presence or otherwise of a likely cause of heart failure which are most useful rather than any of these in isolation.

People with heart failure will usually have a condition to explain why heart failure has developed. The commonest cause of heart failure in the UK today is coronary heart disease and a previous history of a myocardial infarction makes the diagnosis of heart failure more likely. Some patients may have had a silent MI (this should be particularly considered in people with diabetes). Other causes of heart failure include long-standing hypertension and alcohol excess. A smaller proportion of patients have valvular heart disease (? murmur, ? history of rheumatic fever).

1.2.2 Examination

Clinical examination is also helpful, and the following makes the diagnosis of heart failure more likely [3];

- Raised jugular venous pressure
- Displaced apex beat
- Gallop rhythm
- Basal crackles

	Sensitivity	Specificity
Tachycardia	7%	99%
Rales	13%	91%
Third heart sound	31%	95%
Raised JVP	10%	97%
Oedema	10%	93%

The likelihood that a patient has left ventricular dysfunction also varies with the combination of symptoms and signs. For example [4],

	Sensitivity	Specificity
Prior MI & gallop or crackles	24%	98%
Displaced apex beat & prior MI	39%	99%
Displaced apex beat & crackles or raised JVP or gallop	44%	99%

1.2.3 Investigation

ECG

An ECG can provide very useful information. Left ventricular systolic dysfunction was unlikely in a primary care population if there was no major abnormality on the ECG (sensitivity 94%, NPV 98%) [5]. Although most studies support this finding, there are contrary data published including one report in which 27% of cases had a normal ECG [6]. Thus, in patients with breathlessness and a normal ECG alternative causes might be considered first, although patients must be investigated further (for example with echocardiography) if heart

failure is still thought to be the likely diagnosis. An ECG may also diagnose other abnormalities e.g. atrial arrhythmias which may cause heart failure and is mandatory in all those with new onset or worsening heart failure. A regular pulse does not exclude an atrial arrhythmia.

CXR

A chest X ray may provide useful information. Cardiomegaly may be present (cardiothoracic ratio (CTR) > 0.50 on standard PA CXR). The prevalence of an increased CTR has been reported in some of the large heart failure trials:

	CTR > 0.50	CTR > 0.55
SOLVD – treatment	57%	-
DIG	60%	35%

It may also show pulmonary congestion or another explanation for breathlessness such as a lung tumour.

Echocardiograph

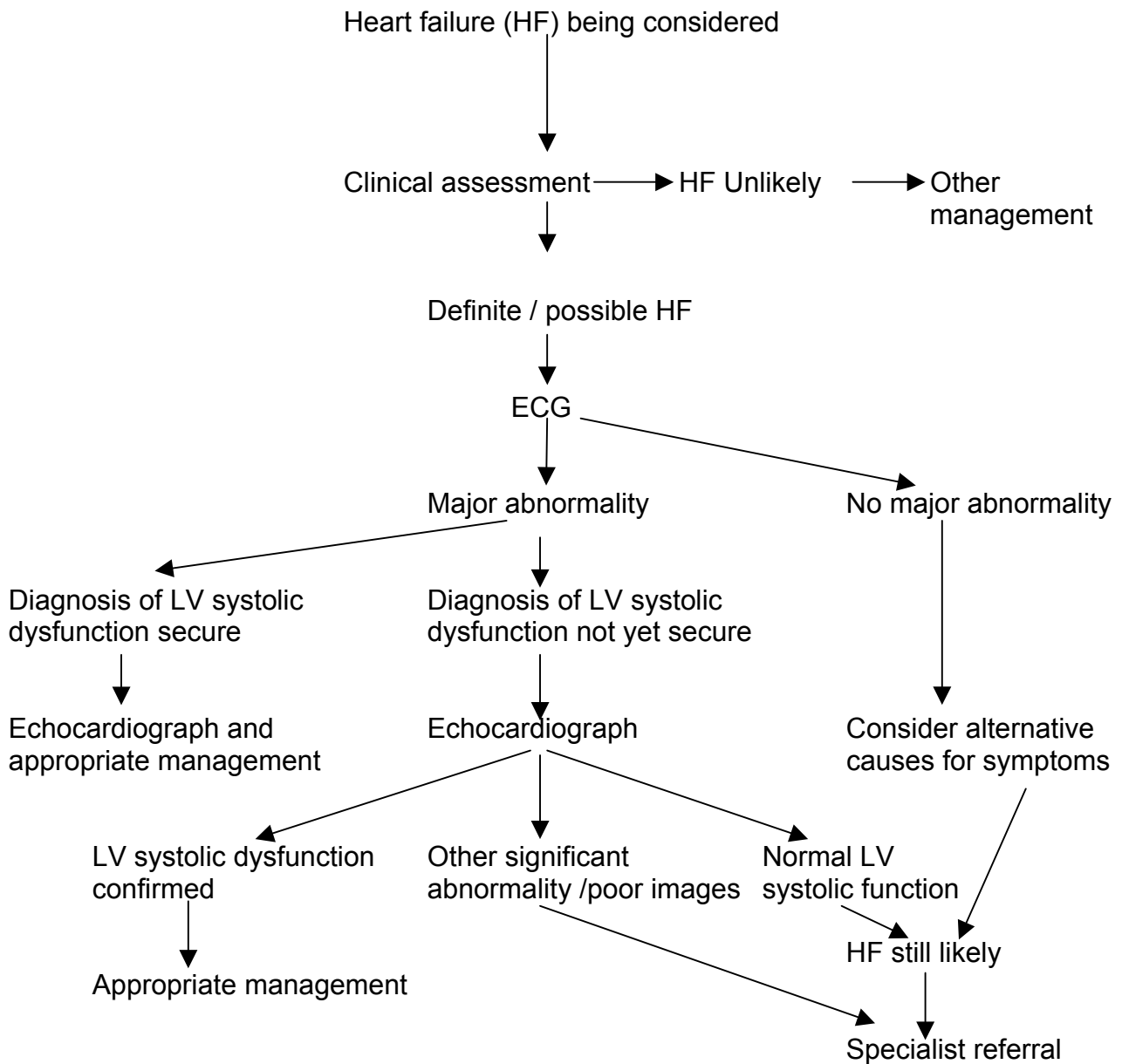
All patients who are thought to have heart failure require an assessment of left ventricular function. The echocardiograph is the most frequently used investigation, but may not be possible in approximately 10% patients due to technical reasons and alternative investigation may be necessary. Atrial fibrillation also makes the assessment of left ventricular function less reliable. Some patients may have had an alternative method of estimate of left ventricular function in secondary care e.g. gated heart scan, left ventriculography during coronary angiography. Symptomatic treatment with diuretics should not be delayed until the results are available, but the clinical response should be reviewed and treatment reassessed once the results of the investigation are available. Some patients may have a history and ECG which makes left ventricular systolic dysfunction virtually certain and in these patients other therapies such as ACE inhibitors can be considered whilst an assessment of left ventricular function is being arranged.

'The prevalent pool'

There are patients who have been treated for some time with diuretics for suspected heart failure ('the prevalent pool'). Patients notes should be reviewed following which, it may be possible to remove some patients from the register. Other patients may need an assessment of left ventricular function (for example by echocardiography) to confirm or refute the diagnosis.

It is also important to note that patients with previously documented heart failure secondary to left ventricular systolic dysfunction and treated with ACE inhibitors may have apparently normal or near normal left ventricular systolic dysfunction after a period of time. Left ventricular function may deteriorate in these patients if ACE inhibitors and other treatments are withdrawn. Thus, any decision to withdraw treatment in these patients must be made only after a full review of the circumstances in which the diagnosis of heart failure was made and not just from the results of an echocardiograph. Any treatment plan to withdraw treatment must incorporate planned reviews over a period of time, pragmatically probably over the following 3 months.

Diagnosis and echocardiography in patients with suspected heart failure in primary care



Notes

- Major ECG abnormality - atrial fibrillation, previous myocardial infarction, left ventricular hypertrophy, bundle branch block, or left axis deviation³

NB Symptomatic treatment should not be delayed in patients who clinically are very likely to have heart failure whilst awaiting investigation

³ Davie AP et al Value of the electrocardiogram in identifying heart failure due to left ventricular systolic dysfunction BMJ 1996;312:222

Assessment of patients with left ventricular systolic dysfunction

The aims of assessment are to;

- Determine the aetiology of heart failure – history, examination and investigation (see above)
- Determine symptomatic limitation
- Estimate prognosis
- Identify any precipitating or exacerbating conditions / drugs
- Provide baseline information before initiation of some treatments
- Ensure appropriate referral and follow up

2.1 Identify exacerbating conditions/drugs

Anaemia, thyrotoxicosis, and renal failure may all exacerbate heart failure. Drugs include most calcium channel blockers, some anti-arrhythmic drugs, NSAIDs, etc.

Routine investigations

These are minimum requirements

- ECG
- CXR
- Blood count, U&E, LFT, blood glucose, thyroid function, lipids within FATS

It is recommended that an echocardiograph or other assessment of left ventricular dysfunction is made if at all possible, as an aid to prognostic assessment, but is not always necessary to make the diagnosis of left ventricular systolic dysfunction.

The recently published NICE guidance about implantable cardiac defibrillators will lead to an increase in other investigations such as 24 hour Holter monitoring. Regional guidelines are currently being prepared and should be referred to when available.

2.2 Symptomatic limitation

The most frequently used classification is the New York Heart Association (NYHA) classification. The grading refers to symptoms.

New York Heart Association classification of heart failure symptoms

Class I

No limitations. Ordinary physical activity does not cause undue fatigue, dyspnoea or palpitation (asymptomatic left ventricular dysfunction).

Class II

Slight limitation of physical activity. Such patients are comfortable at rest. Ordinary physical activity results in fatigue, palpitation, dyspnoea or angina pectoris (symptomatically mild heart failure).

Class III

Marked limitation of physical activity. Although patients are comfortable at rest, less than ordinary physical activity will lead to symptoms (symptomatically moderate heart failure).

Class IV

Inability to carry on any physical activity without discomfort. Symptoms of congestive cardiac failure are present even at rest. With any physical activity increased discomfort is experienced (symptomatically severe heart failure).

2.3. Prognosis

There are many predictors of reduced survival in patients with left ventricular systolic dysfunction and these notes are not intended to list them. However, some pointers may be helpful when talking to patients in clinical practice. In the recent trials in which beta-blockers were added to standard therapy, including ACE inhibitors, in patients with mild to moderate heart failure the annual mortality was about 10% [7]. In patients with moderate to severe heart failure in which spironolactone was added to standard therapy, annual mortality was 18-20% [8], and in patients with severe heart failure in whom carvedilol was added to standard therapy annual mortality was 11% (19% in the placebo group) [9].

2.4 Appropriate referral and follow up

The following patients should be considered for referral for specialist assessment;

1. Patients with poorly controlled symptoms not responding to treatment.
2. All patients with angina and heart failure.
3. Some patients for drug initiation and dose up titration, or if drug intolerant.
4. For clarification of the aetiology of left ventricular systolic dysfunction.
5. Appropriate patients with known coronary disease may also be referred for consideration of coronary artery bypass graft surgery for prognostic reasons.
6. All patients with haemodynamically significant valve disease (or if there is doubt that this is the case).
7. Patients in atrial fibrillation in whom cardioversion (or alternative non pharmacological treatments) might be considered.
8. All patients with definite heart failure (e.g. definite pulmonary congestion on a chest X-ray) with normal left ventricular systolic function on echocardiograph should be referred for specialist assessment.
9. Patients in whom the diagnosis is not secure and in whom echocardiographic images cannot be obtained or the quality is too poor for an accurate assessment of left ventricular function.
10. Patients who may benefit from other interventions e.g. implantation of devices (ICD, cardiac resynchronisation) patients who may benefit from transplantation.
11. Patients in whom their employment is threatened.
12. Patients should not be referred if co-morbidity makes this inappropriate, or the patient declines.

Treatment of patients with left ventricular systolic dysfunction

A holistic approach to the treatment of patients with heart failure is vital.

The aims of treatment are to improve quality of life by;

- Improving symptoms or slowing their deterioration
- Reducing mortality
- Reducing frequency of cardiac events and admissions to hospital
- Avoiding or minimising the side effects of treatment
- Offering appropriate counselling to patients and carers
- Ensuring that the need for palliative care is addressed appropriately

1.1 Non pharmacological interventions

1.1.1 Diet

Salt

Dietary salt should be reduced as much as possible by avoiding the intake of salt rich foods. Lo-salt contains potassium and should generally be avoided.

Fluid intake

Excessive fluid intake should be avoided.

Obesity

Obesity should be reduced. Patients should be advised about setting realistic targets to reduce body weight. This will require counselling about behaviour change as well as nutritional advice. Management strategies are outlined in the district obesity policy.

Cachexia

This should be managed in conjunction with a dietician. Meals may need to be small and often, and advice given about the nutritional content. For example, fat-soluble vitamins may be poorly absorbed, diuresis may lead to a loss of water-soluble vitamins.

1.1.2 Alcohol

Alcohol should be avoided completely in patients with alcohol-induced cardiomyopathy. In other patients with heart failure alcohol can be consumed in small amounts, for example 1-2 units per day.

1.1.3 Smoking

Patients should be advised to stop smoking and their readiness to do so assessed. Those motivated to stop should be offered access to intermediate or specialist smoking cessation advice in line with the district smoking cessation strategy. Those who are not motivated to stop should be able to access smoking cessation advice later if they wish.

1.1.4 Exercise

Appropriate exercise is beneficial for patients with stable heart failure and structured programmes for patients with heart failure, including long-term maintenance, are to be developed in the future.

1.1.5 Education

This includes the following;

- Education about heart failure
- Lifestyle advice (see above)
- Information about drugs and the need for compliance.
- Explanation about the symptoms of worsening heart failure and the appropriate action to be taken.
- Explanation of the adverse effects of medication, and the appropriate action to be taken if they occur.
- Social activity, employment and travel.

1.1.6 Immunisation

Once only pneumococcal vaccination and annual influenza immunisation.

1.2 Cardiac rehabilitation

Some of the above interventions, and others, might be offered through a programme of cardiac rehabilitation. Cardiac rehabilitation should be tailored to the individual needs of the patient dependent on local provision.

1.3 Other interventions

Coronary revascularisation may improve the symptoms and prognosis of patients with heart failure and angina. There was a consensus in the group to recommend that all patients with heart failure and angina should be referred for a specialist opinion.

Cardiac transplantation and or ventricular assist devices may be indicated where there are no alternatives. Acceptance for these interventions is limited if co-morbidities co-exist.

Cardiac resynchronisation improves morbidity and reduces mortality in patients with heart failure due to left ventricular systolic dysfunction and cardiac dyssynchrony.

Resynchronisation may be considered in patients who remain symptomatic (NYHA III or IV) despite optimal pharmacological therapy, who have a widened QRS, and meet the additional criteria for dyssynchrony.

Implantable cardioverter defibrillators (ICDs) have been shown to reduce mortality in selected patients at high risk of malignant arrhythmias. Patients should be managed within the recommendations of the NICE Technology Appraisal for ICDs.

1.4 Supportive care services

Studies have shown that people with significant heart failure have symptoms such as pain, dyspnoea, anxiety and depression similar to those experienced by people with malignant conditions. These people may benefit from a supportive care approach. This requires a comprehensive assessment of physical, psychological and social problems and appropriate symptom relief. Consideration should be given to;

- Relief of physical symptoms such as pain and dyspnoea.
In many patients ensuring interventions for treatment of heart failure are optimised will treat physical symptoms. Careful use of opiates may be helpful if breathlessness is troublesome (start with low doses; morphine and diamorphine accumulate in patients with renal failure), lorazepam may be helpful for anxiety and breathlessness. In patients with nausea, the cause should be considered before selecting specific treatment
- Detection and management of psychological problems – anxiety, depression
- The need for social support for patients and their carers
- Full opportunity to discuss the prognosis and consequences of their illness
- Discussion of resuscitation wishes as appropriate

Patients with complex problems may benefit from referral to specialist supportive (palliative) care teams.

1.5 Social support

Appropriate social support should be offered.

2.1 Pharmacological interventions

This is intended to summarise the drug treatments which should be considered in patients with left ventricular systolic dysfunction. It is assumed that individual contra-indications will be excluded. Some patients may not tolerate individual drugs. It is good clinical practice to record this and the reason in the notes. However, patients should not be recorded as intolerant when alternative measures might not have been considered. For example, patients who develop symptomatic hypotension taking an ACE inhibitor and diuretic may benefit from a reduction in the dose of diuretic, and not have to reduce or stop the ACE inhibitor. Clinicians should refer to other sources of information e.g. BNF.

2.1.1 Diuretics (see below for spironolactone)

Patients with signs of fluid overload require treatment with a diuretic. Patients who are breathless, but who do not have clear signs of pulmonary oedema often also benefit.

Monitoring of renal function and serum potassium is mandatory (see section 2.1.12, Therapeutic drug monitoring).

Most symptomatic patients require a loop diuretic. In some with mild symptoms of heart failure a thiazide may be sufficient, but is less effective in patients with renal failure and is associated with a higher incidence of hyponatraemia. In patients with severe heart failure and resistant oedema the combination of a loop and thiazide diuretic is very effective, but

doses must be appropriate and the effects, including on serum sodium, potassium and renal function, must be monitored closely. Some hospital specialists consider the combination of a loop diuretic and for a thiazide (for example Bendroflumethazide 1.25mg – 2.5 mg daily) once a patient is taking furosemide 80mg – 160mg daily. Some patients may require higher dose loop diuretics e.g. furosemide 250 – 500mg daily. In a few patients with very resistant fluid retention despite optimising other treatment, metolazone may be considered in combination with a loop diuretic (usually under hospital supervision). However, bendroflumethazide 10mg daily and metolazone 10mg daily for 3 days are equally effective, while longer courses add no benefit [10]. In an outpatient setting, self-medication with metolazone 2.5mg b.d. for up to 2 days in the event of deterioration may prevent readmissions in patients able to self-monitor [11].

2.1.2 ACE inhibitors

All patients with left ventricular systolic dysfunction, including those who are asymptomatic, should be treated with ACE inhibitors unless there are contra-indications.

ACE inhibitors have been shown to reduce symptoms and signs of heart failure, and improve exercise capacity. Mortality and hospital admission are reduced [12,13]. A recent overview reported a 20% reduction in mortality and 33% reduction in readmission for heart failure [14]. The benefits were seen early after the start of treatment and persisted long term. There was a trend towards greater risk reductions in those with the lowest ejection fractions.

ACE inhibitors are started at a low dose (e.g. lisinopril 2.5 – 5 mg od) and should be up titrated to at least the doses shown to have been effective in the trials e.g. Lisinopril 20-40 mg od, or the maximum tolerated. The ATLAS study [15] compared lisinopril 2.5 - 5 mg od with 32.5 –35 mg od and reported a non significant 8% reduction in mortality and a significant 12% reduction in the combined end point of death and hospital admission for any reason.

Alternative ACE inhibitors may be used. In North Tyneside in particular some clinicians prefer perindopril, starting dose 2 mg daily and up-titrating to 4-8 mg daily. Ramipril is also included on the formulary. Comparable costs are included in appendix 1.

It is expected that there will some fall in blood pressure with ACE inhibitors. Asymptomatic low blood pressure requires no further action.

Patients who develop symptomatic hypotension (documented dizziness with low blood pressure, postural hypotension) should have their fluid status assessed (e.g. JVP, other signs of congestion). The dose of diuretic should be reduced if there are no signs or symptoms of congestion. Other non-essential drugs which lower blood pressure should be withdrawn. If these measures fail, referral should be made for specialist advice.

2.1.3 Spironolactone

Patients with severe heart failure and left ventricular systolic dysfunction with an ejection fraction < 35% should be treated with low dose spironolactone (12.5 – 25 mg od) unless there are contra indications.

Patients with a serum creatinine > 220 micromol/l and/or potassium > 5 mmol/l at baseline before starting spironolactone should not be treated with this. In all patients monitoring of serum potassium is mandatory (see therapeutic drug monitoring section, 2.1.12).

The addition of spironolactone has been shown to reduce mortality and hospitalisation for severe heart failure. The RALES trial [9] was stopped early after a mean follow up of 24 months because an interim analysis reported a 30% reduction in mortality and 35% lower frequency of hospitalisation. Patients in the trial had severe heart failure, all were taking loop diuretics and 94% ACE inhibitors. Gynaecomastia may be a problem and was found in 10% of men in the trial.

2.1.4 Beta blockers

Stable patients with controlled heart failure and left ventricular systolic dysfunction should be treated with beta blockers in addition to diuretics and/or digoxin and ACE inhibitors unless there are contra-indications.

The addition of beta blockers to diuretics, ACE inhibitors and digoxin has been shown to reduce mortality 35% in patients with mild to moderate heart failure [7,16, 17] and in patients with severe heart failure [9].

Both carvedilol and bisoprolol are licensed for use as adjunctive treatment in heart failure. The MERIT trial used metoprolol as a slow release preparation. At present there is insufficient evidence to definitely recommend the use of one particular beta blocker. However, in the recent COMET trial, all cause mortality was reduced 17% in the carvedilol group compared to the metoprolol group [20]. If patients taking a different beta blocker (e.g. atenolol) develop mild heart failure it is reasonable to suggest they continue this if they are tolerating it.

Initiation and dose up titration of beta blockers

The starting dose of beta blocker is substantially lower than conventional doses e.g. carvedilol 3.125 mg bd, bisoprolol 1.25 mg od. The dose is up-titrated, doubling the dose at intervals of 2 weeks or more

<i>Beta blocker</i>	<i>Starting dose</i>	<i>Target dose (or max tolerated)</i>
Carvedilol	3.125 mg bd	25 mg bd (if weight < 85kg or severe heart failure) 50 mg bd (if weight > 85kg)
Bisoprolol	1.25 mg od	10 mg od

In the MERIT trial the formulation of metoprolol used was the controlled release/extended release one, with a starting dose of 12.5 mg or 25 mg daily (or half a 25 mg for patients in NYHA III-IV). The extended formulation available locally is a dose of 200 mg, and thus is not suitable for initiation in patients with heart failure. Clinicians may wish to use the non extended release preparation although no firm recommendations about doses can be made. Some clinicians have used 12.5 mg bd (i.e. quarter of 50 mg twice daily). Elixirs are not recommended.

The current recommendations are that initiation should be under the supervision of a hospital consultant. However, there was consensus that stable patients with mild heart failure could have beta blockers initiated and up-titrated in primary care. In some patients with more severe symptoms patients may have beta blockers initiated from hospital care, but with further up-titration being in primary care.

How to use beta blockers (adapted from NICE guidelines for the management of chronic heart failure)

1. Start with a low dose
2. Double dose at no more than 2 weekly intervals
3. Aim for target dose, or maximum tolerated
4. Monitor heart rate, blood pressure, clinical status (symptoms and signs, particularly of congestion)

Dealing with problems which may arise (adapted from NICE guidelines for the management of chronic heart failure)

Worsening symptoms / signs

1. Increasing congestion;
 - Mild deterioration – continue beta blocker and treat with additional standard anti-failure treatment (diuretics etc). Review in a few days. If no or slow improvement, increase anti failure treatment and consider halving the dose of beta blocker (increasing again after an interval once failure resolved).
 - Moderate deterioration – some may need admission to hospital. If not, treat with additional standard anti-failure treatment (diuretics etc) and consider halving the dose of beta blocker. Review in a few days. If these patients do not improve or deteriorate further the beta blocker may need to be temporarily withdrawn, and admission to hospital necessary.
 - Severe deterioration – admission to hospital. Beta blockers may need to be stopped.
2. If marked fatigue, halve the dose of beta blockers (rarely needed, and there may be other causes of fatigue e.g. over diuresis, symptoms from other co-morbid conditions). Review patient at least within 1-2 weeks and if not improving seek specialist advice.

Low heart rate

1. If < 50 beats per minute and worsening symptoms – halve beta blocker or, if severe deterioration admit to hospital when beta blocker may need to be stopped
2. Review other medication and indications. Consider discontinuing / reducing those which slow the heart rate (e.g. diltiazem, digoxin, amiodarone) if possible.
3. Arrange ECG to exclude heart block
4. If unsure, seek specialist advice

Asymptomatic low blood pressure

Does not usually require any change in therapy

Symptomatic hypotension

1. If low blood pressure causes dizziness, falls, or confusion, consider stopping drugs such as calcium channel blockers, nitrates and other drugs which may lower blood pressure or cause postural hypotension
2. If no signs of congestion; consider reducing the dose of diuretic (check the JVP and if low reduce the diuretics)
3. If unsure, seek specialist advice

Beta blockers should only be stopped altogether if absolutely necessary and generally requires specialist advice.

2.1.5 Digoxin

Digoxin is indicated in patients in sinus rhythm treated with diuretics, and ACE inhibitors if possible, who remain symptomatic, particularly those who have had at least one admission to hospital. Some clinicians find digoxin useful in patients unable to tolerate the usual doses of other drugs, often due to symptomatic hypotension

Digoxin is also indicated in patients with heart failure and atrial fibrillation with a rapid ventricular response.

Withdrawal trials have shown withdrawal of digoxin from patients with heart failure in sinus rhythm leads to deterioration in symptoms and exercise tolerance [19]. A placebo controlled trial reported an overall neutral net effect on mortality (balance between reduction in death due to worsening heart failure and an increase in death due to other cardiac causes e.g. arrhythmias) and a 28% reduction in hospitalisation for heart failure [20].

Digoxin dose

The median daily dose of digoxin in the DIG trial was 0.25 mg. The mean plasma concentration was 0.86 ng/ml at 1 month and 0.80 ng/ml at 1 year. The beneficial effects of digoxin may not be dependent on achieving high serum digoxin concentrations [22] and lower doses of digoxin may be preferred initially, particularly in patients with impaired renal function. Care should be taken to avoid toxicity if higher doses are being used, particularly in women. Routine monitoring of digoxin levels is not necessary, but serum digoxin levels should be checked (at least 5-7 hours after the last dose) if there is a clinical suspicion of digoxin toxicity, whatever the dose being used. The serum digoxin level must be interpreted in the clinical context as symptoms of toxicity may occur even when the serum level is within the 'therapeutic range'.

2.1.6 Angiotensin 2 receptor antagonists

ACE inhibitors are first line for ACE inhibition in patients with left ventricular systolic dysfunction. Trials comparing losartan with captopril have reported at least similar outcomes with losartan as with captopril [22,23] and it is reasonable to use an angiotensin 2 receptor antagonist in patients unable to tolerate an ACE inhibitor due to cough, rash or angio-oedema. However, it is important to exclude other causes of cough before switching, for example viral infections can cause a cough for some time and patients who develop

worsening pulmonary oedema may present with a cough. It is worth noting that whilst fewer patients develop angio-oedema with a AT2 receptor antagonist the incidence in patients taking an AT2 receptor antagonist is not zero.

The trials combining an ACE inhibitor and AT2 receptor antagonist have been conflicting and at the present time the combination is not routinely recommended. There may be some patients in whom the combination might be considered, for example in those in whom hypertension is difficult to control, when heart failure is particularly difficult to control and in some with diabetes, but these patients should be under specialist care and be carefully monitored.

The current AT2 receptor antagonists on the formulary are losartan and Irbesartan. Comparative costs of some the AT2 receptor antagonists are included in appendix 1.

2.1.7 Hydralazine/nitrate

Patients treated with diuretics and or digoxin who are unable to tolerate an ACE inhibitor due to development of renal failure should be considered for treatment with hydralazine and oral nitrate.

The mortality of patients treated with a combination of hydralazine and oral isosorbide dinitrate was lower than those treated with an alternative vasodilator, prazosin, or placebo [24], although mortality was lower in patients treated with enalapril than with hydralazine and nitrate [25]. The target doses in the trial was a total daily doses of hydralazine 300 mg and isosorbide dinitrate 160 mg, taken in a four times per day regimen.

In patients of Afro-Caribbean origin with advanced heart failure the addition of hydralazine and nitrates to standard heart failure led to additional survival benefit [26] and might be considered in this group. In this trial the target total daily dose of hydralazine was 225mg and isosorbide dinitrate 120 mg.

2.1.8 Warfarin/Aspirin

Aspirin is considered the first line anti-platelet agent in patients with heart failure and vascular disease, and can be safely used in combination with ACE inhibitors.

Patients in atrial fibrillation should be considered for treatment with warfarin in place of aspirin with a target INR of 2.5. Warfarin may also be preferred in a few other selected patients at higher risk of thrombo-embolism, for example those with very poor left ventricular function, those with a left ventricular aneurysm and patients with peri-partum cardiomyopathy. The decision to use warfarin instead of aspirin in high risk patients other than those with AF, should generally be made in specialist care.

Warfarin control may become unstable if patients become unstable for other reasons e.g. worsening heart failure, when more frequent monitoring may be necessary. It is mandatory that all patients admitted to hospital as an emergency have an INR measured before any warfarin is prescribed.

2.1.9 Nitrates

Nitrates may be used in combination with hydralazine. Nitrates are also effective anti-anginal drugs and are also useful for treating the symptoms of heart failure. Oral nitrate at

night can be considered in patients in those with nocturnal breathlessness. to treat symptoms of angina in patients with chronic heart failure.

2.1.10 Anti anginals

Patients with angina should generally be referred for a specialist opinion. Beta blockers and nitrates have been discussed. Some calcium antagonists may precipitate or aggravate heart failure (e.g. nifedipine, diltiazem). Trials have reported that amlodipine is safe to use in patients with heart failure [27]. Felodipine is also reported to be well tolerated [28].

2.1.11 Statins

Statins should be prescribed to patients who are likely to benefit (see the local statin strategy - FATS). Patients without established vascular disease should be managed for primary prevention in the context of an additional serious illness.

2.1.12 Therapeutic drug monitoring

Monitoring of renal function and serum electrolytes is essential in all patients with heart failure. The frequency will vary according to any changes in medication, clinical stability and presence of co-morbidity, but should be at least 6 monthly. These notes are intended as a practical guide. However, each patient must be managed individually.

ACE inhibitors and AT2 receptor antagonists

- Check renal function and serum electrolytes at baseline
- Start a low dose ACE inhibitor (or AT2 receptor antagonist)
- Monitor serum creatinine, urea and electrolytes at a minimum within 2 weeks. Some may require monitoring earlier (see below).
- Up-titrate as blood pressure and renal function allow, aiming for target doses of the drug.

Particular vigilance is recommended (and specialist referral may be necessary) in some patients. For example;

- those with a serum sodium < 135mmol/l,
- a creatinine > 150micromol/l,
- a systolic blood pressure < 100mmHg,
- treatment with furosemide 80mg daily or more,
- those with severe symptoms of heart failure and or peripheral vascular disease
- Patients who are frail, with multiple co-morbidities and other therapies
- NSAIDs (excluding low dose aspirin) should be stopped if at all possible, but if not the possibility of interaction with deterioration in renal function requires particular attention

Dealing with problems with renal function which may arise with ACE inhibitors (adapted from NICE guidelines for the management of chronic heart failure)

- Some rise in urea, creatinine and potassium is expected and if small and asymptomatic no action is needed
- An increase of potassium to ≤ 5.5 mmol/l requires no action. A rise in potassium to between 5.5 and 5.9 mmol/l needs review, and repeating. The rate of rise as well as the absolute value will influence what action may be taken.

- An increase in creatinine of up to 50% above baseline, or to 200 micromol/l whichever is the smaller, is acceptable.
- If there is an excessive rise in urea, creatinine or potassium, consider stopping concomitant medication which may be contributing e.g. NSAIDs. Check fluid balance status (e.g. JVP) and consider reducing the dose of diuretic if no signs of congestion.
- If there are further rises in creatinine and potassium the dose ACE inhibitor should be reduced, and blood chemistry repeated. If there is still an unsatisfactory response, referral should be made for specialist advice.
- If potassium is ≥ 6 mmol/l and or creatinine rises by $> 100\%$, or is $\geq 280-300$ micromol/l ACE inhibitors should be stopped and referral made for specialist advice for further management of heart failure.

Spironolactone (adapted from NICE guidelines for the management of chronic heart failure)

In the trial of spironolactone deterioration in renal function and hyperkaleamia was not a major problem. However, post trial surveillance of use in clinical practice has shown that some patients do develop deterioration in renal function and hyperkalaemia, and monitoring is mandatory.

- All patients must have serum urea, creatinine and potassium checked at baseline
- Exclude patients if creatinine > 220 micromol/l and or potassium > 5 mmol/l
- Repeat serum urea, creatinine and potassium at 1, 4, 8 and 12 weeks, 6, 9 and 12 months and at least 6 monthly thereafter
- If potassium rises to 5.5 – 5.9 mmol/l and or creatinine to > 200 micromol/l reduce dose of spironolactone to 12.5 mg daily (or stop if already on the lower dose). Repeat blood chemistry after a week.
- If potassium rises to ≥ 6.0 mmol/l and or creatinine > 200 micromol/l stop spironolactone and refer for specialist advice

Management of acute left heart failure

All patients with severe symptoms should be admitted to hospital. The summary outlines the steps to be taken following admission.

A treatable cause such as myocardial infarction or arrhythmia should always be sought and treated.

Basic treatment measures are to sit the patient upright and give high flow oxygen (controlled oxygen in COPD patients). Initial drug treatment is with intravenous loop diuretics (e.g. furosemide 80mg), morphine 2.5- 10 mg or diamorphine 2.5 – 5mg, (caution in COPD, the elderly) and buccal or intravenous nitrates.

Second line treatments include dobutamine, especially if the systolic blood pressure is below 100mmHg, and IV GTN if not already given. Bronchodilators such as beta -2 agonists may be used if wheezing is present – 'cardiac asthma'.

Mechanical ventilation may be necessary in severe cases with respiratory failure. Intra aortic balloon counterpulsation may be used in selected cases in whom further definitive treatment is being considered.

Following initial 'rescue therapy', ACE inhibitors and other treatments described in this guideline should be started. Initiation of beta blockers should be delayed until heart failure has been treated and the patient is stable on other treatment.

The re-admission rate of patients with heart failure is high (40%+). This may be reduced by ensuring the following:

- Active on ward without breathlessness or oedema
- Clear lung fields on CXR pre-discharge
- Normal or slightly elevated venous pressure
- U&E stable
- Cardiac nurse notified of admission (it is envisaged that with additional resource all patients admitted to hospital with a primary diagnosis of acute heart failure will be seen by a cardiac nurse who will help with management and follow up)
- Patient understands condition, knows what to do in case of deterioration
- Arrange early follow up in difficult cases, prompt communication with GP important

In some patients the goals may need reassessing: very ill, recurrent admission

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APPENDICES

Appendix 1 – some comparative drug costs

Drug	Cost of 28 days treatment	Comments
Beta-blockers		
Bisoprolol 1.25 mg od	£8.56	No generic preparation
Bisoprolol 2.5 mg od	£5.90	No generic preparation
Bisoprolol 5 mg od	£2.09	Generic
Bisoprolol 10 mg od	£2.11	Generic
Carvediolol 3.125 mg bd	£6.67	
Carvediolol 6.25 mg bd	£7.71	
Carvediolol 12.5 mg bd	£8.69	
Carvediolol 25 mg bd	£10.56	
ACE Inhibitors		
Lisinopril 2.5 mg od	£1.17	
Lisinopril 5 mg od	£1.34	
Lisinopril 10 mg od	£1.70	
Lisinopril 20 mg od	£2.22	
Lisinopril 40 mg od	£4.44	
Perindopril 2 mg od	£10.22	
Perindopril 4 mg od	£10.22	
Perindopril 8 mg od	£10.22	
Ramipril 2.5 mg od	£1.63 - £2.37	Capsules cost less than tablets
Ramipril 5 mg od	£2.32 - £3.22	Capsules cost less than tablets
Ramipril 10 mg od	£2.68 - £3.98	Capsules cost less than tablets
Angiotensin II receptor antagonists		
Losartan 50mg daily	£18.09	
Lorsartan 100mg daily	£24.20	
Irbesartan 150mg	£12.57	
Irbesartan 300mg	£16.91	
Notes		
<ul style="list-style-type: none"> • Costs are based on NHS prices published in the September 2005 Drug Tariff 		

Appendix 2 - membership of the guideline development group

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Declared conflicts of interest

JSS has received travel grants and lecture honoraria from various pharmaceutical companies. PCA has received travel grants, lecture honoraria and research support from various pharmaceutical companies. RJ has received funding from Takeda to attend an educational event about candesartan. CD has received sponsorship, lecture fees, and been a member of advisory boards for various pharmaceutical companies, including Servier, MSD, Merck, AstraZeneca, Roche.

Review date

September 2008, or earlier if clinically indicated

Diagnosis of Patients with heart failure in Primary Care

Use within an overall clinical management strategy and in conjunction with the resource document

Definite or possible heart failure from history and examination

- Arrange FBC, U&E, LFT, TFT, plasma glucose, lipids (FATS), ECG, CXR
- Major abnormality present on ECG/CXR
 - Echocardiograph or refer to specialist care
- Major abnormality not present on ECG/CXR
 - Consider alternative causes for symptoms
 - Refer to specialist care if still clinical suspicion of heart failure

Notes

1. Patients treated for a long time with diuretics for suspected heart failure ('the prevalent pool') are more likely to need an echocardiograph to confirm or refute the diagnosis – see supporting notes
2. All patients with LV systolic dysfunction – consider aetiology
3. All patients with confirmed LV systolic dysfunction - see management flow
4. From April 2003 all patients with suspected heart failure require an assessment of left ventricular function (new GMS contract), usually with an echocardiograph
5. An echocardiograph is not clinically indicated if left ventricular systolic dysfunction has been assessed with alternative imaging e.g. gated heart scan, gated spect or left ventriculogram
6. Consider referral in some e.g. valvular disease; arrhythmias including atrial fibrillation; angina; therapeutic difficulty; clarification of aetiology; definite heart failure (e.g. pulmonary congestion on CXR, raised JVP) and normal LV systolic function; for other interventions e.g. ICD assessment, pacing etc.

Management of patients with heart failure secondary to left ventricular systolic dysfunction

Ensure diagnosis is secure

Use within an overall clinical management strategy & with the resource document
It is assumed that patients with contraindications will be identified and excluded
The BNF should be referred to as necessary

Drug treatment

- Diuretic for salt and water retention
- ACE inhibitor in all patients to target dose (or maximum tolerated)
- Beta blocker in stable patients
- Spironolactone in severe heart failure
- Digoxin if persisting symptoms, previous hospital admission
- Avoid aggravating drugs if possible e.g. NSAID, most calcium channel blockers

Non drug measures

- Reduce salt
- Avoid excess fluid intake
- Moderate alcohol (avoid in alcoholic cardiomyopathy)
- Smoking cessation advice
- Regular, individualised exercise
- Reduce obesity – realistic targets
- Manage cachexia

Annual influenza immunisation/once only pneumococcal immunisation

Palliative care / Social Support / Education

Notes

1. Monitor renal function and electrolytes with up titration of ACE inhibitors and AT II receptor antagonist, and at least 6 monthly
2. Consider AT II receptor antagonist if ACEI cough (consider other causes of cough first)
3. Treat asymptomatic LV systolic dysfunction with ACE inhibitors
4. Hydrallazine/oral nitrate if intolerant of ACE inhibitor / AT II antagonist
5. Aspirin in patients with vascular disease or consider warfarin in AF (+/- referral), and in other patients at high thrombo-embolic risk

Hospital Management of Acute Heart Failure

September 2005

Use in conjunction with the resource document

Triage and initial assessment

- Does the patient need ventilation *now*; contact ITU staff early
- Is there a treatable cause?
Consider myocardial infarction, arrhythmia, valve disease
ECG, CXR, FBC, U&E, LFT, TFT, plasma glucose, lipids in some
Echo, gated heart scan (poor echo subject, regular rhythm), if no previous
record and or new cardiac event suspected

First line

- Sit patient up, give high flow oxygen, iv access
- Morphine 2.5-10 mg or diamorphine 2.5 – 5 mg . (in-dwelling i.v. cannula)
- Furosemide 40-120mg i.v. (lower dose with diuretic naïve patient)
- Buccal GTN 5mg if BP >100 systolic

Second line (not better within 2 hrs)

- GTN 1-2mg/hour i.v. infusion, increasing as tolerated by BP
- Dobutamine 2.5-7.5microg/kg/min infusion, higher dose if hypotensive
- Nebulised salbutamol 2.5-5mg 4hrly, as tolerated by heart rate

Third line (consider occasionally)

- Mechanical ventilation (tired patient, inability to maintain oxygenation)
- Intra-aortic balloon pump (generally only if there is a reversible cause for the heart failure)
- Dialysis/CVVH

Hospital management of patients with heart failure secondary to left ventricular systolic dysfunction

Ensure diagnosis is secure and cause of heart failure established & treated where possible (e.g. AF, hypertension, exacerbating drugs)

Drug treatment: as in primary care

- Diuretic for salt and water retention
- ACE inhibitor in all patients to target dose (or maximum tolerated)
- Beta blocker in stable patients
- Spironolactone in severe heart failure
- Digoxin if persisting symptoms, previous hospital admission

Resistant cases, including right heart failure with congestion

- Remember salt and fluid restriction & bed rest
- DVT prophylaxis: e.g. tinzaparin 3500 u sc/warfarin/TED stockings
- Increase diuretic dose (furosemide up to 500 mg od especially in CRF)
- Consider bumetanide if peripheral oedema a problem: better absorption
- Consider iv diuretic if absorption suspect
- Combine a loop and thiazide diuretic e.g. furosemide 120 mg/bendroflumethazide 1.25-2.5 mg od initially: Watch U&E.
- Consider dobutamine infusion if very resistant
- High dose bendroflumethazide or intermittent metolazone may be needed

Goals of in-patient treatment

- Active on ward without breathlessness or oedema
- Clear lung fields on chest X-ray pre-discharge
- Normal or slightly elevated venous pressure
- U&E stable
- Re-assess goals in some patients: very ill, recurrent admission
- Patient understands condition, knows what to do in case of deterioration
- Cardiac nurse notified of admission (once service available)
- Arrange early follow up in difficult cases, prompt communication with GP important

Other considerations

- Consider **diastolic dysfunction** where LV apparently normal: see notes
- Consider **other causes of congestion**: valve disease, constrictive pericarditis, renal artery stenosis, high fluid intake with renal dysfunction
- Treat asymptomatic LV dysfunction with ACEI
- Coronary disease patients with heart failure: think about **revascularisation**
- Consider **devices**: ICD implantation if high risk of malignant arrhythmias, resynchronisation therapy in cardiac dyssynchrony: see notes
- **Exercise** programmes shown to benefit heart failure patients substantially
- **Non drug measures**: as in primary care