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Management of chronic heart failure

A national clinical guideline

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February 2007

KEY TO EVIDENCE STATEMENTS AND GRADES OF RECOMMENDATIONS

LEVELS OF EVIDENCE

- 1⁺⁺ High quality meta-analyses, systematic reviews of randomised controlled trials (RCTs), or RCTs with a very low risk of bias
- 1⁺ Well conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias
- 1⁻ Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias
- 2⁺⁺ High quality systematic reviews of case control or cohort studies
High quality case control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal
- 2⁺ Well conducted case control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal
- 2⁻ Case control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal
- 3 Non-analytic studies, eg case reports, case series
- 4 Expert opinion

GRADES OF RECOMMENDATION

Note: The grade of recommendation relates to the strength of the evidence on which the recommendation is based. It does not reflect the clinical importance of the recommendation.

- A** At least one meta-analysis, systematic review of RCTs, or RCT rated as 1⁺⁺ and directly applicable to the target population; *or*
A body of evidence consisting principally of studies rated as 1⁺, directly applicable to the target population, and demonstrating overall consistency of results
- B** A body of evidence including studies rated as 2⁺⁺, directly applicable to the target population, and demonstrating overall consistency of results; *or*
Extrapolated evidence from studies rated as 1⁺⁺ or 1⁺
- C** A body of evidence including studies rated as 2⁺, directly applicable to the target population and demonstrating overall consistency of results; *or*
Extrapolated evidence from studies rated as 2⁺⁺
- D** Evidence level 3 or 4; *or*
Extrapolated evidence from studies rated as 2⁺

GOOD PRACTICE POINTS

- Recommended best practice based on the clinical experience of the guideline development group

Scottish Intercollegiate Guidelines Network

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Scottish Intercollegiate Guidelines Network
28 Thistle Street, Edinburgh EH2 1EN

www.sign.ac.uk

1 Introduction

1.1 WHAT IS CHRONIC HEART FAILURE?

Chronic heart failure (CHF) is a complex clinical syndrome that can result from any structural or functional cardiac or non-cardiac disorder that impairs the ability of the heart to respond to physiological demands for increased cardiac output. Chronic heart failure is characterised by symptoms such as exertional breathlessness and fatigue, and signs of fluid retention as well as signs associated with the underlying cardiac disorder.

Heart failure may arise as a consequence of a myocardial, valvular, pericardial, endocardial or electrical problem (or some combination of these). In contrast with chronic heart failure, the term acute heart failure is often used to mean acute (cardiogenic) dyspnoea characterised by signs of pulmonary congestion including pulmonary oedema.

1.2 CAUSES OF HEART FAILURE

A syndrome is a constellation of symptoms and signs and is not a single disease. The underlying diagnosis and aetiology must always be sought in patients presenting with the heart failure syndrome. This is the only way in which optimum treatment can be provided, ie the treatment varies depending on whether the underlying cause is myocardial dysfunction, valve disease or some other aetiology.

The commonest cause of heart failure is myocardial dysfunction which is commonly systolic, ie there is reduced left ventricular contraction. Around two thirds of these cases result from coronary heart disease (CHD) and there is usually a past history of myocardial infarction (MI). The remainder have a non-ischaemic cardiomyopathy, which may have an identifiable cause (eg, hypertension, thyroid disease, valvular disease, alcohol excess, or myocarditis) or may have no known cause (eg, idiopathic dilated cardiomyopathy).

1.3 REMIT OF THE GUIDELINE

This guideline is subdivided into six sections. The first deals with diagnostic tests which are effective in arriving at a diagnosis and underlying cause for disease. The second section addresses lifestyle modification which affects risks or progression of CHF. The third and fourth address optimum pharmacological and interventional treatments. The fifth section discusses organisation of care and discharge planning. The sixth section deals with palliative care. The quality of the evidence and hence the strength of the recommendations varies across the six sections with the strongest evidence generally being available for the treatment sections.

There are overlaps between this guideline and other SIGN guidelines on aspects of cardiovascular disease (CVD). For example, implantable cardiac defibrillators are relevant to heart failure but they are dealt with fully in SIGN guideline 94 on cardiac arrhythmias in coronary heart disease.¹

This guideline refers only to chronic heart failure and acute heart failure is dealt with in SIGN guideline 93 on acute coronary syndromes.²

1.4 DEFINITIONS

Once a diagnosis of CHF has been established symptoms may be used to classify the severity of heart failure. The New York Heart Association (NYHA) classification is the most widely used stratification tool for assigning patients with CHF to functional classes (see *Table 1*).³

Table 1: New York Heart Association classification

Class	Symptoms
I	No limitation: ordinary physical exercise does not cause undue fatigue, dyspnoea or palpitations.
II	Slight limitation of physical activity: comfortable at rest but ordinary activity results in fatigue, palpitations or dyspnoea.
III	Marked limitation of physical activity: comfortable at rest but less than ordinary activity results in symptoms.
IV	Unable to carry out any physical activity without discomfort: symptoms of heart failure are present even at rest with increased discomfort with any physical activity.

Chronic heart failure can be associated with left ventricular systolic dysfunction (LVSD) and/or left ventricular diastolic dysfunction (LVDD). It can go on to involve right ventricular dysfunction (RVD) in the late stages. Left ventricular systolic dysfunction means the left ventricle does not contract well enough to pump out an adequate supply of oxygenated blood around the peripheral circulation. Left ventricular diastolic dysfunction means the left ventricle fails to fill properly due to stiffness of the left ventricle or inadequate inflow across a damaged mitral valve. The result is an inadequate supply of oxygenated blood to the peripheral circulation.

It is possible to have impaired LVSD without the clinical symptoms of chronic heart failure. This can happen:

- a) with a history of symptomatic heart failure and subsequent ongoing treatment
- b) with no history of previous symptoms of heart failure nor treatment (asymptomatic LVSD).

1.5 STATEMENT OF INTENT

This guideline is not intended to be construed or to serve as a standard of care. Standards of care are determined on the basis of all clinical data available for an individual case and are subject to change as scientific knowledge and technology advance and patterns of care evolve. Adherence to guideline recommendations will not ensure a successful outcome in every case, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgement must be made by the appropriate healthcare professional(s) responsible for clinical decisions regarding a particular clinical procedure or treatment plan. This judgement should only be arrived at following discussion of the options with the patient, covering the diagnostic and treatment choices available. It is advised, however, that significant departures from the national guideline or any local guidelines derived from it should be fully documented in the patient's case notes at the time the relevant decision is taken.

1.5.1 PATIENT VERSION

A patient version of this guideline is available from the SIGN website, www.sign.ac.uk

1.5.2 ADDITIONAL ADVICE TO NHSSCOTLAND FROM NHS QUALITY IMPROVEMENT SCOTLAND AND THE SCOTTISH MEDICINES CONSORTIUM

NHS QIS processes multiple technology appraisals (MTAs) produced by the National Institute for Health and Clinical Excellence (NICE) in England and Wales.

The Scottish Medicines Consortium (SMC) provides advice to NHS Boards and their Area Drug and Therapeutics Committees about the status of all newly licensed medicines and any major new indications for established products.

NHS QIS validated NICE MTAs and SMC advice relevant to this guideline are summarised in the section on implementation.

1.6 REVIEW AND UPDATING

This guideline was issued in 2007 and will be considered for review in three years. Any updates to the guideline in the interim period will be noted on the SIGN website: www.sign.ac.uk

2 Diagnosis and investigations

Patients often present with symptoms of fatigue and/or shortness of breath and/or ankle swelling. These patients are frequently obese, they often smoke and they may have a history of chronic obstructive pulmonary disease, hypertension, coronary heart disease or diabetes. The challenge for the clinician is to differentiate CHF from a myriad of other conditions with similar symptoms and signs and to streamline the patient's journey via the most efficient diagnostic and therapeutic pathway. A successful diagnosis is likely to require both subjective (review of symptoms) and objective (evidence of cardiac dysfunction) components.

2.1 DIAGNOSING HEART FAILURE

2.1.1 CLINICAL EXAMINATION

There is no symptom or sign that is both sensitive and specific for the diagnosis of CHF and a purely clinical diagnosis is problematic. Table 2 reports sensitivities and specificities of some common symptoms associated with CHF.⁴

Table 2: Sensitivity and specificity of symptoms in diagnosing chronic heart failure

Symptom	Sensitivity (%)	Specificity (%)
dyspnoea	66	52
orthopnoea	21	81
paroxysmal nocturnal dyspnoea	33	76
history of oedema	23	80

The following signs are more specific for heart failure and should be sought in patients presenting with symptoms suggestive of CHF.⁴

- raised jugular venous pressure (JVP)
- lateral displacement of the apex beat
- presence of a third heart sound (S3)
- basal crepitations
- peripheral oedema.

Identification of any of these signs adds to the clinical suspicion of CHF (see Table 3). Many patients will not exhibit any of these signs.

Pulse rate and rhythm and blood pressure should also be measured and recorded.

Table 3: Sensitivity and specificity of diagnostic signs in individuals with suspected heart failure

Sign	Sensitivity (%)	Specificity (%)
raised JVP	10	97
third heart sound	31	95
peripheral oedema	10	93
tachycardia	7	99
crepitations	13	91

Pulmonary crepitations and ankle oedema are relatively common signs in presenting patients, but are not specific to heart failure. In clinical practice it is the combination of symptoms and signs, and the presence or otherwise of a likely cause of heart failure which is most useful.

Basic early investigations are necessary to differentiate heart failure from other conditions and to provide prognostic information. Urinalysis, serum urea and creatinine tests may help to determine if there is kidney failure, since symptoms of kidney disease are similar to those of CHF. Chest X-ray may indicate signs of CHF such as cardiomegaly, pulmonary congestion or pleural effusion and also non-cardiac indications such as lung tumours which account for breathlessness.

- ☑ Patients suspected of chronic heart failure should receive a range of basic tests. The investigations will vary depending on the presentation but should usually include a full blood count, fasting blood glucose, serum urea and electrolytes, urinalysis, thyroid function and chest X-ray.

2.1.2 FURTHER INVESTIGATIONS

Following clinical examination and basic investigations, a decision must be made as to whether the patient should undergo an echocardiogram (see *section 2.1.5*). To help make this decision, the patient should undergo either an electrocardiogram (ECG, see *section 2.1.3*) or brain natriuretic peptide (BNP) test (see *section 2.1.4*), or both depending on local circumstances. If either test is abnormal, there is sufficient likelihood of heart failure to warrant echocardiography to confirm a diagnosis. If both tests are normal, heart failure is unlikely and alternative tests for the symptoms should be considered.

If echocardiography suggests a diagnosis of heart failure, an ECG should be done (if it has not already been done) to help identify the underlying cause of the heart failure.

Pulmonary function tests should be considered in selected patients, ie in those whom heart failure is excluded and also in those with heart failure and comorbid lung disease which may contribute to dyspnoea.

2.1.3 ELECTROCARDIOGRAPHY

The ECG is used firstly as a screening test to assess the likelihood of CHF and the need for subsequent echocardiography to confirm or refute a diagnosis. It is unusual for a patient with chronic heart failure to have a normal ECG. The ECG abnormalities reported in heart failure are all non-specific, and relatively common in elderly patients. The specificity of an abnormal ECG is relatively poor (around 60% at best).⁵

2++

Electrocardiographic abnormalities in CHF include:

- pathological Q waves
- left bundle branch block
- left ventricular hypertrophy (LVH)
- atrial fibrillation
- non-specific ST and/or T wave changes.

Electrocardiography is also useful once CHF has been confirmed as it may help to determine the cause (eg, Q waves indicate previous myocardial infarction, LVH is seen in hypertension and aortic valve disease) and it is important to exclude atrial fibrillation.

2.1.4 B-TYPE NATRIURETIC PEPTIDE

Brain natriuretic peptide and N terminal-pro-BNP (NT-proBNP) are peptide hormones produced in the heart by breakdown of a precursor protein (pro-BNP). BNP causes natriuresis, diuresis, vasodilation and muscle relaxation; NT-proBNP is inactive.⁶

Plasma BNP and NT-proBNP concentrations are raised in patients with heart failure and the concentrations tend to rise with NYHA class.

The evidence of clinical effectiveness of BNP as a diagnostic tool for heart failure is drawn from a health technology appraisal carried out by NHS Quality Improvement Scotland, which included 19 observational studies (11 using BNP, eight using NT-proBNP).⁵

2++

Pooled sensitivity for the diagnosis of heart failure using BNP was 0.91 (95% confidence intervals CI, 0.90 to 0.93), specificity was 0.73 (95% CI 0.71 to 0.75). Pooled sensitivity for the diagnosis of heart failure using NT-proBNP was 0.91 (95% CI 0.88 to 0.93), specificity was 0.76 (0.75 to 0.77). Although simple single value cut-offs for the diagnosis of heart failure have been proposed, a more realistic interpretation of BNP and NT-proBNP is to suggest that very low values rule out heart failure, very high values make heart failure likely in the absence of other causes of raised BNP. Intermediate to high values should be regarded as indeterminate, necessitating further investigation. The upper limit of normal is age, sex and race dependent, and must be determined locally depending on the assay used.

BNP and NT pro-BNP are suitable for widespread use as a screening test in patients with suspected chronic heart failure, assuming appropriate quality control of the assay and selection of appropriate cut-off values for the patients tested. BNP levels fall after commencing therapy for CHF, eg diuretics, so the sensitivity is lower in patients who have already commenced treatment.

B Brain natriuretic peptide or NT pro-BNP levels and/or an electrocardiogram should be recorded to indicate the need for echocardiography in patients with suspected heart failure.

In the assessment of suspected heart failure, brain natriuretic peptide or NT pro-BNP levels should ideally be checked on samples taken prior to commencing therapy.

2.1.5 ECHOCARDIOGRAPHY

Echocardiography is a safe and relatively inexpensive investigation which is very helpful in diagnosing heart failure and determining the cause. It provides a semi-quantitative assessment of left ventricular systolic and diastolic function, valve disorders can usually be accurately delineated, and pulmonary artery systolic pressure can be estimated. The limitation of poor image quality due to obesity or lung disease is minimised by the skilled use of modern imaging equipment.

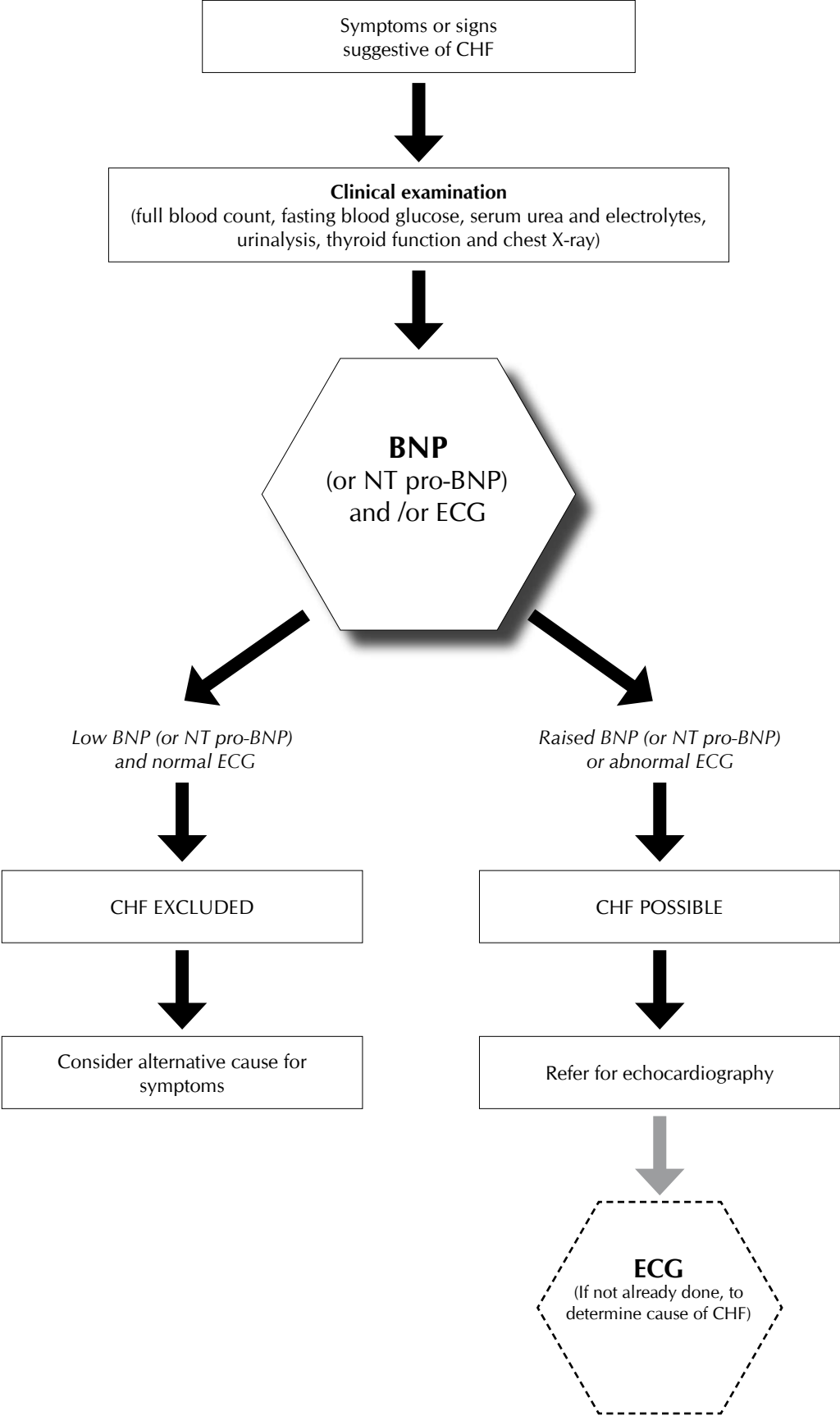
As it may not be feasible, or cost effective to refer all patients with suspected heart failure for echocardiography, screening with either ECG and/or BNP is desirable. Brain natriuretic peptide testing has the practical advantage of being a simple blood test (see *Figure 1*).

Echocardiography is recommended in patients with suspected heart failure who have either a raised brain natriuretic peptide or N terminal-pro-BNP level or abnormal electrocardiograph result to confirm the diagnosis and establish the underlying cause. The investigation should include:

- a description of overall left ventricular systolic function together with any wall motion abnormalities
- assessment of diastolic function
- measurement of left ventricular wall thickness
- Doppler assessment of any significant valve disease
- estimation of pulmonary artery systolic pressure, where possible.

Echocardiography should be performed on modern high resolution equipment by suitably trained operators.

Figure 1: Diagnostic algorithm for patients with suspected chronic heart failure



2.1.6 CHEST X-RAY

The chest X-ray (CXR) is important to help exclude other causes of shortness of breath and to support a possible diagnosis of CHF. On its own it cannot be used to diagnose heart failure and must be used in combination with other sources of clinical evidence.

In one systematic review pulmonary venous redistribution with upper lobe blood diversion on CXR was shown to have 65% sensitivity (67% specificity) for increased preload in CHF. Cardiomegaly on CXR had 51% sensitivity (79% specificity) for decreased ejection fraction in CHF. Neither finding alone can adequately confirm or refute left ventricular dysfunction.⁷

2⁺⁺

B A chest X-ray is recommended early in the diagnostic pathway to look for supportive evidence of chronic heart failure and to investigate other potential causes of breathlessness.

2.2 DETERMINING THE UNDERLYING CAUSE OF HEART FAILURE

Much of the evidence base for the management of heart failure relates to heart failure due to LVSD. Although this is the most common underlying cardiac abnormality in patients with heart failure in the UK, other cardiac abnormalities may be the cause of the heart failure – for example valve disease, or diastolic dysfunction of the left ventricle (heart failure with preserved systolic function). Identifying the cause is important as heart failure due to, for example, valve disease requires management that differs from heart failure caused by LV systolic dysfunction.⁸ Echocardiography can reliably differentiate between these different types of heart failure.

4

The cause of the LVSD has management implications for many patients with CHF since most patients with coronary heart disease are treated with aspirin and a statin in addition to their heart failure specific therapy. In some patients with severe coronary disease left ventricular function improves after revascularisation. Two large randomised controlled trials (RCTs) are currently in progress to evaluate whether revascularisation of viable myocardium is associated with improved outcome in CHF patients. There is insufficient evidence available to make a recommendation on the benefit of revascularisation in these patients.

An indication of the presence of coronary disease as the cause of LVSD is often apparent from the history, ECG and echocardiogram but in cases of doubt coronary angiography may be required.

Routine coronary angiography and revascularisation are not recommended.

2.2.1 IMAGING TECHNIQUES

Radionuclide blood pool - multiple gated acquisition (MUGA) - scanning can provide an accurate measure of the left ventricular ejection fraction, but it exposes the patient to ionising radiation and does not allow visualisation of the heart valves. Myocardial perfusion imaging is the most common nuclear cardiology test to assess coronary artery disease. This non-invasive test can identify and quantify areas of inadequate blood supply within the myocardium and detect scarring due to previous MI.

Differentiation between heart failure due to idiopathic dilated cardiomyopathy and heart failure due to coronary artery disease may be achieved by analysis of clinical findings, electrocardiogram, or coronary angiography.

One prospective observational study suggests that gadolinium enhanced cardiovascular magnetic resonance imaging (MRI) may be more accurate than coronary angiography in differentiating heart failure due to coronary artery disease from dilated cardiomyopathy.⁹

2⁺⁺

Potentially viable myocardium can be detected by radionuclide positron emission tomography (PET), magnetic resonance imaging and dobutamine stress echocardiography (DSE) and studies of these imaging modalities have been pooled together in one meta-analysis and one systematic review.^{10,11} All three techniques appear capable of detecting ischaemic but viable myocardium, and the presence of such viability predicts improved survival following revascularisation. The level of concordance between individual studies is not high and methodological variations impede confident conclusions.

2+
2-

A single small diagnostic study compared contrast enhanced cardiac MRI with PET.¹² No definite evidence of superiority of any technique was demonstrated but MRI appeared as accurate as PET in detection of viability.

2+

- Routine use of myocardial viability testing with dobutamine stress echocardiography, positron emission tomography, single photon emission computed tomography or magnetic resonance imaging to identify patients most likely to benefit from revascularisation is not recommended.

3 Behavioural modification

3.1 ALCOHOL CONSUMPTION

Alcohol is a myocardial depressant.¹³ In patients with CHF, hospital readmissions due to decompensated CHF are lower amongst patients who abstain from alcohol.¹⁴ Other CHD risks of alcohol consumption are addressed in SIGN guideline 97 on risk estimation and the prevention of cardiovascular disease.¹⁵

2+
4

One unit of alcohol in the UK means a beverage containing 8 g or 10 ml of ethanol. The amount of alcohol in units is calculated as follows: volume of drink (ml) x percentage alcohol/8.¹⁶ The volume of alcohol representing a unit depends on the strength of the drink, and it can be misleading to say that one glass of wine or half a pint of beer is equivalent to a single unit. Half a pint of beer which is 3.5% alcohol by volume represents one unit of alcohol. A 125 ml glass of wine at 13% alcohol by volume represents approximately 1.6 units.

3.1.1 ALCOHOLIC CARDIOMYOPATHY

Long term heavy alcohol consumption is an important cause of dilated cardiomyopathy especially in men in their late forties. Although the amount and duration of alcohol that results in alcoholic cardiomyopathy (ACM) is not clearly established, men and women who consume alcohol >11 units / day for over five years are at risk.¹⁷

4

Two prospective studies of patients with severe ACM found that after six months of total abstinence from alcohol, left ventricular function had significantly improved with an accompanying reduction in the cardiothoracic ratio on CXR.^{18,19}

3

Another observational study found that among patients with alcoholic cardiomyopathy followed up for four years, those who continued to drink between 2-3 units and 7-8 units alcohol per day had a similar improvement in cardiac function to those who became total abstainers (0.131 and 0.125 improvement in LVEF respectively), while those who continued to drink > 10 units alcohol/day had a further deterioration in LVEF.²⁰ Non-cardiac harms which may manifest themselves at much lower levels of alcohol consumption were not assessed in this study.

2+

C All patients with heart failure should be advised to refrain from excessive alcohol consumption. When the aetiology of heart failure is alcohol related, patients should be strongly encouraged to stop drinking alcohol.

See SIGN guideline 74 on the management of harmful drinking and alcohol dependence in primary care for information on detection and assessment of individuals with alcohol dependence, hazardous or harmful drinking.¹⁶

3.2 SMOKING

No prospective studies have quantified the effects of a smoking cessation intervention on outcomes in patients with heart failure. Observational data support the association between continued smoking and increased heart failure mortality and increased rates of hospital admissions due to worsening heart failure compared with never, recent ex-and longer ex-smokers.^{14,21}

2+
3

Because of its many harmful effects, the effect of smoking on heart failure cannot be viewed in isolation. See SIGN guideline 97 on risk estimation and the prevention of cardiovascular disease for a discussion of the effect of smoking on cardiovascular disease.¹⁵

B Patients with chronic heart failure should be strongly advised not to smoke and should be offered smoking cessation advice and support.

3.3 UNSUPERVISED PHYSICAL ACTIVITY

Although most lifestyle recommendations are easily understood by patients, the recommendation to become more physically active in the presence of significant known heart disease may be frightening and contradictory to previously suggested management, ie rest and limitation of physical activity in acute heart failure (see section 5.1.4 for a discussion of supervised exercise programmes and SIGN guideline 57 on cardiac rehabilitation for recommendations on exercise training for individuals with CHD).²²

A 12 week, home based, low intensity, walking programme with a detailed prescription updated weekly, improved stable heart failure patients' six minute walking distance compared with a control group given a pedometer and advice only. Improvements in quality of life were inconsistent. Walking was well tolerated and appears safe for stable patients. Compliance was lower than in other studies which have supervised group exercise training, despite regular contact and home visits.²³

1+

Motivational interviewing is a client-centred, directive method for enhancing intrinsic motivation to change behaviour by exploring and resolving an individual's ambivalence towards behaviour change. In motivational interviewing the healthcare professional avoids adopting an authoritative stance but uses cognitive behaviour strategies to encourage the client to take active responsibility for the decision to change and goal setting.

In one study, heart failure patients receiving motivational interviewing had better outcomes in terms of level and type of physical activity than those receiving usual care (ie advice giving).²⁴

1+

Further discussion of motivational interviewing techniques is included in SIGN guideline 97 on risk assessment and the prevention of cardiovascular disease.¹⁵

B Motivational techniques should be used to promote regular low intensity physical activity amongst patients with stable heart failure.

Due to the concern over central haemodynamic volume and blood pressure responses during immersion in water, the safety and appropriateness of water based exercise therapy has been questioned in patients with chronic heart failure.²⁵

4

In NYHA III heart failure patients, the enhanced preload created by immersion in water resulted in abnormal cardiac responses including left ventricular overload, further left ventricular (LV) dyskinesia and a failure in stroke volume to increase (risk of further dilation of a damaged ventricle).²⁶ Further studies on the safety of swimming in patients with CHF are required.

2+

In patients with NYHA III or IV heart failure, other forms of physical activity are preferable to exercises in water or swimming.

3.4 DIETARY CHANGES

3.4.1 SALT AND FLUID RESTRICTION

It is common practice to advise patients with heart failure to restrict salt and fluid intake. This is difficult for patients and the evidence to support this advice is scarce.

One randomised trial of a low salt diet in patients with heart failure, mostly NYHA I, over 15 days showed some weight loss, but no change in NYHA classification.²⁷

1+

Another RCT showed that following a six month, individually prescribed salt and fluid restricted diet, patients with mild to moderate heart failure showed clinical improvements with a greater absence of oedema and fatigue, resulting in a significant improvement in NYHA category and quality of life when compared to general advice.²⁸ Although randomly assigned, there was a significant difference between the proportion of male and female subjects in the experimental and control groups. This may limit the generalisability of these findings across sexes.

1+

Salt restriction has a favourable effect on blood pressure which may be advantageous in patients with CHF (see *SIGN guideline 97 on risk estimation and the prevention of cardiovascular disease*).¹⁵

The Food Standards Agency has recommended that the total salt intake for adults should not exceed 6 g/day (approximately 1.5 teaspoons).²⁹ Food labels often include the sodium content rather than salt. To convert the sodium content of food into salt content, multiply the sodium level by 2.5.

- Patients with chronic heart failure should be advised to avoid a salt intake of >6g/day.
- Patients with chronic heart failure should be advised not to use “low salt” substitutes due to their high potassium content.
- Healthcare professionals caring for patients with frequent decompensated heart failure should assess individual patients’ fluid intake and use a tailored approach when giving fluid restriction advice.

3.4.2 HOME DAILY WEIGHT MONITORING

Although daily weight monitoring is a regular part of management for patients with heart failure to identify early weight gain and allow rapid intervention to avert serious decompensation, no trials were identified which have examined this in isolation. Daily weight monitoring is included in most multifactorial interventions (see *section 6.2 on post-discharge care*).

- Patients with chronic heart failure should be encouraged to weigh themselves at a set time of day, every day (after waking, before dressing, after voiding, before eating). Patients should report to their general practitioner or heart failure specialist any weight gain of more than 1.5 to 2 kgs in two days.

3.4.3 NUTRITIONAL SUPPLEMENTS AND FRUIT JUICES

No trials have been identified on the effect of omega-3 capsules or creatine supplements on morbidity in patients with CHF (see *SIGN guideline 97 on risk estimation and the prevention of cardiovascular disease for a fuller discussion of omega-3*).¹⁵ One trial of 56 patients with advanced heart failure indicated that supplementation with vitamin E did not result in any significant improvements in prognostic or functional indexes of heart failure or in quality of life.³⁰

1⁺⁺

The evidence surrounding coenzyme Q10 (CoQ10) supplementation is inconsistent. A meta-analysis of nine trials concluded that taking CoQ10 does not improve ejection fraction or mortality.³¹ However, in a later RCT in patients with CHF awaiting transplant, those randomised to CoQ10 gained improvement in functional status, clinical status and quality of life compared to those randomised to placebo.³²

1⁺

Healthy eating guidelines from the British Dietetic Association encourage the consumption of five portions of fruit and vegetables each day. Often fruit juices are seen by patients as a convenient way of increasing their fruit intake. However, the therapeutic effect of certain commonly prescribed medications in patients with heart failure is known to be affected by drinking certain fruit juices (eg grapefruit or cranberry juices).

The British National Formulary (BNF) advises that due to interactions with prescribed medications certain supplements and fruit juices should be avoided.³³

4

- Patients with chronic heart failure who are taking warfarin should be advised to avoid cranberry juice (which may increase drug potency).
- Patients with chronic heart failure who are taking simvastatin should be advised to avoid grapefruit juice (which may interfere with liver metabolism of the drug).
- Patients with chronic heart failure should not take St John’s wort supplements due to the interaction with warfarin, digoxin, eplenerone and selective serotonin re-uptake inhibitors.

3.5 COMPLEMENTARY THERAPIES

No clinical trials were identified on aromatherapy, reflexology or reiki in patients with CHF.

A small study of a 12 week programme of tai chi showed enhanced quality of life (QoL) and reduced BNP levels in patients with CHF. From the study design, it is uncertain whether the improvement was due to the physical and meditative aspects of tai chi or the benefits of social contact.³⁴

1-

There is insufficient evidence to draw substantial conclusion regarding acupuncture. No trials have examined the effect of a course of acupuncture. A small placebo controlled randomised trial showed a single session of acupuncture eliminated surges in sympathetic activation during laboratory induced mental stress. How this translates to changes in quality of life remains to be evaluated.³⁵

1-

Group relaxation therapy with additional home practice, did not improve physical quality of life or exercise capacity but improved the peace-spiritual domains of QoL compared with usual care.³⁶

1+

In elderly patients with optimally treated CHF, meditation (audio tape at home and weekly group sessions) reduced sympathetic activity levels and improved quality of life compared to a control group.³⁷

1-

3.6 MOOD DISORDERS

Depression is common in patients with chronic heart failure and is associated with an increased risk of mortality in some,³⁸⁻⁴¹ but not all, studies^{42,43} and may be related to morbidity and rehospitalisation.^{39,41}

2+
3

There is insufficient evidence to guide clinicians as to which screening or assessment measures to use with this population. The British Medical Association Quality Outcome Framework for general practitioners recommends that all patients on the CHD register should be screened for depression using two standard questions.⁴⁴ Where a patient is newly diagnosed or known to be depressed the framework recommends three screening questionnaires to aid clinical judgement in measuring the severity of depression and monitoring treatment. One of these, the Hospital Anxiety and Depression Scale, is familiar to hospital and cardiac rehabilitation services in Scotland.⁴⁵ It requires a small amount of staff training before use (see *SIGN guideline 57 on cardiac rehabilitation*).²² There is, as yet, no widely recognised screening measure for mood disorders in palliative care in Scotland. As at all stages of heart failure, criteria for depression such as loss of appetite and fatigue must be interpreted with care.

4

Screening for depression in heart failure may help to identify patients who are at poorer prognostic risk.

A Cochrane review of psychological therapies (a broad definition incorporating education, counselling, stress management and cognitive behaviour therapy and other psychotherapies provided by trained professionals) found no RCTs of the treatment of depressed mood in patients with CHF.⁴⁶ Anxiety and depression frequently present comorbidly in general population studies. There is little evidence as to the incidence and prevalence of different types of anxiety problem in chronic heart failure and no RCTs of treatment were identified.

1++

There is insufficient evidence on efficacy or safety to support the use of antidepressant pharmacotherapy in patients with heart failure. If antidepressant medication is felt to be desirable, a tricyclic antidepressant should not be used.⁴⁷

If antidepressant medication is prescribed, a tricyclic antidepressant should not be used in patients with chronic heart failure.

4 Pharmacological therapies

A large number of high quality trials on pharmacological therapy have been undertaken in patients with LVSD with all stages of disease from asymptomatic LVSD to severe heart failure. The aims of treatment are to prevent progression of the disease, thereby reducing symptoms, hospital admissions and mortality. Many treatments have been shown to reduce either one or more (often all) of these but each can produce side effects and careful monitoring is essential in order to maximise benefit and minimise adverse effects.

This section lists the main classes of drugs used in the management of chronic heart failure. Annexes 1-4 list important cautions, contraindications, interactions and recommended starting and target drug doses where possible.⁴⁸ Annex 5 lists medicines and herbal preparations which are known to interact with drugs used in the management of CHF or which may cause harm.

4

4.1 ANGIOTENSIN CONVERTING ENZYME INHIBITORS

Angiotensin converting enzyme (ACE) inhibitors were first shown to be effective in heart failure in the 1980s. Since then, many RCTs have confirmed their benefit on mortality and morbidity, in patients with chronic heart failure,^{49,50} LVSD, heart failure or both after MI⁵¹⁻⁵³ and in patients with asymptomatic LVSD.⁵⁴ Meta-analysis of these and other major trials (n = 7,105 patients) has shown that in patients with chronic heart failure treatment with an ACE inhibitor reduces relative risk of mortality by 23% (odds ratio OR 0.77, 95% CI 67 to 88; absolute risk reduction ARR 6.1%) and admission for heart failure is reduced by 35% (95% CI 26 to 43%; ARR 10.2%).⁵⁵ In a further meta-analysis in patients with LVSD, heart failure or both after MI relative risk of mortality was reduced by 26% (95% CI 17 to 34%; ARR 5.7%) and hospital admission by 27% (95% CI 15 to 37%; ARR 3.6%).⁵⁶

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A Angiotensin converting enzyme inhibitors should be considered in patients with all NYHA functional classes of heart failure due to left ventricular systolic dysfunction.

Important adverse effects are cough, hypotension, renal impairment and hyperkalaemia. Angio-oedema is a rare adverse effect, which can be life threatening (due to laryngeal involvement). Any patient who suffers angio-oedema should have the ACE inhibitor withdrawn immediately and be prescribed an alternative agent. Renal impairment is likely to occur in those with unsuspected (bilateral) renovascular disease. ACE inhibitor induced renal dysfunction is a possible indicator of renovascular disease and may warrant a MRI renal scan.

A systematic review of six RCTs of concomitant ACE inhibitor and aspirin use did not show any significant reduction in efficacy of ACE inhibitor therapy in patients also taking aspirin.⁵⁷ This combination of drugs is safe and effective in reducing CVD events in patients with CHF.

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4.2 BETA BLOCKERS

Many RCTs have been undertaken with beta blockers in patients with heart failure. In the CIBIS II,⁵⁸ MERIT-HF,⁵⁹ and COPERNICUS⁶⁰ trials a consistent, approximately one third reduction in total mortality was seen with bisoprolol, extended release metoprolol succinate and carvedilol. In the SENIORS trial, nebivolol significantly reduced a composite outcome of death or cardiovascular hospitalisations in elderly heart failure patients.⁶¹

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There is consistent evidence for positive benefits from beta blockers in patients with heart failure, with risk of mortality from cardiovascular causes reduced by 29% (95% CI 14% to 42%); mortality due to pump failure reduced by 36% (95% CI 9% to 55%); and all cause mortality reduced by 23% (95% CI 8% to 35%).⁶²

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Benefits were seen with beta blockers with different pharmacological properties, whether β 1 selective (bisoprolol, metoprolol, nebivolol) or non-selective (carvedilol).

Two formulations of metoprolol were used in clinical trials of patients with CHF. Only long acting metoprolol succinate has been shown to perform better than placebo in reducing mortality (in MERIT-HF).⁵⁹ Short acting metoprolol tartrate, given twice daily, was compared to carvedilol in COMET.⁶³ Carvedilol reduced mortality over five years by 17% compared with metoprolol tartrate (33.8% vs 39.5%), hazard ratio 0.83 (95% CI 0.74 to 0.93), ARR 5.7%; $p=0.0017$.

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Extended release metoprolol succinate is not available in the UK and no evidence was identified for the effectiveness of metoprolol tartrate, the preparation that is available in the UK.

Beta blockers produce benefit in the medium to long term. In the short term they can produce decompensation with worsening of heart failure and hypotension. They should be initiated at low dose and only gradually increased with monitoring up to the target dose. Beta blockers are contraindicated in patients with asthma, second or third degree atrioventricular heart block or symptomatic hypotension and should be used with caution in those with low initial blood pressure (ie systolic BP < 90 mm Hg). There is some evidence that cardioselective beta blockers can be used safely in patients with chronic obstructive pulmonary disease (COPD) and heart failure.⁶⁴

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A meta-analysis confirms that beta blockers also reduce mortality in diabetic patients with heart failure (RR 0.84, 95% CI 0.73% to 0.96%; $p=0.011$).⁶⁵

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A All patients with heart failure due to left ventricular systolic dysfunction of all NYHA functional classes should be started on beta blocker therapy as soon as their condition is stable (unless contraindicated by a history of asthma, heart block or symptomatic hypotension).

Bisoprolol, carvedilol or nebivolol should be the beta blocker of first choice for the treatment of patients with chronic heart failure due to left ventricular systolic dysfunction.

4.3 ANGIOTENSIN RECEPTOR BLOCKERS

Angiotensin II type 1 receptor blockers (ARBs) block the biological effect of angiotensin II, mimicking the effect of ACE inhibitors. Unlike ACE inhibitors they do not produce cough as a side effect and should be used in patients who cannot tolerate an ACE inhibitor due to cough. In CHARM Alternative, in which 2,028 patients intolerant of an ACE inhibitor were randomised to placebo or candesartan, ARB treatment led to a relative risk reduction of 23% (95% CI 11% to 33%; $p=0.0004$) in the primary composite outcome of cardiovascular death or hospitalisation for CHF in patients receiving candesartan (absolute risk reduction of seven fewer patients experiencing this outcome per 100 treated).⁶⁶

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ARBs can also be added to ACE inhibitor therapy in patients with chronic heart failure. In the ValHeFT trial, in which 93% of patients were already taking an ACE inhibitor and 35% using a beta blocker, adding the ARB valsartan had no effect on mortality, but it did significantly reduce heart failure hospitalisation and mortality combined (relative risk 0.87, 97.5% CI 0.77 to 0.97; $p=0.009$).⁶⁷ The CHARM Added trial showed a 15% relative risk reduction (95% CI 4% to 25%, $p=0.01$; ARR 4.4%; number needed to treat NNT=27) for cardiovascular death or hospitalisation for CHF in patients receiving candesartan in addition to an ACE inhibitor.⁶⁸

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A Patients with chronic heart failure due to left ventricular systolic dysfunction alone, or heart failure, left ventricular systolic dysfunction or both following myocardial infarction who are intolerant of angiotensin converting enzyme inhibitors should be considered for an angiotensin receptor blocker.

B Patients with heart failure due to left ventricular systolic dysfunction who are still symptomatic despite therapy with an angiotensin converting enzyme inhibitor and a beta blocker may benefit from the addition of candesartan, following specialist advice.

4.4 ALDOSTERONE ANTAGONISTS

Aldosterone produces many adverse extrarenal effects, for example on vascular function and myocardial fibrosis. The RALES trial demonstrated that adding the aldosterone antagonist spironolactone to an ACE inhibitor reduced all cause mortality by 30% (RR 0.70, 95% CI 0.60% to 0.82%; $p < 0.001$; ARR 11%; NNT=9) and cardiac mortality by 31% (RR 0.69, 95% CI 0.58% to 0.82%; $p < 0.001$).⁶⁹ The frequency of hospitalisation for worsening heart failure was 35% lower in the spironolactone group than in the placebo group (RR 0.65; 95% CI 0.54 to 0.77; $p < 0.001$).

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Spironolactone can produce gynaecomastia, hyperkalaemia and renal dysfunction making careful monitoring of blood urea, creatinine and electrolytes essential during spironolactone therapy, especially during its initiation. The dose of spironolactone should be no more than 25-50 mg/day and it is only recommended in those with moderate to severe heart failure due to LVSD. It should not be used in patients whose baseline serum potassium is > 5 mmol/l or serum creatinine is > 220 micromol/l. Such patients are particularly likely to suffer the adverse effects of hyperkalaemia or renal dysfunction.

B Following specialist advice, patients with moderate to severe heart failure due to left ventricular systolic dysfunction should be considered for spironolactone unless contraindicated by the presence of renal impairment or a high potassium concentration.

There is no evidence that spironolactone is as effective in mild heart failure and no recommendation can be given for this group of patients.

Eplerenone is an alternative aldosterone receptor antagonist that is less likely to produce sexual side effects such as gynaecomastia, breast pain or menstrual irregularities. Although spironolactone and eplerenone are similar drugs with similar actions, there is not yet evidence for a class effect in aldosterone receptor antagonists.

Eplerenone can be substituted for spironolactone in patients who develop gynaecomastia.

The EPHEsus study, performed in post MI patients with LVEF $\leq 40\%$ and either diabetes or clinical signs of heart failure, demonstrated a 13% reduction (95% CI 5% to 21%; $p = 0.002$; ARR 3.3%; NNT=30) in rate of mortality from cardiovascular causes or hospitalisation for cardiovascular events in patients taking eplerenone.⁷⁰ There was also a 21% relative reduction (95% CI 3% to 36%; $p = 0.03$; ARR 1.2%; NNT=83) in the rate of sudden death.

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Eplerenone can be recommended as an additional therapy which is started between 3 and 14 days post MI in patients with LVSD and CHF or diabetes.

Although eplerenone produces less gynaecomastia than spironolactone, it can still produce hyperkalaemia and renal dysfunction and blood urea, creatinine and potassium should be carefully monitored after initiation and throughout therapy.

B Patients who have suffered a myocardial infarction and with left ventricular ejection fraction $\leq 40\%$ and either diabetes or clinical signs of heart failure should be considered for eplerenone unless contraindicated by the presence of renal impairment or a high potassium concentration.

4.5 DIURETICS/ LOOP DIURETICS/METOLAZONE

In the majority of patients with heart failure, fluid retention occurs, causing ankle oedema, pulmonary oedema or both and contributing to the symptom of dyspnoea. Diuretic treatment relieves oedema and dyspnoea.

A meta-analysis has demonstrated a 75% reduction in mortality (OR=0.25, 95% CI 0.07% to 0.84%; p=0.03; ARR 8.2%; NNT=12) and a 63% improvement in exercise capacity (OR=0.37, 95% CI 0.1% to 0.64%).⁷¹ The evidence reviewed in this meta-analysis consists of a number of small, poor quality studies with reasonable consistency. Although not strong, this evidence supports the view that there is a benefit from diuretic therapy for patients with dyspnoea or oedema.

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In most cases the agent of choice will be a loop diuretic although a thiazide might suffice where the fluid retention is very mild.

B Diuretic therapy should be considered for heart failure patients with dyspnoea or oedema (ankle or pulmonary).

Care should be taken to select the dose of the loop diuretic, ie the dose should eliminate ankle or pulmonary oedema without dehydrating the patient and placing them at risk of renal dysfunction or hypotension. The correct dose to achieve this varies markedly from one patient to the next.

The tendency of loop diuretics to cause hypokalaemia is offset by ACE inhibitors, ARBs and spironolactone. Serum potassium should be monitored to maintain its concentration in the range 4-5 mmol/l and adjustments in therapy should be made to prevent both hypokalaemia and hyperkalaemia.

In cases where oedema is resistant to the loop diuretic, a number of strategies are available. One randomised crossover study showed that in patients with severe heart failure, high dose furosemide administered as a continuous infusion was more efficacious than bolus injection.⁷²

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Sequential nephron blockade with thiazides and loop diuretics may also be effective. The careful addition of metolazone (starting dose 2.5 mg/day) can often cause a useful natriuresis, although careful monitoring of blood is essential to prevent abnormalities in sodium, creatinine and other electrolytes. Addition of 25-100 mg of hydrochlorothiazide, another thiazide diuretic, also proved to be very effective in patients with severe CHF and impaired renal function showing diuretic resistance to a daily dose of furosemide of at least 250 mg.⁷³ Bendrofluazide 10 mg and metolazone 10 mg have been shown to be equally effective in establishing a diuresis when combined with loop diuretics.⁷⁴

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The dose of diuretic should be individualised to reduce fluid retention without overtreating which may produce dehydration or renal dysfunction.

4.6 DIGOXIN

A Cochrane review has shown a 64% improvement in symptoms (OR=0.31, 95% CI 0.21% to 0.43%; ARR 11.5%; NNT=9) and a 23% reduction in hospitalisation (OR=0.68, 95% CI 0.61% to 0.75%; ARR 5.7%; NNT=18) for patients receiving digoxin (digitalis). Digoxin did not improve survival.⁷⁵ This review is dominated by one large trial (the DIG study) which was carried out before the introduction of beta blockers and spironolactone for heart failure, which may have influenced the conclusions.⁷⁶ Evidence of benefit must be weighed against the possibility of an increase in sudden deaths associated with digoxin. The risk of digoxin toxicity is increased by hypokalaemia.

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In patients with heart failure and atrial fibrillation a beta blocker is preferred for control of the ventricular rate, though digoxin may be used initially while the beta blocker is being introduced. If excessive bradycardia occurs with both drugs, digoxin should be stopped (see *SIGN guideline 94 on cardiac arrhythmias in coronary heart disease*).¹

In patients with heart failure and sinus rhythm, digoxin may reduce symptoms and hospital admission for worsening heart failure although it has not been tested in addition to optimum therapy (ie an ACE inhibitor, beta blocker and an ARB or aldosterone antagonist) and is usually only reserved for patients with severe heart failure who have not responded to other treatments.⁷⁵ In two smaller and shorter studies of digoxin withdrawal in patients with stable heart failure, the PROVED and RADIANCE trials, withdrawal of digoxin was associated with a decline in exercise capacity, deterioration in left ventricular systolic function, and significantly increased risk of hospitalisation for worsening heart failure.^{77,78}

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A Digoxin should be considered as an add-on therapy for heart failure patients in sinus rhythm who are still symptomatic after optimum therapy.

If excessive bradycardia occurs with concurrent beta blockade and digoxin therapy, digoxin should be stopped.

4.7 SUMMARY OF THE USE OF MAJOR DRUG CLASSES FOR TREATMENT OF HEART FAILURE

The use of the major classes of drugs for the control of chronic heart failure is summarised in Table 4. Unless contraindicated, all patients with LVSD should be started on an ACE inhibitor and a beta blocker (and a diuretic, in most cases). For those who remain symptomatic, the addition of candesartan may be considered. If the disease progresses to class IV, spironolactone should be added. In this case, candesartan should be stopped as adverse effects on renal and potassium function are common in patients taking three drugs to block the renin-angiotensin system.

Table 4: Which drugs to prescribe by NYHA class

Class	Prescribe
NYHA I	ACE inhibitor beta blocker
NYHA II-III	ACE inhibitor beta blocker candesartan (intiation requires specialist advice)
NYHA III-IV	ACE inhibitor beta blocker spironolactone (intiation requires specialist advice)

The safety and efficacy of combining an ACE inhibitor, an ARB and spironolactone is uncertain and the use of these three drugs together is not recommended.

4.8 ANTITHROMBOTIC THERAPY

Many patients with chronic heart failure have underlying cardiovascular disease, including previous myocardial infarction or stroke, and may be taking aspirin. One study has suggested that aspirin may contribute to an increased risk of hospitalisation due to heart failure.⁷⁹ The preliminary results of a second study comparing aspirin, warfarin and clopidogrel appear to support this finding.⁸⁰ There is no evidence to support any specific strategy of antithrombotic use in heart failure patients undergoing percutaneous coronary intervention. There is no firm evidence to support the use or the withdrawal of aspirin in patients with chronic heart failure (see SIGN guideline 94 on cardiac arrhythmias in coronary heart disease¹ and SIGN guideline 36 on antithrombotic therapy).⁸¹

4.9 HYDRALAZINE AND ISOSORBIDE DINITRATE

The combination of hydralazine and isosorbide dinitrate (H-ISDN) was shown to reduce mortality in patients with heart failure before ACE inhibitors were introduced.⁸² It was found to be less effective than an ACE inhibitor in a subsequent head-to-head comparison with enalapril (28% mortality reduction in favour of enalapril, $p=0.016$).⁸³ Hydralazine and isosorbide dinitrate have been shown to reduce symptoms and the risk of death and hospital admissions for heart failure when added to standard treatment (which included ACE inhibitors, ARBs, beta-blockers for at least three months before randomisation, digoxin, spironolactone, and diuretics) in African-Americans with NYHA class III or IV CHF (absolute survival benefit 4.0%, hazard ratio for all cause mortality 0.57; $p=0.01$).⁸⁴ In Caucasian patients the main indication for H-ISDN is intolerance of an ACE inhibitor and ARB due to renal dysfunction or hyperkalaemia. Vasodilator adverse effects are common and, rarely, hydralazine can cause a lupus-like syndrome.^{85,86}

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A African-American patients with advanced heart failure due to left ventricular systolic dysfunction should be considered for treatment with hydralazine and isosorbide dinitrate in addition to standard therapy.

B Patients who are intolerant of an angiotensin converting enzyme inhibitor and an angiotensin II receptor blocker due to renal dysfunction or hyperkalaemia should be considered for treatment with a combination of hydralazine and isosorbide dinitrate.

4.10 PATIENTS WITH HEART FAILURE WITH PRESERVED EJECTION FRACTION

Not all patients with heart failure have LVSD. Patients with clinical heart failure but normal LV systolic function are described as having 'heart failure with preserved LV systolic function.' The proportion of heart failure patients with preserved LV systolic function may be as high as 35-50%.⁸⁷

Heart failure with preserved LV systolic function often occurs along with myocardial ischaemia, hypertension, myocardial hypertrophy or even myocardial/pericardial constriction. Consideration should be given as to whether these entities may be present and contribute to the clinical picture in heart failure patients with preserved LV systolic function. If present, they should be identified and treated in their own right. An additional contributory factor could be tachy-arrhythmias; if so, rate control is likely to be beneficial.

The evidence on how to treat heart failure with preserved LV systolic function is limited. The best evidence comes from the CHARM Preserved study where candasartan had favourable, but not significant, effects on the endpoint of cardiovascular mortality or heart failure hospitalisations.⁸⁸

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No good evidence was identified for the benefit of diuretics, ACE inhibitors,⁸⁹ beta blockers, aldosterone antagonists or calcium antagonists in these patients. In practice, diuretics are often used to reduce and then prevent fluid overload. ARBs are also now often used because of the favourable trends in the CHARM Preserved trial.⁸⁸ Beta blockers and rate limiting calcium antagonists are also often used although the evidence base is not robust enough to recommend any of these treatments.

4.11 HEART FAILURE AND GOUT

Loop diuretics can cause an elevated urate level and may precipitate gout.⁹⁰

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No evidence was identified on how best to treat gout in patients with heart failure. Current practice in the management of acute gout is to use colchicine to suppress the inflammation and pain.⁹¹ This requires careful consideration or monitoring. Another alternative is a short course of prednisolone.

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Once the pain is under control, consideration should be given to starting prophylactic antagonist therapy and stopping colchicine.

4.12 HEART FAILURE AND RENAL IMPAIRMENT

Renal dysfunction is common in heart failure and the underlying cause of the renal dysfunction should be assessed in each individual patient.

Possible causes include dehydration; ACE inhibitor, ARB and/or spironolactone use; coincidental renal disease (eg diabetic nephropathy or renovascular disease).

- Renal dysfunction in patients with heart failure caused by:
 - dehydration requires a reduction in dose or temporary cessation of the diuretic⁹²
 - ACE inhibitor,⁹³ ARB and/or spironolactone use requires a cessation or a reduction in dose
 - coincidental renal disease requires renal investigations (24 hour urine protein collection, kidney ultrasound and/or MRI of the renal arteries).

Correction of renovascular disease by renal angioplasty may enable the patient to benefit from an ACE inhibitor or an ARB.

4.13 HEART FAILURE AND ANGINA

Beta blockers are the drug of choice in patients with heart failure and angina (see *SIGN guideline 96 on the management of stable angina*).⁹⁴ Sublingual and oral nitrate preparations may also be used safely for the treatment of anginal symptoms where blood pressure permits. Calcium channel blockers (with the exception of amlodipine⁹⁵) have been found to exacerbate symptoms of heart failure or increase mortality after myocardial infarction in people who also have pulmonary congestion or left ventricular dysfunction.⁹⁶

Some patients with angina will require revascularisation for symptomatic relief (see *SIGN guideline 96 on the management of stable angina*).⁹⁴

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4.14 HEART FAILURE IN THE FRAIL ELDERLY

Many patients with heart failure are elderly. Many diagnostic and treatment trials do not include frailer, older patients, especially those with multiple comorbidities. Trials that have done so suggest that the benefits of drug treatment do extend to the older population.^{61,97} The general approach to the investigation and management of heart failure in the frail elderly should follow the principles outlined in this guideline. The following factors should also be considered.

4.14.1 COMORBIDITY

The possible presence of coexistent cognitive impairment, renal dysfunction, urinary incontinence, postural hypotension, falls, chronic obstructive pulmonary disease and depression should be considered as it might influence treatment.

4.14.2 GOAL OF TREATMENT

In elderly heart failure patients with significant multiple comorbidities, functional impairment or other life limiting systemic disease such as neoplasia, the goal of treatment may be the improvement of symptoms and function alone, rather than the improvement of prognosis. Target dose titration and multiple drug regimens as utilised in treatment trials may be undesirable or problematic. An effort should always be made to engage elderly patients or their carers in discussion regarding the goals of heart failure treatment.

4.14.3 MODEL OF CARE

Elderly heart failure patients with multiple comorbidities and functional impairment should be managed within an integrated care model that provides multidisciplinary functional and medical assessment and rehabilitation in both primary and secondary care settings (see *section 6.2*).

4.15 VACCINATIONS

A large cohort study of elderly individuals in the general population demonstrated a 37% reduction in hospital admissions for CHF among those immunised against influenza during an outbreak of influenza A.⁹⁸ A case series also showed that, in a group of patients with moderate to severe CHF, 23% of episodes of decompensation were associated with infection.⁹⁹ A third of these infections were pulmonary. A further case series showed that 12% of hospitalisations in heart failure patients were due to pulmonary infection.¹⁰⁰

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The Joint Committee on Vaccination and Immunisations recommends immunisation, for those with chronic conditions, with pneumococcal vaccine. This immunisation is required once only, not annually as with influenza immunisation.¹⁰¹

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D Patients with chronic heart failure should receive one pneumococcal vaccination and an annual influenza vaccination.

5 Interventional procedures

5.1 PATIENTS WITH LEFT VENTRICULAR SYSTOLIC DYSFUNCTION

5.1.1 CARDIAC RESYNCHRONISATION

A large evidence base has accrued showing the benefits of cardiac resynchronisation therapy (CRT) in addition to optimal medical therapy in terms of improving exercise capacity, reducing NYHA class, improving quality of life and reducing hospitalisations for worsening heart failure.^{102,103} Cardiac resynchronisation therapy has been shown to significantly reduce mortality in patients with left ventricular systolic dysfunction (hazard ratio 0.64, 95% CI 0.48 to 0.85; $p < 0.002$).¹⁰⁴ Most of the evidence for CRT applies to patients with CHF who are in sinus rhythm.

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A For patients in sinus rhythm with drug refractory symptoms of heart failure due to left ventricular systolic dysfunction (left ventricular ejection fraction $\leq 35\%$) and who are in NYHA class III or IV and who have a QRS duration of > 120 ms, cardiac resynchronisation should be considered.

5.1.2 IMPLANTABLE CARDIAC DEFIBRILLATORS

Implantable cardiac defibrillators are an important part of the management of patients with CHF (See *SIGN guideline 94 on cardiac arrhythmias in coronary heart disease*).¹ Some patients at high risk will require a defibrillator in conjunction with CRT.

5.1.3 ASSISTED VENTILATION

Both obstructive sleep apnoea (OSA) and central sleep apnoea are recognised in patients with heart failure. Several trials have looked at the impact of continuous positive airway pressure (CPAP) in patients with OSA. These trials have been mostly acute studies in small numbers which have shown an improvement in LVEF^{105,106} and in quality of life.¹⁰⁶

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Central sleep apnoea occurs in 25-40% of patients with heart failure and may arise as a consequence of it.¹⁰⁷ The CANPAP study has shown that over 18 months follow up patients with central sleep apnoea and heart failure who are randomised to CPAP have no survival benefit over control patients despite improved physiological outcomes such as LVEF, decreased circulating noradrenalin and increased oxygen saturation at night.¹⁰⁸

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B Patients with obstructive sleep apnoea and heart failure may be safely treated with continuous positive airway pressure.

5.1.4 EXERCISE TRAINING PROGRAMMES

A large amount of literature is available concerning exercise training for patients with heart failure although methodological problems are associated with many of the studies. Trials often involved small numbers of patients, were short term and not representative of the population at large.¹⁰⁹ There is some evidence that exercise training improves exercise tolerance and quality of life but no single randomised trial has looked at mortality over a sustained period.¹¹⁰ Studies have looked at different training regimens and diverse outcome measures and generalisation regarding exercise training is difficult.

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Two meta-analyses were identified which draw from largely the same trials.^{111,112} One meta-analysis which only included trials with survival figures for at least three months, suggested a significant reduction in mortality with exercise training.¹¹¹ The second meta-analysis reported no difference in mortality between the two groups despite looking at similar (but not identical) trials.¹¹² This meta-analysis also reported an improvement in QoL in seven out of nine trials. The trials suggest that moderate intensity exercise training is safe and progression of exercise should be followed in the order of duration, then frequency, then intensity.¹¹³ Exercise training must be continued to result in sustained benefit.¹¹⁴ Most of these trials looked at hospital based supervised training programmes rather than home based schemes.

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B Consideration should be given to enrolling stable heart failure patients who are in NYHA class II - III into a moderate intensity supervised exercise training programme to give improved exercise tolerance and quality of life.

Patients should be encouraged to take aerobic exercise within limits dictated by their symptoms.

Exercise programmes should be individually tailored to the patient following the recommendations in SIGN guideline 57 on cardiac rehabilitation.²²

5.1.5 CORONARY ARTERY BYPASS GRAFTING

No evidence from RCTs has been identified regarding myocardial revascularisation in patients with predominant symptoms of heart failure.

5.1.6 CARDIOMYOPLASTY

No evidence has been identified to support the role of skeletal muscle myoplasty in the treatment of patients with left ventricular systolic dysfunction.

5.1.7 INTRA-AORTIC BALLOON COUNTERPULSATION

No evidence has been identified for the use of intra-aortic balloon counterpulsation in patients with chronic left ventricular systolic dysfunction.

5.1.8 CORRECTIVE SURGERY

No randomised trials were identified comparing left ventricular remodelling surgery or mitral valve repair with best medical therapy. In patients with a combination of left ventricular systolic dysfunction and functional mitral regurgitation, a very careful judgement has to be made regarding the severity of mitral regurgitation before considering corrective surgery.

5.1.9 LEFT VENTRICULAR ASSIST DEVICES

One randomised trial was identified in which patients unsuitable for transplantation due to age or comorbidity were randomised to best medical therapy or an implantable left ventricular assist device (LVAD). Results showed a reduction of 48% in the risk of death from any cause in the group that received LVAD as compared with the medical therapy group (RR 0.52, 95% CI 0.34 to 0.78; $p=0.001$). Two year survival was 23% with LVAD and 8% with best medical therapy ($p=0.09$). The quality of life scores were better in the device group at one year. The main complications were thromboembolism and infection which must be overcome before LVAD can find a place in the standard treatment of heart failure.¹¹⁵

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For patients with severe decompensated heart failure ventricular mechanical support can be considered as a bridge to transplantation.

5.1.10 CARDIAC TRANSPLANTATION

Cardiac transplantation offers patients good outcomes in both quality of life and survival. There are no randomised trials but registry data both in the UK and internationally demonstrate a one year survival of 80% and a ten year survival of 50%.¹¹⁶ Few patients with CHF optimally managed with medical and complex pacemaker therapies now warrant cardiac transplantation.

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Patients with drug refractory severe heart failure should be referred to an advanced heart failure centre where they can be assessed for suitability for transplantation.

5.2 SURGICAL ASSESSMENT AND INTERVENTION

5.2.1 NON-CARDIAC SURGERY

No evidence was identified on assessment and intervention for patients with heart failure who are undergoing non-cardiac surgery. SIGN guideline 96 on management of stable angina discusses the assessment of patients with cardiovascular disease undergoing various forms of surgery.⁹⁴

5.2.2 CARDIAC SURGERY

A single randomised control trial was identified that examined the efficacy of intra-aortic balloon counterpulsation in patients with low ejection fraction ($\leq 35\%$) undergoing coronary artery bypass grafting (CABG). It shows a clear perioperative survival advantage when the counterpulsation is introduced prior to surgery.¹¹⁷ Survival was higher in a group of patients who received intra-aortic balloon counterpulsation preoperatively compared to a group that received counterpulsation intraoperatively ($p=0.047$). Cardiac performance after revascularisation improved in both groups with significantly better outcomes in the preoperatively counterpulsated patients (LVEF 42% versus 33%; $p<0.001$).

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B In patients undergoing coronary artery bypass grafting with left ventricular ejection fraction $\leq 35\%$ consideration should be given to preoperative introduction of intra-aortic balloon counterpulsation.

6 Models of care

6.1 COMMUNICATION WITH PATIENTS

Patients with chronic heart failure report high levels of frustration with progressive loss of function, social isolation and the stresses of monitoring a complex medical regimen. In one study, their reported understanding of their condition and involvement in the regimen was lower than that in a comparison group of patients with cancer.¹¹⁸ Among the same cohort, patients identified unmet needs in psychosocial care, education and co-ordination between primary and secondary care.¹¹⁹

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In a small qualitative study patients listed the following as inhibiting communication with doctors:¹²⁰

- factors intrinsic to heart failure (eg confusion, uncertainty of prognosis)
- patient characteristics (eg misconceptions about causes/treatment of symptoms)
- structure of the system (eg difficulty attending hospital)
- factors in the doctor/patient relationship (eg their belief that doctors found it hard to share some information about heart failure).

6.1.1 COGNITIVE DEFICITS AS BARRIERS TO COMMUNICATION

One systematic review found that CHF is associated with a pattern of generalised cognitive impairment which includes memory and attention deficits.¹²¹ There were few good quality studies and heterogeneity of populations. Two studies were identified which looked at general cognitive functioning in 203 patients with CHF and 704 controls. Poorer cognitive outcomes were measured on the Mini Mental State Examination and Wechsler Adult Intelligence Scale in the patients with CHF (standardised mean difference -0.40, 95% CI -0.56 to -0.24; $p < 0.00001$).

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- Clinicians involved with educating or helping heart failure patients to manage their condition should be aware of the possibility of cognitive deficits and tailor interventions accordingly.

6.1.2 INTERVENTION STUDIES AIMED AT IMPROVING EDUCATION AND COMMUNICATION

One approach to improving patient education has been structured interventions by a dedicated professional (eg nurse). Several small studies have shown structured interventions to be better than usual care in improving self-management and adherence.^{122,123}

One RCT compared two intervention strategies, a nurse facilitator and a combination of patient and provider notification including computer reminders and patient letters aimed at improving the use of beta blockers in 169 patients with CHF.¹²⁴ The primary outcome, the proportion of patients who were initiated or uptitrated and maintained on beta blockers was achieved in 67% (36 of 54) of patients in the nurse facilitator group compared with 16% (10 of 64) in the provider/patient notification and 27% (14 of 51) in the control groups ($p < 0.001$ for the comparisons between the nurse facilitator group and both other groups). There were no differences in hospital readmission or mortality between groups.

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Another approach focussed on tackling communication barriers in health consultations. A Cochrane review of three trials involving 347 health professionals caring for cancer patients concluded that there is some evidence on how to improve behaviours which can be reliably measured, such as responding to patients' cues and asking fewer leading questions. The review concluded that further work is needed to compare different training methods and to look at patients' awareness of and satisfaction with change.¹²⁵ No evidence was identified in heart failure services.

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6.2 POST-DISCHARGE CARE

One good meta-analysis investigated comprehensive discharge planning and post-discharge multidisciplinary support using a variety of interventions.¹²⁶ Two were pre-determined subgroups of interventions, mostly post-discharge.^{127,128}

Reduction in mortality was shown for home/clinic-based specialist team intervention,^{127,128} but not for comprehensive discharge planning and multidisciplinary follow up, more frequent clinic attendances or telephone follow-up or enhanced self-care.¹²⁶ Tele/video monitoring was also associated with a reduction in mortality. Most successful interventions had an element of home visits.¹²⁷

All-cause admissions were reduced by specialist team interventions in clinics or in a patient's home^{127,128} and by comprehensive discharge planning and multidisciplinary follow up (home visits but not increased clinic visits or frequent telephone contact).¹²⁶ Heart failure admissions were reduced by attendance at multidisciplinary heart failure clinics, by specialised follow up by multidisciplinary teams, telephone follow up,^{127,128} enhanced self-care¹²⁸ and telephone/video monitoring,¹²⁷ but not by GP and non-specialist clinic follow up.¹²⁷

Quality of life improved more in patients receiving post-discharge planning and post-discharge support.¹²⁶

None of the trials conducted formal cost effectiveness analyses but many did record the medical costs of each comparator. Three meta-analyses consistently reported that implementing a discharge-management plan reduced costs compared to usual care.^{126,128,129} The resultant savings exceeded the cost of implementation by an average of over six times (range two to 14 times). The savings arose primarily from the lower rate of re-admissions. The only study where the intervention costs exceeded savings provided follow up support in a day hospital.

A Comprehensive discharge planning should ensure that links with post-discharge services are in place for all those with symptomatic heart failure. A nurse led, home based element should be included.

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6.2.1 NURSE LED FOLLOW UP

One RCT of a structured telephone service delivered by trained nurses for patients with stable heart failure (no hospital admission or change in therapy within previous two months and patients on optimal pharmacological treatment) showed a reduction from 31% to 26.3% in the intervention group in the composite primary endpoint of all cause mortality or hospital admission for worsening heart failure compared to the group receiving usual care (relative risk reduction 20%, 95% CI 3% to 34%; $p=0.026$; ARR 4.7%; NNT=21).¹³⁰ This was mainly due to reduction in admission for worsening heart failure over a mean of 16 months. The nurses could change diuretic therapy and recommend non-scheduled/emergency room visits. Patients in the intervention group were more likely to be compliant with prescribed beta blockers, spironolactone and digoxin at the end of the study. Patients in the intervention group had better quality of life than control patients at the end of the study (mean total score in intervention group 30.6 versus 35.0 in control group; mean difference=4.4, 95% CI 1.8 to 6.9; $p=0.001$).

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A further small RCT of nurse led follow up of patients post-discharge (which included home visits supplemented by telephone contact) compared to usual care showed that 37% of patients in the intervention group died or were readmitted with heart failure compared with 53% in the usual care group (hazard ratio=0.61, 95% CI 0.33 to 0.96). Compared with usual care, patients in the intervention group had fewer readmissions for any reason (86 vs 114, $p=0.018$), fewer admissions for heart failure (19 vs 45, $p<0.001$) and spent fewer days in hospital for heart failure (mean 3.43 v 7.46 days; $p=0.0051$).¹³¹

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A Follow up (including by telephone) by trained heart failure nurses should be considered for patients post-discharge or with stable heart failure. Nurses should have the ability to alter diuretic dose and the interval between telephone calls, and recommend emergency medical contact.

- Consideration should be given to establishing telephone centres to support all patients in Scotland with stable heart failure or adding follow up duties to existing multidisciplinary heart failure teams.

6.2.2 ROLE OF PHARMACISTS

Three good quality RCTs were identified which looked at the contribution of pharmacists to follow up of patients with CHF. One trial showed that the addition of monthly contact with specially trained community pharmacists to standard patient care reduced the number of days, and two day periods of missed diuretic dose.¹³² There was no effect on hospital admission or death but there was already high compliance in the control arm. A further RCT showed that adding a pharmacist intervention at a multidisciplinary heart function clinic improved patient recollection of instruction about drug taking, help with goal setting and ongoing prompting; although over the three month follow up there was no measurement of admission or mortality.¹³³ The third trial showed a significant improvement in all cause mortality, non-fatal CHF events (emergency room visits or CHF admissions) and ACE inhibitor or other vasodilator therapy for the ACE inhibitor intolerant, for those who had a structured pharmacist intervention about compliance and knowledge of drugs with telephone follow up as well as feedback to physicians about optimisation of therapy, compared to those who had usual care.¹³⁴ The result may have been due to optimisation of ACE inhibition or ARB use or to deterioration being picked up sooner.

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A Patients with heart failure should be offered multidisciplinary follow up, including pharmacy input to address knowledge of drugs and compliance. Follow up should include feedback to clinicians about possibilities for optimising pharmacological interventions.

6.2.3 SELF-MANAGEMENT

One small before and after study of a self care management programme for low literacy individuals gives an indication that programmes tailored to literacy levels can improve CHF knowledge, self weighing, increased accuracy of dose adjustment over time, and improved symptoms.¹³⁵

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- Self-management programmes should be tailored to individual patient requirements, particularly in respect of low literacy.

6.3 PATIENT SUPPORT GROUPS

There are 37 cardiac support groups across Scotland supported by Chest Heart and Stroke Scotland (CHSS) and run by people with experience of heart disease. Each has its own constitution, aims and objectives and is shaped by local requirements, and links with cardiac services vary. Aims include emotional and social support of patients and carers, ongoing rehabilitation, secondary prevention, information and education.

- Healthcare professionals should be aware of local support networks for heart failure patients, their structure, aims and constitution. This information should be made available to patients.

7 Palliative care

In Scotland, heart failure is associated with one of the poorest five year survival rates, - approximately 25% for both sexes.¹³⁶

A survey of UK palliative care services during 1997-98 showed that 1,094 patients with heart disease received specialist palliative care, as compared to 62,499 patients with cancer.¹³⁷ There is no evidence to define when, how, and by whom supportive and palliative care is best provided during the patient's journey from diagnosis of heart failure to death.¹³⁸

4

Extrapolating from cancer care, general palliative care should be delivered by the usual professional carers of the patient and family, where the need is of low to moderate complexity, and should be given equal priority alongside diagnosis and treatment. Current palliative care delivery largely depends upon local arrangements between specialist palliative care, primary care and heart failure teams.¹³⁸

In this common chronic disease state there is little robust end-of-life research about:

- functional status
- quality of life
- symptom prevalence and severity
- decisions about treatment preference.

The studies which exist in this area demonstrate high rates of unmet needs in the areas of symptom management, communication, decision-making, emotional support, co-ordination of care and quality end-of-life care.¹³⁹⁻¹⁴¹

3

- ☑ A palliative care approach, with focus on symptom relief and the discontinuation of non-essential treatments should be adopted by all clinicians managing patients with chronic heart failure in the early stages of the disease.

7.1 UNCERTAINTY OF PROGNOSIS

Chronic heart failure is a complex pathophysiological condition which can demand highly technical interventions, but remains a progressive clinical syndrome despite therapeutic advances. It is often associated with multiple comorbidities. Predicting the illness trajectory in end stage heart failure patients is much harder than prediction in those with terminal malignancy. Episodes of acute decompensation may increase in frequency and severity until one such episode proves fatal, but there remains a significant risk of sudden death at all stages of the disease.¹³⁸

- ☑ Issues of sudden death and living with uncertainty are pertinent to all patients with heart failure. The opportunity to discuss these issues should be available to patients at all stages of care.

7.2 QUALITY OF LIFE

In chronic heart failure, quality of life decreases as NYHA functional class worsens. Though NYHA functional class is the most dominant predictor among somatic variables in studies, the major determinants of reduced quality of life are unknown.¹⁴²⁻¹⁴⁴

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Patients may exhibit psychological distress due to increasing dependence on others, the need for assistance with activities of daily living, and consequent disruption of social life, personal goals, income, faith and daily function.^{144,145}

7.3 SYMPTOM MANAGEMENT

Professionals should take a careful history of symptoms. Attention to therapeutic detail, individualised care, open communication and compliance with patients' wishes regarding treatment strategies are all necessary elements of a patient-centred approach to end-of-life care. Little evidence exists on palliative symptom management in chronic heart failure. Management strategies might be extrapolated and adapted from those used in cancer care, although the use of NSAIDs and tricyclic antidepressants should be avoided. The evidence on the management of mood disorders is discussed in section 3.6.

7.3.1 DYSPNOEA

In the dyspnoea of chronic heart failure, opioids may ameliorate the sensation of breathlessness by reducing hypercapnic chemosensitivity.¹⁴⁶ Carefully prescribed opioids can reduce the demand for ventilation without significant respiratory depression. In the elderly, altered pharmacokinetics and diminished renal clearance may necessitate starting with smaller doses and titrating slowly to minimise adverse effects.

One pilot study showed the benefit of opioids in patients with heart failure¹⁴⁷ and a systematic review supported the use of oral and parenteral opioids in breathlessness in advanced disease of any cause.¹⁴⁸ Controlled breathing and relaxation techniques may also be helpful.

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- After optimising diet, fluid intake and standard management for chronic heart failure, prescription of low dose opioids, titrated against effect, should be considered in patients with dyspnoea.

7.3.2 OXYGEN

No evidence was identified that oxygen at rest or when ambulatory is beneficial in chronic heart failure.¹⁴⁹

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7.3.3 PAIN

The precise prevalence of pain in heart failure remains uncertain. Retrospective studies indicate a prevalence of 24–35%.^{139,141,144} Management strategies used in other chronic pain states might be adapted and applied in individual cases.

7.4 DISCONTINUING TREATMENTS

Decisions to adjust drugs should be taken actively rather than in response to adverse effects. The likelihood that the life limiting illness or the comorbidity is being influenced by the current interventions should be considered.¹⁵⁰

- Medications should be reviewed regularly and decisions to adjust or stop drugs should be taken actively rather than in response to adverse effects. Consideration should be given to the difference between treatments prescribed for symptomatic relief and prognostic benefit.

Patient and family education regarding palliative care treatment goals and the function of pacemakers and other implanted arrhythmia control devices (ICDs) can help to alleviate anxiety at the end of life.^{151,152} Patients have the right to refuse any and all unwanted medical interventions or to request their withdrawal, including pacemakers and ICDs. Discussion with families should include the issue of turning off the defibrillator function of ICDs.

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Communication with patients should include discussions about place and type of future care and resuscitation preferences. Studies show that patients' resuscitation preferences may change over time in response to their illness trajectory and functional status.¹⁵³

3

The Liverpool Care of the Dying Pathway is a tool increasingly used in all diagnoses, in end-of-life care.^{154,155} Further research is needed into its use in end-stage cardiac failure.

8 Sources of further information and support for patients and carers

British Cardiac Patients Association

BCPA Head Office, 2 Station Road, Swavesey, Cambridge, CB4 5QJ

Tel: 0800 479 2800 • Fax: 01954 202 022

www.bcpa.co.uk • E-mail: enquiries@bcpa.co.uk

The British Cardiac Patients Association is a charitable organisation run by volunteers providing support, advice and information to cardiac patients and their carers.

British Heart Foundation (Scotland)

Ocean Point One, 94 Ocean Drive Edinburgh EH6 6JH

Tel: 0131 555 5891 • Heart Information line: 08450 70 80 70 (available Mon-Fri 9am-5pm)

www.bhf.org.uk • E-mail: scotland@bhf.org.uk

The British Heart Foundation provides a telephone information service for those seeking information on heart health issues. Also provide a range of written materials offering advice and information to CHD patients and carers. Topics include physical activity, smoking and diabetes.

Chest Heart and Stroke Scotland

65 North Castle Street, Edinburgh, EH2 3LT

Tel: 0131 225 6963 • Helpline: 0845 0776000

www.chss.org.uk • E-mail: admin@chss.org.uk

Chest Heart and Stroke Scotland provides a 24 hour advice line offering confidential, independent advice on all aspects of chest, heart and stroke illness. A series of information booklets, factsheets and videos are available free of charge to patients and carers. There are over 30 cardiac support groups in Scotland which are affiliated to CHSS, patients can contact CHSS for details of their nearest local support group.

Depression Alliance Scotland

3 Grosvenor Gardens, Edinburgh, EH12 5JU

Tel: 0131 467 3050

www.depressionalliance.org • E-mail: info@dascot.org

Depression Alliance Scotland provides information and support for people in Scotland who have depression.

NHS Health Scotland

Woodburn House, Canaan Lane, Edinburgh, EH10 4SG

Tel: 0131 536 5500 • Textphone: 0131 535 5503 • Fax: 0131 535 5501

www.healthscotland.com • E-mail: publications@health.scot.nhs.uk (information on obtaining Health Scotland publications); library.enquiries@health.scot.nhs.uk (help with general health information enquiries)

NHS Health Scotland is a special health board within NHS Scotland. The organisation provides information on projects, publications, support groups and information leaflets relating to CHD.

NHS 24

Tel: 0845 4 24 24 24 • www.nhs24.com

NHS 24 is a nurse led service for members of the public. It is a helpline offering health information, advice and help over the phone.

9 Implementation and audit

9.1 LOCAL IMPLEMENTATION

Implementation of national clinical guidelines is the responsibility of each NHS Board and is an essential part of clinical governance. It is acknowledged that every Board cannot implement every guideline immediately on publication, but mechanisms should be in place to ensure that the care provided is reviewed against the guideline recommendations and the reasons for any differences assessed and, where appropriate, addressed. These discussions should involve both clinical staff and management. Local arrangements may then be made to implement the national guideline in individual hospitals, units and practices, and to monitor compliance. This may be done by a variety of means including patient-specific reminders, continuing education and training, and clinical audit.

9.2 KEY POINTS FOR AUDIT

The National Clinical Datasets Development Programme and ISD Scotland are working to develop national standard datasets for implementation in IT systems supporting patient care. The datasets, available from www.datadictionary.scot.nhs.uk, are:

- CHD core
- acute coronary syndromes
- cardiac rehabilitation
- heart failure
- electrophysiology

The CHD and stroke programme is setting up working groups to develop methods and coding definitions to support the monitoring of the new SIGN guidelines from new datasets and existing data collections. Where there are gaps in the data ISD Scotland will work to support the necessary information collection.

9.3 RECOMMENDATIONS FOR RESEARCH

Diagnosis and investigations

- An assessment of the consequences of BNP screening of patients with suspected heart failure in terms of healthcare usage and expenditure.
- An assessment of the accuracy and acceptability of ECG as a screening tool in primary care for patients with suspected heart failure.

Pharmacological therapy

- What is the benefit of introducing an ARB to an ACE inhibitor and a beta blocker in patients with asymptomatic LV systolic dysfunction?
- What is the benefit of introducing an aldosterone blocker to an ACE inhibitor and a beta blocker in patients with mild heart failure or asymptomatic LV systolic dysfunction?
- How to most accurately identify those patients who will suffer hyperkalaemia or renal dysfunction with double or triple renin-(aldosterone)-angiotensin system blockade?
- Does hydralazine/isosorbide dinitrate produce clinical benefit in non-black patients with heart failure when added to standard therapy?
- Which patients with non-atrial fibrillation heart failure benefit from warfarin therapy?

Behavioural modification

- Further studies on the safety of swimming in patients with CHF are required.
- Does the identification of depression or anxiety in patients with heart failure lead to treatment interventions which improve quality of life?
- How can we improve patients' adherence to treatment and to health recommendations?

Interventional procedures

- There is a need for more research into the subjective and symptomatic benefit of oxygen therapy for hypoxaemic patients with heart failure.
- Which patients will most benefit from CRT or CRT-D?
- Which patients will most benefit from ICD implantation?

Models of care

- Which components of nurse follow up produce the greatest benefits for patients with heart failure?
- Would day care intravenous therapy speed discharge and avoid readmission?

Palliative care

- Palliative care for heart failure: is there a role for it? What does it offer? How should it be organised?

10 Development of the guideline

10.1 INTRODUCTION

SIGN is a collaborative network of clinicians, other healthcare professionals and patient organisations and is part of NHS Quality Improvement Scotland. SIGN guidelines are developed by multidisciplinary groups of practicing clinicians using a standard methodology based on a systematic review of the evidence. Further details about SIGN and the guideline development methodology are contained in “SIGN 50: A Guideline Developer’s Handbook”, available at www.sign.ac.uk

10.2 THE GUIDELINE DEVELOPMENT GROUP

Professor Allan Struthers (Chair)	<i>Consultant Physician, Ninewells Hospital and Medical School, Dundee</i>
Ms Gillian Armstrong	<i>Senior 1 Physiotherapist, Glasgow Royal Infirmary</i>
Ms Lynda Blue	<i>Heart Failure Nurse Co-ordinator, Western Infirmary, Glasgow</i>
Ms Joyce Craig	<i>Senior Health Economist, NHS Quality Improvement Scotland</i>
Dr Martin Denvir	<i>Consultant Cardiologist, Western General Hospital, Edinburgh</i>
Dr Geoff Dobson	<i>General Practitioner, Edinburgh</i>
Dr Barbara Dymock	<i>Associate Specialist in Palliative Medicine, Royal Victoria Hospital, Dundee</i>
Dr Andrew Elder	<i>Consultant in Acute Elderly Medicine, Western General Hospital, Edinburgh</i>
Ms Trisha Graham	<i>Physiotherapist, Stobhill General Hospital, Glasgow</i>
Dr Hamish Greig	<i>General Practitioner, Brechin</i>
Mr Robin Harbour	<i>Quality and Information Director, SIGN Executive</i>
Dr Kerry-Jane Hogg	<i>Consultant Cardiologist, Stobhill General Hospital, Glasgow</i>
Mr Steve McGlynn	<i>Area Pharmacy Specialist, Glasgow</i>
Professor John McMurray	<i>Consultant Cardiologist, Western Infirmary, Glasgow</i>
Dr Caroline Morrison	<i>Public Health Consultant, Greater Glasgow Health Board</i>
Mr Andrew Murday	<i>Consultant in Cardiothoracic Surgery, Glasgow Royal Infirmary</i>
Dr Moray Nairn	<i>Programme Manager, SIGN Executive</i>
Dr David Northridge	<i>Consultant Cardiologist, Western General Hospital, Edinburgh</i>
Ms Agnes Sloey	<i>Clinical Co-ordinator for Cardiology, Wishaw General Hospital</i>
Mr Peter Thompson	<i>Patient Representative, Edinburgh</i>
Dr Deborah Tinson	<i>Chartered Clinical Psychologist, Astley Ainslie Hospital, Edinburgh</i>

The membership of the guideline development group was confirmed following consultation with the member organisations of SIGN. All members of the guideline development group made declarations of interest and further details of these are available on request from the SIGN Executive. Guideline development and literature review expertise, support and facilitation were provided by the SIGN Executive.

10.3 THE STEERING GROUP

A steering group comprising the chairs of the five SIGN CHD guidelines and other invited experts was established to oversee the progress of guideline development. This group met regularly throughout the lifetime of the guidelines.

Dr Kevin Jennings	<i>Co-chair and Consultant Cardiologist, Aberdeen Royal Infirmary</i>
Professor Lewis Ritchie	<i>Co-chair and Mackenzie Professor of General Practice, University of Aberdeen</i>
Dr Alan Begg	<i>Chair of SIGN stable angina guideline</i>
Dr Nick Boon	<i>Consultant Cardiologist, Royal Infirmary of Edinburgh</i>
Ms Marjory Burns	<i>Director for Scotland, British Heart Foundation</i>
Mr David Clark	<i>Chief Executive, Chest, Heart and Stroke Scotland</i>
Professor Stuart Cobbe	<i>Chair of SIGN arrhythmias guideline</i>
Ms Joyce Craig	<i>Senior Health Economist, NHS Quality Improvement Scotland</i>
Dr Iain Findlay	<i>Chair of SIGN acute coronary syndromes guideline</i>
Professor Keith Fox	<i>Professor of Cardiology, University of Edinburgh</i>
Dr James Grant	<i>Chair of SIGN prevention guideline</i>
Mr James Grant	<i>Lay representative, Balerno</i>
Dr Grace Lindsay	<i>Lecturer, Glasgow Caledonian University</i>
Dr Moray Nairn	<i>Programme Manager, SIGN Executive</i>
Professor Allan Struthers	<i>Chair of SIGN heart failure guideline</i>
Dr Lorna Thompson	<i>Programme Manager, SIGN Executive</i>

10.4 ACKNOWLEDGEMENTS

SIGN is grateful to the following members of the guideline development group and others who have contributed to the development of the guideline.

Mr Iain Lewis	<i>Head of Community Fundraising, British Heart Foundation, Edinburgh</i>
Ms Theresa McDonagh	<i>Senior Lecturer in Medical Cardiology, Glasgow Royal Infirmary</i>
Dr Olivia Wu	<i>Systematic Reviewer, Glasgow University</i>

10.5 SYSTEMATIC LITERATURE REVIEW

The evidence base for this guideline was synthesised in accordance with SIGN methodology. A systematic review of the literature was carried out using an explicit search strategy devised by a SIGN Information Officer. Searches were focused on existing guidelines, systematic reviews, randomised controlled trials, and (where appropriate) observational and/or diagnostic studies. Databases searched include AMED, Medline, Embase, Cinahl, PsychINFO, and the Cochrane Library. The year range covered was 1996-2005, though where questions overlapped with those addressed in the 2003 NICE guidelines on chronic heart failure searches were limited to an update of the evidence tables from that guideline. The palliative care literature was reviewed back to 1986. Internet searches were carried out on various websites including those for the Guidelines International Network, National Institute for Health and Clinical Excellence, the National Library for Health, and the US National Guidelines Clearinghouse. The Medline version of the main search strategies can be found on the SIGN website, in the section covering supplementary guideline material. The main searches were supplemented by material identified by individual members of the development group. Each of the selected papers was evaluated by two members of the group using standard SIGN methodological checklists before conclusions were considered as evidence.

10.6 CONSULTATION AND PEER REVIEW

10.6.1 NATIONAL OPEN MEETING

A national open meeting is the main consultative phase of SIGN guideline development, at which the guideline development group present its draft recommendations for the first time. The national open meeting for the five parallel SIGN guidelines on aspects of cardiovascular disease was held on 16 September 2005 and was attended by over 600 representatives of all the key specialties relevant to the guideline. The draft guideline was also available on the SIGN website for a limited period at this stage to allow those unable to attend the meeting to contribute to the development of the guideline.

10.6.2 SPECIALIST REVIEW

This guideline was also reviewed in draft form by the following independent expert referees, who were asked to comment primarily on the comprehensiveness and accuracy of interpretation of the evidence base supporting the recommendations in the guideline. SIGN is very grateful to all of these experts for their contribution to the guideline.

Mrs Elizabeth Armour	<i>Quality Improvement Manager, Murray Royal Hospital, Perth</i>
Ms Doreen Bell	<i>Lay Reviewer (NHSQIS), Glenrothes, Fife</i>
Dr Kirsty Boyd	<i>Consultant in Palliative Medicine, Royal Infirmary of Edinburgh</i>
Dr Paul Broadhurst	<i>Consultant Cardiologist, Aberdeen Royal Infirmary</i>
Dr Patricia Cantley	<i>Consultant Physician, Liberton Hospital, Edinburgh</i>
Professor Stuart Cobbe	<i>Consultant Cardiologist, Glasgow Royal Infirmary</i>
Dr Charles Crichton	<i>General Practitioner, Portree Medical Practice, Isle of Skye</i>
Mr Ewen Cummins	<i>Health Economist, McMaster Consultants Ltd, Glasgow</i>
Ms Karen Fletcher	<i>CHD and Stroke Prevention Co-ordinator, Angus Community Health Partnership, Forfar</i>
Dr Ian Gillanders	<i>Consultant Physician, Stracathro Hospital, Brechin</i>
Dr Barclay Goudie	<i>General Practitioner, Westgate Health Centre, Dundee</i>
Ms Julie Graham	<i>MacMillan Palliative Care Clinical Nurse Specialist, Wishaw General Hospital</i>
Ms Jenny Hally	<i>Clinical Research Fellow, Dental Health Services Research Unit, University of Dundee</i>
Dr Andrew Hannah	<i>Consultant Cardiologist, Aberdeen Royal Infirmary</i>
Dr Andrew Henderson	<i>Consultant Physician, Lorn and Islands District General Hospital, Oban</i>
Dr Graham Hillis	<i>Senior Lecturer and Honorary Consultant Cardiologist, Aberdeen Royal Infirmary</i>
Ms Alison Hume	<i>Nurse Co-ordinator for Cardiac Rehabilitation and Heart Failure Services, Ninewells Hospital, Dundee</i>
Ms Cathy King	<i>Practice Nurse, St Margaret's Health Centre, Auchterarder</i>
Dr Harpreet Kohli	<i>Head of Health Services Research and Assessment, NHS Quality Improvement Scotland, Edinburgh</i>
Professor Chim Lang	<i>Professor in Cardiology, Ninewells Hospital, Dundee</i>
Dr Martin Leiper	<i>Consultant in Palliative Medicine, Royal Victoria Hospital, Dundee</i>
Dr John McAnaw	<i>Lecturer, Strathclyde Institute of Biomedical Sciences, Glasgow</i>
Mr Andrew McGuire	<i>Practice Pharmacist, Craigvinean Surgery, Dunkeld</i>
Ms Annie MacCallum	<i>Lead Nurse and County Co-ordinator, Gloucester Heart Failure Service</i>

Dr Alasdair MacLulich	<i>Honorary Consultant in Geriatric Medicine, University of Edinburgh</i>
Dr Dorothy Moir	<i>Director of Public Health, NHS Lanarkshire</i>
Professor David Newby	<i>British Heart Foundation Reader and Consultant Cardiologist, University of Edinburgh</i>
Ms Lesley O'Brien	<i>Senior 1 Physiotherapist, Wishaw General Hospital</i>
Dr Mark Petrie	<i>Consultant Cardiologist, Glasgow Royal Infirmary</i>
Mr Said Prasad	<i>Cardio-Thoracic Surgeon, Royal Infirmary of Edinburgh</i>
Ms Janet Reid	<i>Lead Heart Failure Nurse, Royal Infirmary of Edinburgh</i>
Dr William G Simpson	<i>Consultant Chemical Pathologist, Aberdeen Royal Infirmary</i>
Professor David Stott	<i>Professor of Geriatric Medicine, Glasgow Royal Infirmary</i>

10.6.3 SIGN EDITORIAL GROUP

As a final quality control check, the guideline is reviewed by an editorial group comprising the relevant specialty representatives on SIGN Council to ensure that the specialist reviewer's comments have been addressed adequately and that any risk of bias in the guideline development process as a whole has been minimised. The editorial group for this guideline was as follows.

Dr Keith Brown	<i>Member of SIGN Council</i>
Professor Hilary Capell	<i>Member of SIGN Council</i>
Mr Robert Carachi	<i>Member of SIGN Council</i>
Ms Ann Marie Hawthorne	<i>Member of SIGN Council</i>
Dr Bernard Higgins	<i>Member of SIGN Council</i>
Professor Gordon Lowe	<i>Chair of SIGN; Co-Editor</i>
Ms Anne Matthew	<i>Member of SIGN Council</i>
Dr Safia Qureshi	<i>SIGN Programme Director; Co-Editor</i>
Dr Sara Twaddle	<i>Director of SIGN; Co-Editor</i>

Abbreviations

ACE	angiotensin converting enzyme
ACM	alcoholic cardiomyopathy
ARB	angiotensin receptor blocker
BNP	brain natriuretic peptide
BP	blood pressure
CABG	coronary artery bypass grafting
CANPAP	CANadian continuous Positive Airway Pressure for patients with central sleep apnea and heart failure trial
CHARM	Candesartan in Heart failure: Assessment of Reduction in Mortality trial
CHD	coronary heart disease
CHF	chronic heart failure
CHSS	Chest Heart and Stroke Scotland
CI	confidence interval
CIBIS II	the Cardiac Insufficiency Bisoprolol Study II trial
COPD	chronic obstructive pulmonary disease
COPERNICUS	Carvedilol Prospective Randomized Cumulative Survival trial
CPAP	continuous positive air pressure
CRT	cardiac resynchronisation therapy
CVD	cardiovascular disease
CXR	chest X-ray
DIG	Digitalis Investigation Group trial
DSE	dobutamine stress echocardiography
ECG	electrocardiogram
EPHESUS	Eplerenone Post-Acute Myocardial Infarction Heart Failure Efficacy and Survival Study trial
GP	general practitioner
H-ISDN	hydralazine and isosorbide dinitrate
IABP	intra-aortic balloon counterpulsation
ICD	implanted arrhythmia control devices
JVP	jugular venous pressure
LV	left ventricular
LVAD	left ventricular assist device
LVDD	left ventricular diastolic dysfunction
LVEF	left ventricular ejection fraction
LVH	left ventricular hypertrophy
LVSD	left ventricular systolic dysfunction
MERIT	Metoprolol CR/XL Randomized Intervention trial

MI	myocardial infarction
MRI	magnetic resonance imaging
MUGA	multiple gated acquisition scan
NICE	National Institute for Health and Clinical Excellence
NSAID	non-steroidal anti-inflammatory drug
NT-pro BNP	N terminal-pro- brain natriuretic peptide
NYHA	New York Health Association
OR	odds ratio
OSA	obstructive sleep apnoea
PET	positron emission tomography
PROVED	Prospective Randomized study Of Ventricular failure and the Efficacy of Digoxin trial
QoL	quality of life
RADIANCE	Randomized Assessment of Digoxin on Inhibitors of the Angiotensin-Converting Enzyme trial
RALES	Randomised Aldactone Evaluation Study trial
RCT	randomised controlled trial
RR	relative risk
RVD	right ventricular dysfunction
S3	third heart sound
SENIORS	Study of the Effects of Nebivolol Intervention on Outcomes and Rehospitalisation in Seniors with Heart Failure
SIGN	Scottish Intercollegiate Guidelines Network
ValHEFT	Valsartan Heart Failure Trial

Annex 1

Practical guidance on the use of angiotensin converting enzyme inhibitors in patients with heart failure due to left ventricular systolic dysfunction

Contraindications

- history of angioneurotic oedema
- known bilateral renal artery stenosis

Cautions/seek specialist advice

- significant hyperkalaemia ($K^+ > 5.0$ mmol/l)
- significant renal dysfunction (creatinine > 221 micromol/l)
- symptomatic or severe asymptomatic hypotension (systolic BP < 90 mm Hg)

Drug interactions to look out for:

- K^+ supplements / K^+ sparing diuretics
- "low salt" substitutes with a high K^+ content

Starting and target doses

ACE inhibitor	Starting dose	Target dose
captopril	6.25 mg three times daily	50 mg three times daily
enalapril	2.5 mg twice daily	10-20 mg twice daily
lisinopril	2.5 – 5 mg once daily	20 mg once daily
ramipril	2.5 mg once daily	5 mg twice daily or 10 mg once daily
trandolapril	0.5 mg once daily	4 mg once daily

How to use ACE inhibitors

- Start with a low dose (see starting and target doses) and double dose at not less than two-weekly intervals. (Healthcare professionals with experience in the use of ACE inhibitors may wish to up-titrate the dose of ACE inhibitor more rapidly, taking account of the risk of adverse effects and the need for close monitoring of toleration and blood chemistry.)
- Aim for target dose or, failing that, the highest tolerated dose.
- Monitor blood pressure and blood chemistry (urea, creatinine, and electrolytes).
- Check blood chemistry one to two weeks after initiation and one to two weeks after each dose titration.
- When to stop up-titration/reduce dose/stop treatment - see problem solving.
- A specialist CHF nurse may assist with patient education, follow-up (in person/by telephone), biochemical monitoring and dose up-titration.

Advice to the patient

- Give written advice and explain expected benefits - treatment is given to improve symptoms, to prevent worsening of CHF leading to hospital admission and to increase survival.
- Symptoms improve within a few weeks to a few months of starting treatment.
- Advise patients to report principal adverse effects, ie dizziness/symptomatic hypotension, cough - see problem solving.
- Advise patients to avoid non-steroidal anti-inflammatory drugs (NSAIDs) not prescribed by a physician (self-purchased "over the counter") and salt substitutes high in K^+

Problem Solving*Asymptomatic low blood pressure*

Does not usually require any change in therapy

Symptomatic hypotension

- If dizziness, light-headedness and/or confusion and a low blood pressure reconsider need for nitrates, calcium channel blockers and other vasodilators. Calcium channel blockers should be discontinued unless absolutely essential (eg, for angina or hypertension).
- If no signs/symptoms of congestion consider reducing diuretic dose.
- If these measures do not solve problem seek specialist advice.

Cough

- Cough is common in patients with heart failure, many of whom have smoking related lung disease, including cancer.
- Cough is also a symptom of pulmonary oedema which should be excluded when a new or worsening cough develops.
- ACE inhibitor induced cough rarely requires treatment discontinuation.
- When a very troublesome cough does develop (eg, one stopping the patient sleeping) and can be proven to be due to ACE inhibition (ie recurs after ACE inhibitor withdrawal and rechallenge) substitution of an angiotensin receptor blocker should be made.

Worsening renal function

- Some rise in urea, creatinine and potassium is to be expected after initiation of an ACE inhibitor; if an increase is small and asymptomatic no action is necessary.
- An increase in creatinine of up to 50% above baseline, or 266 micromol/l, whichever is the smaller, is acceptable.
- An increase in potassium to < 5.5 mmol/l is acceptable.
- If urea, creatinine or potassium do rise excessively consider stopping concomitant nephrotoxic drugs (eg, NSAIDs), other potassium supplements/retaining agents (triamterene, amiloride, spironolactone/eplerenone) and, if no signs of congestion, reducing the dose of diuretic. The safety and efficacy of an ACE inhibitor used with an ARB and spironolactone (as well as beta blocker) is uncertain and the use of all three inhibitors of the renin-angiotensin-aldosterone system together is not recommended.
- If greater rises in creatinine or potassium than those outlined above persist despite adjustment of concomitant medications, the dose of the ACE inhibitor should be halved and blood urea, creatinine and electrolytes rechecked within one to two weeks; if there is still an unsatisfactory response specialist advice should be sought.
- If potassium rises to > 5.5 mmol/l or creatinine increases by > 100% or to above 310 micromol/l the ACE inhibitor should be stopped and specialist advice sought.
- Blood urea, creatinine and electrolytes should be monitored frequently and serially until potassium and creatinine have plateaued.

Source: McMurray J, Cohen-Solal A, Dietz R, Eichhorn E, Erhardt L, Hobbs FD, et al. Practical recommendations for the use of ACE inhibitors, beta blockers, aldosterone antagonists and angiotensin receptor blockers in heart failure putting guidelines into practice. *Eur J Heart Fail.* 2005;7(5):710-21.

Annex 2

Practical guidance on the use of angiotensin receptor blockers in patients with heart failure due to left ventricular systolic dysfunction

Indications

- first line treatment (along with beta blockers) in patients with NYHA Class II - IV HF intolerant of an ACE inhibitor
- second line treatment (after optimisation of ACE inhibitor and beta blocker) in patients with NYHA Class II - III CHF (The safety and efficacy of spironolactone used with an ACE inhibitor and an ARB (as well as beta blocker) is uncertain and the use of all three inhibitors of the renin–angiotensin–aldosterone system together is not recommended).

Contraindications

- known bilateral renal artery stenosis

Cautions/seek specialist advice

- significant hyperkalaemia ($K^+ > 5.0$ mmol/l)
- significant renal dysfunction (creatinine > 221 micromol/l)
- symptomatic or severe asymptomatic hypotension (systolic BP < 90 mm Hg)

Drug interactions to look out for:

- K^+ supplements / K^+ sparing diuretics
- “low salt” substitutes with a high K^+ content

Starting and target doses

ARB	Starting dose	Target dose
candesartan	4 or 8 mg once daily	32 mg once daily
valsartan	40 mg twice daily	160 mg twice daily

Candesartan is the only ARB which is licensed for use in patients with CHF. Valsartan is the only ARB which is licensed for use in patients following MI with CHF or LVSD or both.

How to use angiotensin receptor blockers

- Start with a low dose (see *starting and target doses*) and double dose at not less than two-weekly intervals.
- Aim for target dose or, failing that, the highest tolerated dose.
- Monitor blood pressure and blood chemistry (urea, creatinine, and electrolytes).
- Check blood chemistry one to two weeks after initiation and one to two weeks after each dose titration.
- When to stop up-titration/reduce dose/stop treatment — see *problem solving*.
- A specialist CHF nurse may assist with patient education, follow-up (in person/by telephone), biochemical monitoring and dose up-titration.

Advice to the patient

- Explain expected benefits - treatment is given to improve symptoms, to prevent worsening of CHF leading to hospital admission and to increase survival.
- Symptoms improve within a few weeks to a few months of starting treatment.
- Advise patients to report principal adverse effects, ie dizziness/symptomatic hypotension.
- Advise patients to avoid NSAIDs not prescribed by a physician (self-purchased “over the counter”) and salt substitutes high in K⁺

Problem Solving*Asymptomatic low blood pressure*

- Does not usually require any change in therapy

Symptomatic hypotension

- If dizziness, light-headedness and/or confusion and a low blood pressure reconsider need for nitrates, calcium channel blockers and other vasodilators. Calcium channel blockers should be discontinued unless absolutely essential (eg, for angina or hypertension).
- If no signs/symptoms of congestion consider reducing diuretic dose.
- If these measures do not solve problem seek specialist advice.

Worsening renal function

- Some rise in urea, creatinine and potassium is to be expected after initiation of an ACE inhibitor; if an increase is small and asymptomatic no action is necessary.
- An increase in creatinine of up to 50% above baseline, or 266 micromol/l whichever is the smaller, is acceptable.
- An increase in potassium to ≤ 5.5 mmol/l is acceptable.
- If urea, creatinine or potassium do rise excessively consider stopping concomitant nephrotoxic drugs (eg, NSAIDs), other potassium supplements/retaining agents (triamterene, amiloride, spironolactone/eplerenone) and, if no signs of congestion, reducing the dose of diuretic. The safety and efficacy of an ACE inhibitor used with an ARB and spironolactone (as well as beta blocker) is uncertain and the use of all three inhibitors of the renin–angiotensin–aldosterone system together is not recommended.
- If greater rises in creatinine or potassium than those outlined above persist despite adjustment of concomitant medications, the dose of the ARB should be halved and blood urea, creatinine and electrolytes rechecked within one to two weeks; if there is still an unsatisfactory response specialist advice should be sought.
- If potassium rises to > 5.5 mmol/l or creatinine increases by $> 100\%$ or to above 310 micromol/l the ARB should be stopped and specialist advice sought.
- Blood urea, creatinine and electrolytes should be monitored frequently and serially until potassium and creatinine have plateaued.

Source: McMurray J, Cohen-Solal A, Dietz R, Eichhorn E, Erhardt L, Hobbs FD, et al. Practical recommendations for the use of ACE inhibitors, beta blockers, aldosterone antagonists and angiotensin receptor blockers in heart failure putting guidelines into practice. *Eur J Heart Fail.* 2005;7(5):710-21.

Annex 3

Practical guidance on the use of beta blockers in patients with heart failure due to left ventricular systolic dysfunction

Contraindications

- Asthma
- heart block or heart rate < 60/min
- persisting signs of congestion, hypotension/low blood pressure (systolic < 90 mm Hg), raised jugular venous pressure, ascites, marked peripheral oedema

Cautions/seek specialist advice

- severe (NYHA Class IV) CHF
- current or recent (< 4 weeks) exacerbation of CHF, eg, hospital admission with worsening CHF

Drug interactions to look out for:

- Verapamil/diltiazem (calcium channel blockers should be discontinued unless absolutely necessary and diltiazem and verapamil are generally contraindicated in CHF).
- Digoxin, amiodarone

Starting and target doses

Beta blocker	Starting dose	Target dose
bisoprolol	1.25 mg once daily	10 mg once daily
carvedilol	3.125 mg twice daily	25-50 mg twice daily
nebivolol	1.25 mg once daily	10 mg once daily

Only the drugs listed above have UK formulations shown to reduce mortality or morbidity.

How to use beta blockers

- Start with a low dose (see starting and target doses) and double dose at not less than two-weekly intervals.
- Aim for target dose or, failing that, the highest tolerated dose.
- Monitor heart rate, BP and clinical status (symptoms, signs — especially signs of congestion, body weight).
- Check blood urea, creatinine and electrolytes one to two weeks after initiation and one to two weeks after final dose titration.
- When to stop up-titration/reduce dose/stop treatment— see problem solving.
- A specialist HF nurse may assist with patient education, follow-up (in person/by telephone), biochemical monitoring and dose up-titration.

Advice to the patient

- Explain expected benefits -treatment is given to improve symptoms, to prevent worsening of CHF leading to hospital admission and to increase survival.
- Symptomatic improvement may develop slowly after starting treatment, taking three to six months or longer.
- Temporary symptomatic deterioration may occur during initiation/up-titration phase.
- Advise patients to report deterioration and that deterioration (tiredness, fatigue, breathlessness) can usually be easily managed by adjustment of other medication; patients should be advised not to stop beta blocker therapy without consulting their physician.
- To detect and treat deterioration early, patients should be encouraged to weigh themselves daily (after waking, before dressing, after voiding, before eating) and to increase their diuretic dose should their weight increase, persistently (> two days), by > 1 kg over three days.

Problem solving

Worsening symptoms/signs (eg increasing dyspnoea, fatigue, oedema, weight gain)

- If increasing congestion increase dose of diuretic and/or halve dose of beta blocker (if increasing diuretic doesn't work)
- If marked fatigue (and/or bradycardia—see *below*) halve dose of beta blocker (rarely necessary)
- Review patient in one to two weeks; if not improved seek specialist advice.
- If serious deterioration halve dose of beta blocker or stop this treatment (rarely necessary); seek specialist advice.

Low heart rate

- If heart rate < 50 beats/min and worsening symptoms — halve dose beta blocker or, if severe deterioration, stop beta blocker (rarely necessary).
- Review need for other heart rate slowing drugs, eg digoxin, amiodarone, diltiazem/verapamil (diltiazem and verapamil are generally contraindicated in CHF).
- Arrange ECG to exclude heart block.
- Seek specialist advice.

Asymptomatic low blood pressure

- does not usually require any change in therapy

Symptomatic hypotension

- If dizziness, light-headedness and/or confusion and a low BP reconsider need for nitrates, calcium channel blockers and other vasodilators. Calcium channel blockers should be discontinued unless absolutely essential (eg, for angina or hypertension).
- If no signs/symptoms of congestion consider reducing diuretic or ACE inhibitor dose.
- If these measures do not solve problem seek specialist advice.

Source: McMurray J, Cohen-Solal A, Dietz R, Eichhorn E, Erhardt L, Hobbs FD, et al. Practical recommendations for the use of ACE inhibitors, beta blockers, aldosterone antagonists and angiotensin receptor blockers in heart failure: putting guidelines into practice. *Eur J Heart Fail.* 2005;7(5):710-21.

Annex 4

Practical guidance on the use of aldosterone antagonists in patients with heart failure due to left ventricular systolic dysfunction

Indications

- second line treatment (after optimisation of ACE inhibitor and beta blocker) in patients with NYHA Class III–IV CHF; there is no evidence of benefit in patients with milder HF. (The safety and efficacy of spironolactone used with an ACE inhibitor and an ARB (as well as beta blocker) is uncertain and the use of all three inhibitors of the renin–angiotensin–aldosterone system together is not recommended)

Cautions/seek specialist advice

- significant hyperkalaemia ($K^+ > 5.0$ mmol/l)
- significant renal dysfunction (creatinine > 220 micromol/l)

Drug interactions to look out for:

- K^+ supplements / K^+ sparing diuretics
- ACE inhibitors, ARBs, NSAIDs (avoid unless essential)
- “low salt” substitutes with a high K^+ content

Starting and target doses

Aldosterone antagonist	Starting dose	Target dose
spironolactone	25 mg once daily or on alternate days	25-50 mg once daily
eplerenone	25 mg once daily	50 mg once daily

How to use aldosterone antagonists

- Start with a low dose (see starting and target doses).
- Check urea, creatinine and electrolytes at one, four, eight and 12 weeks; six, nine and 12 months; six monthly thereafter.
- If K^+ rises above 5.5 mmol/l or creatinine rises to > 220 micromol/l reduce dose to 25 mg on alternate days and monitor blood chemistry closely.
- If K^+ rises ≥ 6.0 mmol/l or creatinine to 310 micromol/l stop spironolactone immediately and seek specialist advice.
- A specialist CHF nurse may assist with patient education, follow up (in person/by telephone), biochemical monitoring and dose up-titration.

Advice to the patient

- Explain expected benefits - treatment is given to improve symptoms, to prevent worsening of HF leading to hospital admission and to increase survival.
- Symptoms improve within a few weeks to a few months of starting treatment.
- Advise patients to report principal adverse effects, ie dizziness/symptomatic hypotension.
- Advise patients to avoid NSAIDs not prescribed by a physician (self-purchased “over the counter”) and salt substitutes high in K^+
- If diarrhoea and/or vomiting occurs patients should stop spironolactone and contact their physician.

Problem solving*Worsening renal function / hyperkalaemia*

- See how to use aldosterone antagonists section.
- Major concern is hyperkalaemia (≥ 6.0 mmol/l); conversely, a high normal potassium may be desirable in HF patients, especially if taking digoxin.
- It is important to avoid other K^+ retaining drugs (eg, K^+ sparing diuretics such as amiloride and triamterene) and nephrotoxic agents (eg NSAIDs)
- The risks of hyperkalaemia and renal dysfunction when an aldosterone antagonist is given to patients already taking an ACE inhibitor and ARB are higher than when an aldosterone antagonist is added to just an ACE inhibitor or ARB given singly; close and careful monitoring is mandatory. The safety and efficacy of spironolactone used with an ACE inhibitor and an ARB (as well as a beta blocker) is uncertain and the use of all three inhibitors of the renin-angiotensin-aldosterone system together is not recommended.
- Some “low salt” substitutes have a high K^+ content.
- Male patients treated with spironolactone may develop breast discomfort and/or gynaecomastia. These problems are significantly less common with eplerenone.

Source: McMurray J, Cohen-Solal A, Dietz R, Eichhorn E, Erhardt L, Hobbs FD, et al. Practical recommendations for the use of ACE inhibitors, beta blockers, aldosterone antagonists and angiotensin receptor blockers in heart failure: putting guidelines into practice. *Eur J Heart Fail.* 2005;7(5):710-21.

Annex 5

Drugs to avoid in patients with chronic heart failure

The following tables list some of the more commonly prescribed medicines and herbal remedies and their effect on the myocardium.

Cardiac medications affecting ventricular function

Drug or Class	Effect(s)
beta blockers	reduced contractility if dosed inappropriately
class I and III anti-arrhythmics (excluding amiodarone)	reduced contractility, proarrhythmia
rate limiting calcium channel blockers (verapamil and diltiazem) other calcium channel blockers (except amlodipine and felodipine?)	reduced contractility and/or neurohormonal activation
minoxidil	activation of the renin-angiotensin-aldosterone system

Non- cardiac medication affecting ventricular function

Drug or Class	Effect(s)
corticosteroids	sodium and water retention
non-steroidal anti-inflammatory drugs	sodium and water retention, antagonism of diuretic therapy, increased systemic vascular resistance
metformin	increased risk of lactic acidosis, especially in NYHA classes III and IV or if renal function impaired.
thiazolidinediones (glitazones)	fluid retention
tricyclic antidepressants	reduced contractility, proarrhythmia
itraconazole	reduced contractility
carbenoxolone	fluid retention
macrolide antibiotics and some antifungal agents	proarrhythmia mediated by QT prolongation
terfenadine, and some other anti-histamines	proarrhythmia mediated by QT prolongation, especially when used with macrolide antibiotics or some antifungal agents

Selected herbal medicines with cardiac effects

Drug or Class	Effect(s)
liquorice	fluid retention
ma huang yohimbe bark	sympathomimetic
dong quai aescin	anticoagulant: increased risk of bleeding
gingko garlic dan shen	antiplatelet: increased risk of bleeding
gossypol	hypokalaemia
dandelion	sodium retention

A number of other herbs contain constituents with cardiac glycoside effects and enhance the effects of digoxin or interfere with assays.

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BEHAVIOURAL MODIFICATION

ALCOHOL CONSUMPTION

C All patients with heart failure should be advised to refrain from excessive alcohol consumption. When the aetiology of heart failure is alcohol related, patients should be strongly encouraged to stop drinking alcohol.

SMOKING

B Patients with chronic heart failure should be strongly advised not to smoke and should be offered smoking cessation advice and support.

UNSUPERVISED PHYSICAL ACTIVITY

B Motivational techniques should be employed to promote regular low intensity physical activity amongst patients with stable heart failure.

DIETARY CHANGES

- Patients with chronic heart failure should be advised to avoid a salt intake of > 6 g/day.
- Patients with chronic heart failure should be advised not to use “low salt” substitutes due to their high potassium content.
- Healthcare professionals involved in the care of patients with frequent decompensated heart failure should assess individual patients’ fluid intake and use a tailored approach when giving fluid restriction advice.

Patients with chronic heart failure should be encouraged to weigh themselves at a set time of day, every day (after waking, before dressing, after voiding, before eating). Patients should report to their general practitioner or heart failure specialist any weight gain of more than 1.5 to 2 kgs in two days.

- Patients with chronic heart failure who are taking warfarin should be advised to avoid cranberry juice (which may increase drug potency).
- Patients with chronic heart failure who are taking simvastatin should be advised to avoid grapefruit juice (which may interfere with liver metabolism of the drug).
- Patients with chronic heart failure should not take St John’s wort supplements due to the interaction with warfarin, digoxin, eplerenone and selective serotonin re-uptake inhibitors.

PHARMACOLOGICAL THERAPIES

ACE INHIBITORS

A ACE inhibitors should be considered in patients with all grades of heart failure (asymptomatic left ventricular systolic dysfunction to severe heart failure).

BETA BLOCKERS

A All patients with heart failure due to LVSD of all grades of severity should be started on beta blocker therapy as soon as their condition is stable (unless contraindicated by a history of asthma, heart block or symptomatic hypotension).

ANGIOTENSIN RECEPTOR BLOCKERS

A Patients with chronic heart failure due to LVSD alone, or heart failure following myocardial infarction due to LVSD who are intolerant of ACE inhibitors should be considered for an angiotensin receptor blocker.

B Patients with heart failure due to LVSD who are still symptomatic despite therapy with an angiotensin converting enzyme inhibitor and a beta blocker may benefit from the addition of candesartan, following specialist advice.

ALDOSTERONE ANTAGONISTS

B Following specialist advice, patients with moderate to severe heart failure due to LVSD should be considered for spironolactone unless contraindicated by the presence of renal impairment or high potassium levels.

Patients who develop gynaecomastia while on spironolactone may be transferred to eplerenone.

B Patients who have suffered a myocardial infarction and with left ventricular ejection fraction $\leq 40\%$ and either diabetes or clinical signs of heart failure should be considered for eplerenone unless contraindicated by the presence of renal impairment or high potassium levels.

DIURETICS

B Diuretic therapy should be considered for heart failure patients with dyspnoea or oedema (ankle or pulmonary).

DIGOXIN

A Digoxin should be considered as an add-on therapy for heart failure patients in sinus rhythm who are still symptomatic after optimum therapy.

INTERVENTIONAL PROCEDURES

A For patients in sinus rhythm with drug refractory symptoms of heart failure due to LVSD (left ventricular ejection fraction $\leq 35\%$) and who are in NYHA class III and IV and who have a QRS duration of > 120 ms, cardiac resynchronisation should be considered.

B Consideration should be given to enrolling stable heart failure patients who are in NYHA class II - III into a moderate intensity supervised exercise training programme to give improved exercise tolerance and quality of life.

- Patients should be encouraged to take aerobic exercise within limits dictated by their symptoms.
- Exercise programmes should be individually tailored to the patient following the recommendations in SCGN guideline 57 on cardiac rehabilitation.

B In patients undergoing coronary artery bypass grafting with left ventricular ejection fraction $\leq 35\%$ consideration should be given to preoperative introduction of intra-aortic balloon counterpulsation.

MODELS OF CARE

A Comprehensive discharge planning should ensure that links with post-discharge services are in place for all those with symptomatic heart failure. A nurse led, home based element should be included.

- Follow up (including by telephone) by trained heart failure nurses should be considered for patients post-discharge or with stable heart failure. Nurses should have the ability to offer diuretic dose and the interval between telephone calls, and recommend emergency medical contact.
- Patients with heart failure should be offered multidisciplinary follow up, including pharmacy input to address knowledge of drugs and compliance. Follow up should include feedback to clinicians about possibilities for optimising pharmacological interventions.

PALLIATIVE CARE

A palliative care approach should be adopted by all clinicians managing patients with chronic heart failure in the early stages of the disease.

Issues of sudden death and living with uncertainty are pertinent to all patients with heart failure. The opportunity to discuss these issues should be available to patients at all stages of care.

After optimising diet, fluid intake and standard management for chronic heart failure, prescription of low dose opioids, titrated against effect, should be considered in patients with dyspnoea.

DIAGNOSIS AND INVESTIGATIONS

CLINICAL ASSESSMENT

There is no symptom or sign that is both sensitive and specific for the diagnosis of CHF. Basic early investigations are necessary to differentiate heart failure from other conditions and to provide prognostic information.

Patients suspected of chronic heart failure should receive a range of basic tests. The investigations chosen will vary depending on the presentation but should usually include a full blood count, fasting blood glucose, serum urea and electrolytes, urinalysis, thyroid function and chest X-ray.

FURTHER INVESTIGATIONS

Brain natriuretic peptide or NT pro-BNP levels and/or an electrocardiogram should be recorded to indicate the need for echocardiography in patients with suspected heart failure.

Brain natriuretic peptide or NT pro-BNP levels should ideally be checked on samples taken prior to commencing therapy.

Echocardiography is recommended in patients with suspected heart failure who have either a raised brain natriuretic peptide or N terminal-pro-BNP level or abnormal ECG result to confirm the diagnosis and establish the underlying cause. The investigation should include:

- a description of overall left ventricular systolic function together with any wall motion abnormalities
- assessment of diastolic function
- measurement of left ventricular wall thickness
- Doppler assessment of any significant valve disease
- estimation of pulmonary artery systolic pressure, where possible.

A chest X-ray is recommended early in the diagnostic pathway to look for supportive evidence of chronic heart failure and to investigate other potential causes of breathlessness. A normal chest X-ray does not exclude heart failure.

Differentiation between heart failure due to idiopathic dilated cardiomyopathy and heart failure due to coronary artery disease may be achieved by analysis of clinical findings, electrocardiogram, or coronary angiography.

DIAGNOSTIC ALGORITHM FOR PATIENTS WITH SUSPECTED CHRONIC HEART FAILURE

