NHS GRAMPIAN MEDICAL TREATMENT GUIDELINES FOR CHRONIC HEART FAILURE (CHF) DUE TO LEFT VENTRICULAR SYSTOLIC DYSFUNCTION (LVSD)

MANAGED CLINICAL NETWORK FOR CHRONIC HEART FAILURE

June 2014

Review date: June 2017

Acknowledgements and Accountability

These guidelines have been adapted from those produced by the Lothian Heart Failure Steering group.

The guidelines aim to provide help and support for all healthcare workers involved in the management of patients with CHF on issues relevant to patients in the Grampian area. They are intended to complement SIGN 35 - Diagnosis and Treatment of Heart Failure due to Left Ventricular Systolic Dysfunction.

While this guidance is taken predominantly from evidence-based data, it is fully acknowledged that good clinical judgement in the interpretation and application of evidence should prevail in the management of individual CHF patient.

Dr Andrew Hannah, Consultant Cardiologist, ARI
Dr David Turpie, Specialist Registrar, Cardiology, ARI

Contents

1.1. GENERAL INTRODUCTION

These guidelines are intended to provide a useful reference source and care pathway to guide healthcare professionals involved in the treatment and care of patients with chronic heart failure (CHF).They are directed at various health care professionals, i.e. general practitioners, hospital physicians, heart failure specialist nurses, community nurses and pharmacists.

The guidelines include detailed protocols for evidence-based treatments for patients with CHF caused by left ventricular systolic dysfunction (LVSD).

The guidelines **do not** attempt cover **all** aspects or non-pharmacological management of advanced heart failure, although there is now a section on device therapy (bi-ventricular pacemakers and defibrillators).

Physicians must be aware that some patients with heart failure due to LVSD may require revascularisation, implantable defibrillator or cardiac resynchronisation therapy and occasionally heart transplantation. When valvular heart disease results in LVSD then valve surgery is often required.

1.2. BASIC INVESTIGATIONS IN THE ASSESSMENT OF SUSPECTED HEART FAILURE

Following initial clinical evaluation some basic investigations are indicated. Routine biochemistry, including thyroid function and glucose, and full blood count should be checked.

A CXR and 12 lead ECG should be performed.

An entirely normal ECG makes the diagnosis of heart failure due to LVSD unlikely and alternative diagnoses should be considered. Spirometry may be indicated at this point. BNP or NTproBNP should be checked if available.

Echocardiography is the gold standard test for assessment of patients with suspected heart failure as it can identify and quantify LVSD, diastolic dysfunction, left ventricular hypertrophy, valvular heart disease amongst other mechanisms of heart failure. Heart failure should only be considered a definite diagnosis once echocardiography has been performed and has demonstrated a significant structural or functional abnormality.

1.3. COMMUNITY HEART FAILURE SPECIALIST NURSES

There is published evidence to show that Heart Failure Specialist Nurses (HFSN) working in collaboration with hospital physicians and GPs help improve the management and prognosis of the chronic heart failure patient.

All patients discharged from hospital with a diagnosis of heart failure due to LVSD should be referred to the local HFSN (see page 31 for local contact details).

New community diagnoses of HF due to LVSD, or patients who are previously diagnosed and requiring education / drug up-titration, may also be referred to the HFSN if capacity allows.

Part of the remit of the HFSN team is to support and educate practice/district care nurses in the management of HF patients.

1.4. New York Heart Association (NYHA) classification of the severity of heart failure (important for any health care professional involved in the management of CHF to be aware of this classification)

Grade I	No limitation of physical activity
Grade II	Slight limitation – ordinary activities cause symptoms
Grade III	Marked limitation – less than ordinary activity causes symptoms but comfortable at rest
Grade IV	Unable to perform any activity without dyspnoea – may have symptoms at rest

1.5. BLOOD CHEMISTRY MONITORING

Renal dysfunction is common in patients with heart failure and furthermore, many of the drugs used in its treatment may adversely affect renal function or electrolyte balance. Monitoring of these parameters is therefore of vital importance before and after initiation of therapies, as well as in the stable patient. Accurate measurement of potassium levels may be problematic in primary care and it is therefore important to ensure that samples are sent to the laboratory with minimum delay. Certain individual practices may need to discuss this with the biochemistry department.

2 PHARMACOLOGICAL THERAPY

2.1 LOOP DIURETICS

Most patients with CHF require to be treated with a loop diuretic (furosemide or bumetanide) to relieve fluid retention and breathlessness. Patients with *asymptomatic* LV systolic dysfunction may not require regular diuretic therapy. Fluid retention, manifest by peripheral/pulmonary oedema or elevated jugular venous pressure (JVP), should be treated with a loop diuretic – initially furosemide 40mg or bumetanide 1mg daily. The timing need not be fixed and can be changed for social convenience, for example to allow a comfortable shopping trip or travel (although dosing after 4-6pm may result in nocturia).

On reviewing the patient ask “has the diuretic been given in a sufficient daily dose to achieve dry weight” (the goal of diuretic treatment)? By “dry weight” we mean the weight at which the patient is oedema free with a normalised JVP. Daily weighing can be an excellent tool for the monitoring of CHF. Changes in weight is an excellent ‘early warning’ sign for some patients with regard to impending decompensation or dehydration and amount above ‘dry weight’ can provide the physician with a useful manometer for the diuresis required.

Over-treatment can lead to dehydration with resultant dizziness, light-headedness, fatigue (or a “washed out” feeling) and uraemia. This can be a particular problem if the patient becomes dehydrated for another reason (diarrhoea, vomiting, hot weather, and poor fluid intake). Usually the patient will show a significant (i.e. $\geq$ 2kg) and sustained decrease in weight below dry weight. The patients JVP may not be visible at 45°.
NOTE: In the elderly, symptoms of dehydration may be relatively non-specific, e.g. confusion, impaired mobility, falls or the development of urinary incontinence.

Recommendations for dose adjustment

a) Increasing the diuretic dose – the dose of diuretic should be increased if the patient shows a sustained ($\geq$ 2 day) and significant (> 1kg) increase in weight

above dry weight, especially if this is accompanied by an increase in peripheral oedema, the JVP or breathlessness (See Flow Chart p38). If dry weight is not regained by the end of three days of increased therapy, the dose increment should be maintained and advice should be sought from the GP or hospital physician.

If the patient is taking 40mg of Furosemide (Bumetanide equivalent = 1mg) once daily the dose should be increased to 80mg once daily. If the patient is taking 80mg once daily the dose should be increased to 80mg once (morning) and 40mg once (lunchtime) daily. If the patient is taking 80mg and 40mg once daily the dose should be increased to 80mg twice daily. If the patient is taking 80mg Furosemide twice daily or more consider discussing with a cardiologist/hospital physician before increasing the dose of diuretic.
The patient should be advised that, if heart failure symptoms develop, he/she may independently make one incremental increase in diuretic dose (e.g. Furosemide 40mg) without taking advice from the GP or hospital physician.

b) Decreasing the diuretic dose – this should only be done cautiously and the patient should be contacted 48 hours later to assess their response to the dose reduction. The dose should be reduced from the usual maintenance only if there are signs of volume depletion and hypoperfusion. In other words there should be evidence of significant weight loss from dry weight ($\geq$ 1kg), a rising blood urea(relative to creatinine) ($\geq$ 5mmol/L or $\geq$ 25 per cent increase from baseline) and/or symptoms of dizziness (e.g. postural hypotension) or feeling "dried out". *The dose of diuretic should not be reduced if there is peripheral oedema or if the JVP is elevated to $\geq$ 7cm from the sternal angle (or mid neck level).* If the patient has a rising blood urea, falling weight and/or symptoms of dizziness/dehydration but peripheral oedema please seek advice from a cardiologist/hospital physician.

2.2 THIAZIDE DIURETICS AND METOLAZONE

Bendroflumethiazide and most other thiazides are weak diuretic agents *although can have a useful synergistic effect when used with loop diuretics.* The exception is metolazone which is an extremely potent diuretic and its use can often result in hyponatraemia, dehydration and pre-renal failure, hence careful monitoring is required.

The vast majority of patients with symptomatic LV systolic dysfunction require a loop diuretic. Rarely bendroflumethiazide or other thiazides (not metolazone) can be used as the sole diuretic agent - usually only in those patients with mild symptoms and an excessive diuresis with loop diuretics. In patients with very poorly controlled heart failure despite large doses of loop diuretic thiazides are sometimes used in *addition* to the loop diuretic (Metolazone is often used 'every other day' or '3 days per week' rather than daily). Unlike loop diuretics, thiazides and metolazone are long acting and adjustment of the timing of dosing is not as advantageous as for loop diuretics. Otherwise the principles of use, monitoring, problems etc are similar.

The combination of metolazone and loop diuretic must be used with extreme caution and is usually an indication for consultation with a cardiologist or physician experienced in the management of heart failure. Close biochemical monitoring of combination therapy is mandatory for the first four weeks. If blood chemistry remains stable over this period and thiazide/metolazone therapy is to continue, monthly checks thereafter are sufficient provided there is no change in the dose of diuretic, ACE-inhibitor or Spironolactone or the addition of any drug or intercurrent illness that might affect renal function. Thiazide/metolazone can also cause hyponatraemia, in addition to the other biochemical problems discussed under loop diuretics. If the serum sodium falls below 130mmol/L advice should be sought.

Blood chemistry monitoring

Baseline blood chemistry should be measured (sodium, potassium, urea, creatinine) in all patients with CHF. After any sustained (> 1 week) increase of diuretic dose blood chemistry should be re-checked within 1 week. Increases in urea and creatinine and increases or decreases in potassium are of concern.

Renal function: If the urea increases to $\geq$ 20mmol/L (or by >10mmol) and/or creatinine increases to $\geq$ 300µmol/L (or by > 100µmol/L) consider discussing with cardiologist/hospital physician (generally, in the absence clinical fluid retention, the dose of diuretic should be reduced).

Hyponatraemia: Hyponatraemia can be a difficult problem. It can be due to high dose diuretics which may sometimes be associated with dehydration/overdiuresis, but frequently is in the context of excess fluid retention and decompensated advanced heart failure. In the latter situation reduction in diuretic dose may be detrimental. Careful assessment of fluid balance is therefore mandatory when deciding what diuretic adjustments to make in hypoatraemia. Other causes of hyponatraemia should be considered when it is severe or the patient not currently on high doses of diuretic.

Potassium derangement: Corrective action should be taken if the potassium decreases to 3.5mmol/L (in the absence fluid retention the dose of diuretics may be reduced; alternatively the dose of ACE inhibitor can be increased or Spironolactone added. Rarely potassium supplements may be required).

If the potassium increases to 5.5mmol/L or above action needs to be taken (if there is evidence of worsening renal function, and no sign of fluid retention, the dose of diuretic should be reduced; alternatively the dose of ACE inhibitor may need to be reduced or spironolactone may need to be discontinued).

Always consider the possibility of a haemolysed blood sample if potassium unexpectedly high, with no deterioration in renal function and no recent changes to drug therapy: in those circumstances repeat U+Es may be all that is required.

2.3 ACE INHIBITORS

ACE inhibitors improve the symptoms of heart failure, reduce mortality, slow progression of the disease and reduce hospitalisations.

All patients with LV systolic dysfunction should (if not contraindicated) be prescribed an ACE inhibitor. ACE inhibitors should be started in primary care once a clear diagnosis of heart failure has been made, usually by echocardiography (echo) confirming LV systolic impairment (see flow chart p35). Ramipril, lisinopril or enalapril are the preferred ACE inhibitors. If a patient is already established on captopril this can be continued although the thrice daily (tds) dosing may be inconvenient and can adversely affect compliance. The target doses are ramipril 10mg once daily (od) or 5mg twice daily, lisinopril 20-30mg od, enalapril 10 – 20mg twice daily (bd) and captopril 50mg tds. Every effort should be made to achieve the target dose (or as high as tolerated). The dose of ACE inhibitor should be increased at 1-2 weekly intervals in the absence of severe asymptomatic hypotension (SBP < 90mmHg), symptomatic hypotension or significant renal impairment i.e. creatinine $\geq$ 220 µmol/L. If any of these contraindications are present in a patient receiving a below target dose of ACE inhibitor consider discussing with cardiologist or hospital physician.

There should be at least one week between dose increments. Blood pressure and biochemistry must be checked within one week of a dose increment and before the next dose increment (see “Drug choices in patients with CHF” p42).

Side Effects

Cough, cerebral hypoperfusion, renal dysfunction and angio-oedema are the major adverse effects associated with ACE inhibitor therapy. If a patient has a troublesome cough clearly related to an ACE inhibitor, an angiotension receptor blocker should be substituted (see flow chart p39). Cerebral hypoperfusion presents as dizziness, blackouts, light-headedness etc. Very often this can be resolved by reduction in concomitant medication i.e. diuretics and, especially nitrates, calcium channel blockers or other vasodilators. It is very important to note that patients taking an ACE inhibitor may have a low

blood pressure and no symptoms (asymptomatic hypotension). This finding does not necessitate any action unless there is renal hypoperfusion.

Impaired renal autoregulation leads to an increase in urea, creatinine and, often potassium. Small increases in urea, creatinine and potassium are common and acceptable consequences of using an ACE inhibitor. If potassium rises to >6.0 mmol/L the ACE inhibitor must be stopped immediately, at least temporarily, and advice should be sought from the patient's GP or appropriate hospital physician. If the potassium rises to between 5.5 - 5.9 mmol/L, recheck within 24 hours. If after one check the potassium level remains 5.5 - 5.9 mmol/L then usually dose should be reduced/temporarily stopped. If the urea increases to $\geq$ 20 mmol/L (or by > 10 mmol/L) and/or creatinine to $\geq$ 300 µmol/L (or by > 100 µmol/L) the ACE inhibitor should also be stopped immediately. Very often deteriorating renal function is due to over diuresis/dehydration (e.g. due to diarrhoea/vomiting) or other concomitant medication (especially NSAIDs, potassium sparing diuretics). Advice should be sought from the patient's GP or appropriate hospital physician with respect to adjustment or discontinuation of these concomitant treatments. Less serious increases i.e. urea by 5 - 10 mmol/L or creatinine by 50 - 100 µmol/L should be monitored very closely – blood chemistry should be checked every second day and advice from the GP or hospital physician should be sought. Small changes in urea (<5 mmol/L) and creatinine (< 50 µmol/L) do not require intervention provided these changes are stable i.e. show no progression between two blood tests at least two weeks apart.

2.4 ANGIOTENSION II RECEPTOR BLOCKERS (ARBs)

Angiotensin receptor blockers, previously known as angiotensin II receptor antagonists, have similar physiological effects to ACE inhibitors.
These agents should be used only if patient is truly intolerant of ACE inhibitor, usually due to persistent cough (see flow chart p39). Candesartan, valsartan and losartan are the only ARBs currently licensed for use in chronic heart failure due to LV systolic dysfunction. The starting dose of candesartan is 2mg

once daily, target dose 32mg. The starting dose for Valsartan is 40mg bd, target dose 160mg bd. When initiating and titrating therapy, monitor as for ACE inhibitors. Problems as for ACE inhibitors with the exception of cough. Generally we do not recommend the combination of and ACE inhibitor and Angiotensin receptor blocker.

2.5 BETA-BLOCKERS

Four large studies have demonstrated that patients with LV systolic dysfunction benefit from therapy with certain betablockers in addition to ACE inhibitors. These agents significantly reduce mortality, hospitalisations for heart failure, improve NYHA class and slow the progression of heart failure. Carvedilol or bisoprolol are indicated for all patients with LV systolic dysfunction unless a contraindication exists. The prescribing physician should have experience in their use for heart failure but increasingly this should be done entirely in primary care. The patient can be referred to or discussed with a cardiologist if necessary. Beta-blockers must be started at a very low dose and up-titrated slowly over a period of weeks (see flow chart p36).

The following criteria should be met before a patient with heart failure receives a betablocker:

1 A confirmed diagnosis of heart failure due to left ventricular systolic dysfunction demonstrated by echocardiography, radionuclide ventriculography or x-ray contrast ventriculography.

2 NYHA Class I – IV; Class IV patients should be reviewed by a cardiologist before a beta-blocker is started. Every effort should be made to improve symptom status to <NYHA IV before starting a beta-blocker.

3 Already receiving standard therapy i.e. diuretic (if required) and ACE inhibitor. Some patients may also be on Digoxin (caution regarding bradycardia) or spironolactone (NYHA III-IV).

4 The patient must be clinically stable i.e.
- ➢ No adjustment in dose of treatment in past 2 weeks
- ➢ No admission to hospital with heart failure in the past 2 weeks
- ➢ No clinical evidence of cardiac decompensation.

5 Heart rate ≥ 55 beats per minute and systolic blood pressure ≥ 85 mmHg. (sometimes patients with lower systolic blood pressures (asymptomatic) may be suitable usually after review by a cardiologist)

6. Ensure no contra-indication to beta-blocker therapy e.g. asthma, 2nd/3rd degree heart block, sick sinus syndrome (consult data sheet).

COPD, bundle branch block and first degree heart block are **NOT** contraindications, but caution with trifascicular block (discuss with cardiologist).

Patients who do not fulfil these criteria should be reviewed by a cardiologist if beta-blocker treatment is being considered.

HOW TO USE BETA-BLOCKERS IN HEART FAILURE

- Therapy should be initiated in an appropriate setting at the lowest dose (see below) and up-titrated *slowly* (see below) – the titration intervals shown should be regarded as the *minimum* intervals.
- Patients must be advised of possible adverse effects and how to seek assistance (according to local arrangements) should these occur.
- Before each dose up-titration patients must be reviewed for adverse effects and signs of worsening heart failure.
- This process can be efficiently supervised by a HFSN

Bisoprolol

Week	1	2	3	4	5	6	7	8	9	10	11	12
Bisoprolol dose (mg)	1.25	2.5	3.75	5	5	5	5	7.5	7.5	7.5	7.5	10
Times daily [Once daily – od]	od	Od	od	od	od	od	od	Od	od	od	Od	od

Carvedilol

Week	1	2	3	4	5	6	7	8	9	10
Carvedilol dose (mg)	3.125	3.125	6.25	6.25	12.5	12.5	25	25	25	50*
Times daily [Twice daily – bd]	bd	bd	bd	bd	bd	Bd	bd	bd	bd	bd

*Maintenance in patients with mild and moderate HF > 85kg (187 lbs)

The above titration regime is for guidance and some patients, such as the frail or elderly, may benefit from even slower titration.

Managing adverse effects during dose titration

Adverse events during the initiation and up-titration of beta-blockers in heart failure are not uncommon and patients will often experience temporary deterioration of their heart failure symptoms. This can be minimised by appropriate patient selection, use of a small initial dose of beta-blocker and slow and cautious dose up-titration. Usually initial problems can be overcome by adjustment of the dose of concomitant medications and the majority of appropriate patients can be established on beta-blocker therapy. Generally, beta-blocker therapy should not be stopped suddenly though this may be necessary if the patient develops a significant bradycardia or worsening of symptoms (including symptomatic hypotension).

It is helpful to advise patients that a beta-blocker is prescribed primarily with the objective of maintaining stability and preventing progression of heart failure in the longer term. No immediate symptomatic improvement is expected and, initially, there may be some symptom worsening before improvement occurs.

Worsening heart failure

Patients may become more breathless and / or oedematous (or gain weight). Do not further up-titrate the dose of beta-blocker at this stage. Usually this can be corrected by increasing the dose of diuretic (this may only be necessary on a temporary basis). Normally the patient should improve within 2-3 days. If the patient does not improve within one week consider also decreasing the dose of beta-blocker (or rarely stopping). Wait 2-4 weeks before attempting further dose up-titration or re-initiation of beta-blocker therapy. If ongoing difficulties discuss with cardiologist or hospital physician.

Symptomatic hypotension

Consider dehydration and whether reduction in the dose of diuretic may improve matters. Consider discontinuing other hypotensive drugs of no definite value in heart failure e.g. nitrates, calcium channel blockers, alpha adrenoceptor blockers. Consider temporary decrease in dose of ACE inhibitor. If unresolved, decrease dose of, or stop, the beta-blocker. Wait 2-4 weeks before attempting further dose up-titration or re-initiation of beta-blocker therapy. If ongoing difficulties discuss with a cardiologist.

If the systolic blood pressure falls to below 85-90mmHg blood chemistry should be checked. Advice should be sought if the changes detailed under diuretics and ACE inhibitors occur (often the dose of beta-blocker should be reduced, but if asymptomatic and renal function stable this may not be necessary).

Excessive bradycardia

- If the heart rate falls to < 50 beats per minute reduce to the previous dose level e.g. from 10mg to 7.5mg of Bisoprolol (if very symptomatic consider stopping treatment immediately). Review within one week and reduce dose further if heart rate still < 50 beats per minute. Review medication and consider reducing dose or stopping other drugs that can slow sinoatrial and atrioventriuclar conduction e.g. Digoxin or Amiodarone.

- If the heart rate falls to < 45 beats per minute stop beta-blocker and perform 12 lead ECG (to exclude second or third degree heart block). If heart block is confirmed urgent referral to a cardiologist is necessary. If rhythm is sinus then restart BB at lower dose.

2.6 MINERALOCORTICOID RECEPTOR ANTAGONISTS (MRAs)

Patients who remain symptomatic on less than ordinary activity or at rest (i.e. in NYHA Class II to IV CHF), despite treatment with a diuretic, ACE inhibitor and, where indicated, a beta-blocker, should be considered for treatment with a mineralocorticoid receptor antagonist (MRA). Spironolactone and eplerenone are the two available. This recommendation is based on the RALES, EMPHASIS-HF and EPHESUS studies.

The RALES trial demonstrated a significant reduction in mortality with spironolactone 25mg per day in ACEi treated patients with LVSD who remain highly symptomatic (NYHA III-IV).

In the EMPHASIS-HF study eplerenone 25mg-50mg showed a significant (37% RRR) reduction in cardiovascular death or heart failure hospitalization. Patients had a reduced ejection fraction and NYHA class II symptoms. Additionally patients had either a cardiovascular hospitalization in the previous six months or elevated BNP. The benefit in EMPHASIS-HF was seen in addition to those gained with ACE inhibitor and beta-blocker treatment.

The EPHESUS study was a post MI study. Eplerenone 25mg to 50mg lead to a significant reduction in all cause mortality (15% RRR) in MI patients with an ejection fraction less than 40%, symptomatic heart failure or diabetes.

Eplerenone and spironolactone can be considered to be of similar efficacy in heart failure.

Approximately 10% of male patients treated with spironolactone develop painful gynaecomastia. Eplerenone lacks the antiandrogenic effects of spironolactone. It is less likely to cause gynaecomastia.

Patients with persisting signs of fluid retention may still be commenced on a MRA (see flow chart p37).

In general consider cardiology referral for any severely symptomatic patient with LVSD (ie those suitable for spironolactone / eplerenone) as further non-pharmacological therapies may be appropriate.

Contra-indications and cautions:

1. Serum creatinine > 180 µmol/L – discuss with cardiologist/hospital physician
2. Serum urea > 15 µmol/L – discuss with cardiologist/hospital physician
3. Serum potassium > 5 mmol/L – discuss with cardiologist/hospital physician
4. Concomitant treatment with potassium supplements (e.g. Slow K) or a potassium sparing diuretic (e.g. Amiloride or Triamterene). Watch out for the combination tablets containing these drugs e.g. Co-amilofruse, Frumil, Frusene. **Potassium supplements and potassium sparing diuretics should be discontinued for 2 weeks before giving a MRA.** Combination preparations should be substituted with the appropriate loop diuretic.
5. Be aware that spironolactone may increase digoxin levels, although not usually to a clinically important degree. This does not occur with eplerenone.

Use of Spironolactone / Eplerenone – initiation:

1. Check baseline blood chemistry (see contra-indications/cautions).
2. Initiate spironolactone 25mg once daily (a lower dose may be used where there is concern – see cautions above) or alternatively Eplerenone 25mg once daily.

3. The dose may be increased to 50mg after four to eight weeks.
4. **Re-check blood chemistry after *ONE WEEK, TWO WEEKS and FOUR WEEKS* of treatment.**
5. DISCONTINUE treatment with spironolactone / eplerenone and consider discussing with a cardiologist / hospital physician if
    a) creatinine increases to ≥ 250 µmol/L or by ≥ 25% from baseline (e.g. from 140 to 175 µmol/L).
    b) urea increased to ≥ 18 mmol/L or by ≥ 50% from baseline (e.g. from 8 to 12 mmol/L). (if isolated urea rise consider over diuresis and ?reducing loop diuretic)
    c) potassium increases to ≥ 5.5 mmol/L.
    d) Transiently stop spironolactone / eplerenone if the patient develops diarrhoea and / or vomiting (or any other cause of sodium and water loss) / reduced oral intake due to intercurrent infection (also consider withholding ACE I/reducing loop diuretic if severe).

Further monitoring of the patient receiving a MRA:

1. **Further checks of blood chemistry should be made every 4 weeks for 3 months, then every 3 months for 1 year and every 6 months thereafter.** If renal function deteriorates (as above) or hyperkalaemia develops then treatment should be stopped and advice sought as outlined above.
2. The patient may become sodium and water depleted and hypovolaemic on a MRA, necessitating a reduction in the dose of potassium losing diuretic (e.g. furosemide) or discontinuation of the MRA. This can be expected if:
    a) The patient complains of postural dizziness / light-headedness.
    b) The patient's blood pressure falls excessively and in a sustained way.
    c) The patient exhibits a significant and sustained weight loss (e.g. ≥ 2 kg, sustained over ≥ 1 week).
    d) The patient has had an intercurrent illness causing sodium and water depletion (e.g. diarrhoea and vomiting – IF THIS

OCCURS STOP THE MRA IMMEDIATELY), has not been drinking fluids or has been in a hot climate, etc.

Blood chemistry should be measured immediately if any of the above occurs.

2.7 IVABRADINE

Ivabradine is a specific inhibitor of the If channel in the sinoatrial node. This results in a lower heart rate. It has no effect on atrioventricular or intraventricular conduction. Lower resting heart rates are associated with better outcomes in heart failure. The benefit of ivabradine was demonstrated by the SHIFT study.

Slightly over 6500 patients in sinus rhythm with stable symptomatic heart failure and reduced ejection fraction <35% were studied. In SHIFT 89% of participants were on a beta-blocker at baseline with 26% on full dose of beta-blocker. Ivabradine (vs placebo) showed a 5% absolute risk reduction in cardiovascular death and hospital admission for worsening heart failure.

Ivabradine should only be commenced in stable heart failure patients (NYHA II-IV) on a beta-blocker (or intolerant of beta-blockade) with a heart rate >70b.p.m. and on an ACEI (or ARB) and usually a MRA.

a. The stating dose of Ivabradine is usually 5 mg twice a day (2.5mg twice a day in the elderly)
b. The patient should be assessed after two weeks of treatment.
c. If heart rate above 60bpm increase to 7.5 mg twice a day
d. If heart rate below 50bpm decrease to 2.5 mg twice a day
e. If symptomatic bradycardia or persistently <50bpm stop ivabradine

There is a low incidence of side effects with Ivabradine which are mainly due to bradycardia. These unwanted effects should prompt a dose reduction or may require cessation of therapy.

2.8 DIGOXIN

Digoxin is used less often than previously in heart failure. This is because it has a neutral effect on mortality and may cause significant side effects. In patients with atrial fibrillation and heart failure digoxin continues to have a prominent role. There is evidence for symptomatic benefit and reduced hospitalisations in patients with CHF even if they are in sinus rhythm, although how much additional benefit in patients treated optimally with an ACE inhibitor, betablocker, spironolactone and perhaps an ARB is not known. It therefore may have a role in patients with severely symptomatic heart failure, especially with recurrent hospital admissions and no other therapeutic options.

There is some evidence that high dose digoxin (>250ug) may be detrimental whereas lower doses (125-250ug) may be more efficacious, or at least less likely to cause serious side effects. Lower doses are required in renal impairment. If a patient has very abnormal renal function (creatinine $\geq$ 220 µmol/L and or urea $\geq$12) seek advice from a hospital physician, but usually digoxin should be avoided. Remember that dose may need to be reduced or stopped if renal function deteriorates for any reason. Beware hypokalaemia as this may exacerbate arrhythmias. Be aware of potential interactions such as amiodarone and erythromicin. Digoxin levels can be useful guiding appropriate dose when digoxin used in sinus rhythm ie not for AF rate control: retrospective analysis of the DIG trial suggested improved survival with level 0.5-0.9nmol/l but increased mortality with levels >1.2nmol/l.

2.9 Hydralazine and nitrates

Some patients will be genuinely intolerant of ACE inhibitors or angiotensin receptor blockers, usually due to progressive renal dysfunction (which may be an indicator of bilateral renal artery stenosis). These patients may benefit from hydralazine (target dose 50-100mg three times daily) along with isosorbide dinitrate (target dose 40mg four times daily). It is probably reasonable to use isosorbide mononitrate instead at 120mg per day in divided doses particularly if patients already on this drug. There is no role for nitrates or hydralazine alone in the treatment of CHF (unless for angina or hypertension respectively).

3 NON-CHF MEDICATIONS

A number of concomitant medications (including some bought "over the counter" – OTC - by the patient) can aggravate the CHF state. These include: **NSAID**'s - including larger doses of Aspirin.

Calcium channel blockers: Patients with existing hypertension or angina may be taking or require calcium channel blockers. Amlodipine and felodipine have been shown to be safe in heart failure due to LVSD, whereas verapamil and diltiazem are not. If a patient with heart failure due to LVSD is taking verapamil or diltiazem then this should be reviewed and the agent substituted with a safe alternative.

Lithium levels can be seriously affected by changes in diuretic doses and the use of diuretics in patients on lithium always requires medical supervision (including liaison with the community psychiatric team). Some cardiac drugs may conversely affect lithium levels and the BNF should always be consulted. Occasionally, some herbal and homeopathic medications can cause problems e.g. some contain digitalis (digoxin), liquorice etc. Please check for use of OTC and homeopathic preparations. There is evidence to suggest that St. John's Wort can interact with a number of cardiac medications including Digoxin (by reducing Digoxin levels).

Many patients do need a NSAID for arthritis but this necessity should always be checked, preferably by a period of substitution with Paracetamol or cocodamol.

Aspirin should be taken in a dose of no more than 75mg daily.

4 Management of Gout

Gout is a common problem for patients with heart failure. Reduction in dose of diuretic and the addition of colchicine to treat acute symptoms may be required. Colchicine should be used for the duration of the episode and to cover the introduction of allopurinol if required. See flow chart on p41 for advice.

5 Management of concomitant angina

Heart failure patients with angina should be referred to a cardiologist for assessment of suitability for revascularisation. Antiplatelet and lipid lowering therapy should be prescribed. The only antianginal agents that should be avoided in heart failure are rate limiting calcium channel blockers such as diltiazem or verapamil: amlodipine and felodipine are safe, although other dihydropiridines have not been assessed in CHF. Ivabradine, nicorandil and nitrates are safe.

6 Management of concomitant atrial fibrillation

Patients with AF and LV systolic dysfunction are at high thromboembolic risk and should be anticoagulated with warfarin. Good control of the ventricular rate is important and should be achieved with betablockers and / or digoxin. Often digoxin should be started first to control rate whilst the betablocker is

slowly uptitrated. Diltiazem and verapamil should not be used. In the event of bradycardia (after initial tachycardia) the digoxin should be stopped to allow more complete up titration of the betablocker.

Consider referral to cardiology for consideration of DC cardioversion, although often rate control will be the appropriate strategy.

In patients presenting with atrial fibrillation and first diagnosis of LV systolic dysfunction (ie not pre-existing LVSD) always consider whether tachycardia related cardiomyopathy is the diagnosis. If in doubt refer to cardiology.

7 Management of concomitant hypertension

Sometimes patients with LVSD will have hypertension. Usually this will be controlled by the ACE inhibitor, betablocker and diuretic. If necessary amlodipine or felodipine can be added. Consider the use of spironolactone with the usual checks on renal function and potassium. Consider using concomitant angiotensin receptor blocker along with an ACE inhibitor. Hydralazine may be used if necessary.

Doxazosin, moxonidine, rate limiting calcium channel blockers and methyl dopa should be avoided.

8 DEVICE THERAPY IN HEART FAILURE:

Implantable Cardioverter Defibrillators (ICDs)

Background: Patients with moderate or severe LV systolic dysfunction are at risk of sudden cardiac death, primarily due to ventricular arrhythmias. Patients sustaining an out of hospital cardiac arrest are unlikely to survive and even 'successful' resuscitation does not necessarily indicate survival with a good quality of life.

ICDs are implantable devices that can identify and deliver therapies to terminate ventricular tachycardia or fibrillation. Randomised trials have shown them to reduce absolute mortality by 6-7% in patients with moderately severe LVSD (LVEF <35%). NICE guidance (June 2014) now recommends ICDs are considered for patients with LVEF<35%.

The patients at highest risk are those with severely depressed EF (<25-30%), non sustained VT documented, QRS broadening (>120ms). Patients with an ischaemic aetiology are generally at higher risk than patients with normal coronary arteries. The mean age in the clinical trials was <70 years of age although physiological age is more important than actual age when considering such device therapy. Patients with NYHA category IV HF will not normally be considered for an ICD but may be excellent candidates for a CRT (biventricular pacemaker) if left bundle branch block is present.

Driving and an ICD: DVLA guidance is clear with regards ICDs. In primary prevention circumstances a patient must not drive for 1 month after implant. If the patients experiences symptoms due to and arrhythmia or device therapy then he/she must cease driving for at least 6 months. Patients will be counselled regarding all aspects of ICD insertion by the cardiologist/ rhythm specialist nurse and/or cardiac physiologist.

Patient criteria for referral for consideration of ICD therapy:

- Severe (or at least 'moderate-severe') LV systolic dysfunction
- NYHA class I-III

Factors that make the individual more likely to benefit/be offered a device

- Severely depressed EF (<25-30%)
- Ischaemic aetiology
- QRS lengthening (>120ms)
- Non sustained VT (on holter usually)
- Unexplained syncope / presyncope

Cardiac Resynchronisation Therapy (CRT): bi-ventricular pacemakers

Patients with severely symptomatic heart failure (NYHA III-IV) have very high levels of morbidity and mortality, including high rates of hospitalisation.

Those with bundle branch block (BBB) (QRS >120ms) have a worse prognosis than those with narrower QRS durations. This is partly because BBB, especially LBBB, induces dyssynchronous contraction of the left ventricle which results in greater systolic impairment, greater mitral regurgitation and greater potential for arrhythmias. This can be attenuated by insertion of a biventricular pacemaker (CRT). Randomised trials have shown that absolute mortality is reduced by 10% and absolute reduction in HF hospitalisations/death combined by 25% (relative risk reductions of 30% and 50% respectively over 3 years).

Age is not a barrier to deriving great benefit from a CRT device.

Evidence is accumulating for offering CRTs to patients with less symptomatic heart failure, NYHA II, and these patients should be referred to cardiology for consideration of an ICD in any case.

Patients deemed suitable for a CRT and having criteria for an ICD may be offered a combined CRT-defibrillator.

Referral criteria for CRT

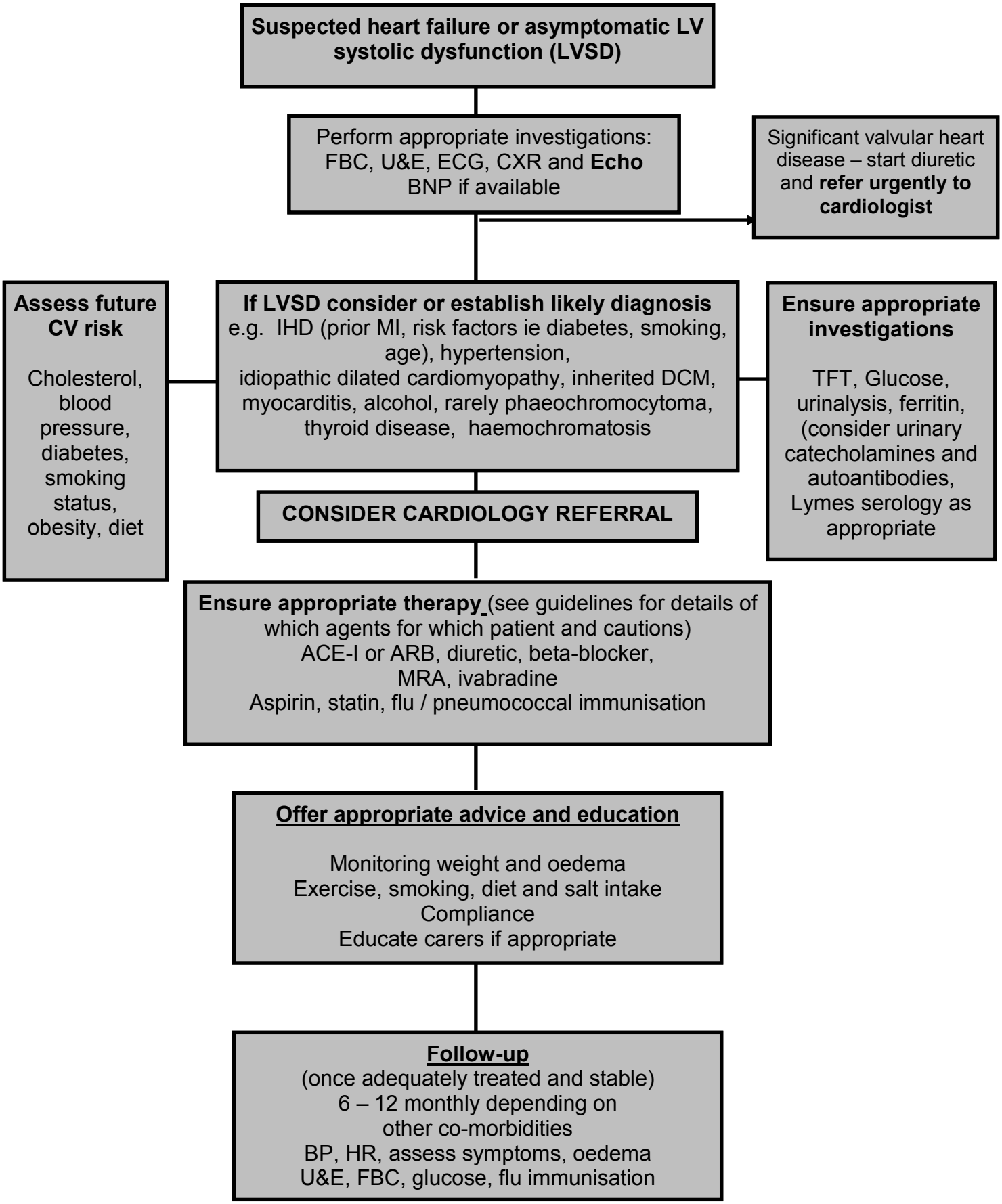
- **Mild, Moderately or severely symptomatic heart failure (NYHA II-IV) due to LVSD (LVEF <40%)**
- **QRS duration >120ms**: ideally left bundle branch block, greatest benefit if QRS >150ms.
- **Optimal medical therapy:** ACE I and BB to maximum tolerated dose. Spironolactone 25mg or eplerenone 25-50mg and adequate dose of loop diuretic.
- No other condition likely to be fatal within 1 year
    - Must have up to date renal function

Grampian Heart Failure Group

MANAGED CLINICAL NETWORK FOR CHRONIC HEART FAILURE

CHRONIC HEART FAILURE MANAGEMENT FLOWCHARTS

Chronic Heart Failure: Diagnosis and Management Overview



Referral Criteria

Community Heart Failure Nursing Service

Patients with Heart Failure due to LVSD

Inclusion Criteria

A new diagnosis of moderate/severe left ventricular systolic dysfunction (LVSD) and those with existing LVSD who have an admission due to decompensation

Residing in Grampian region

Willing to be followed up by the service

Exclusion Criteria

Good left ventricular systolic function

Other life threatening illness requiring palliative care

Unwilling to receive the heart failure nursing service

Note
Patients who have had an MI (unless they have previously diagnosed heart failure due to LVSD) or those receiving Cardiac Surgery will be followed up by Cardiac Rehab.
HFN will check for echo reports on SCI Store for patients who are discharged without an echo this admission and who are waiting for one as an outpatient.

Contact Details
Phone line: 01224 846611
Email: nhsg.heartfailurenurses@nhs.net
SCI Gateway referrals available for General Practice

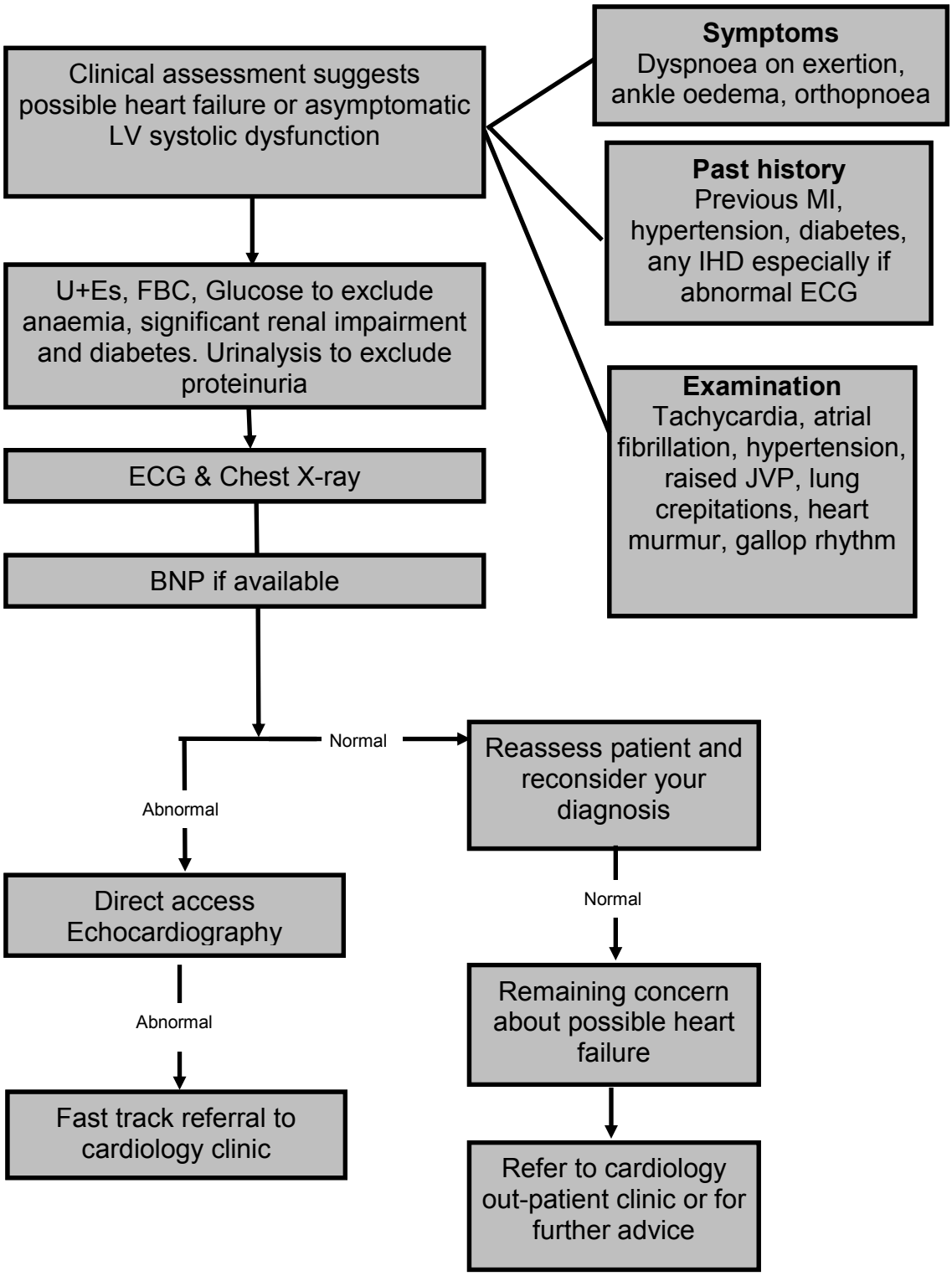
DIAGNOSIS OF CHRONIC HEART FAILURE IN PRIMARY CARE

Any consultant in cardiology would be happy to see any patient with CHF. The majority of patients with LV systolic dysfunction should be evaluated by a cardiologist at some stage.

Echocardiography: Direct access to echocardiography is available at Aberdeen Royal Infirmary, Dr Grays Hospital or Counties Cardiology. The patient should have symptoms or signs of CHF (breathlessness, oedema, fatigue), or there should be clinical suspicion of asymptomatic LV systolic dysfunction (clinical history of ischaemic heart disease, angina, previous MI, hypertension, diabetes and associated abnormal ECG) and CXR or ECG evidence of cardiovascular disease.

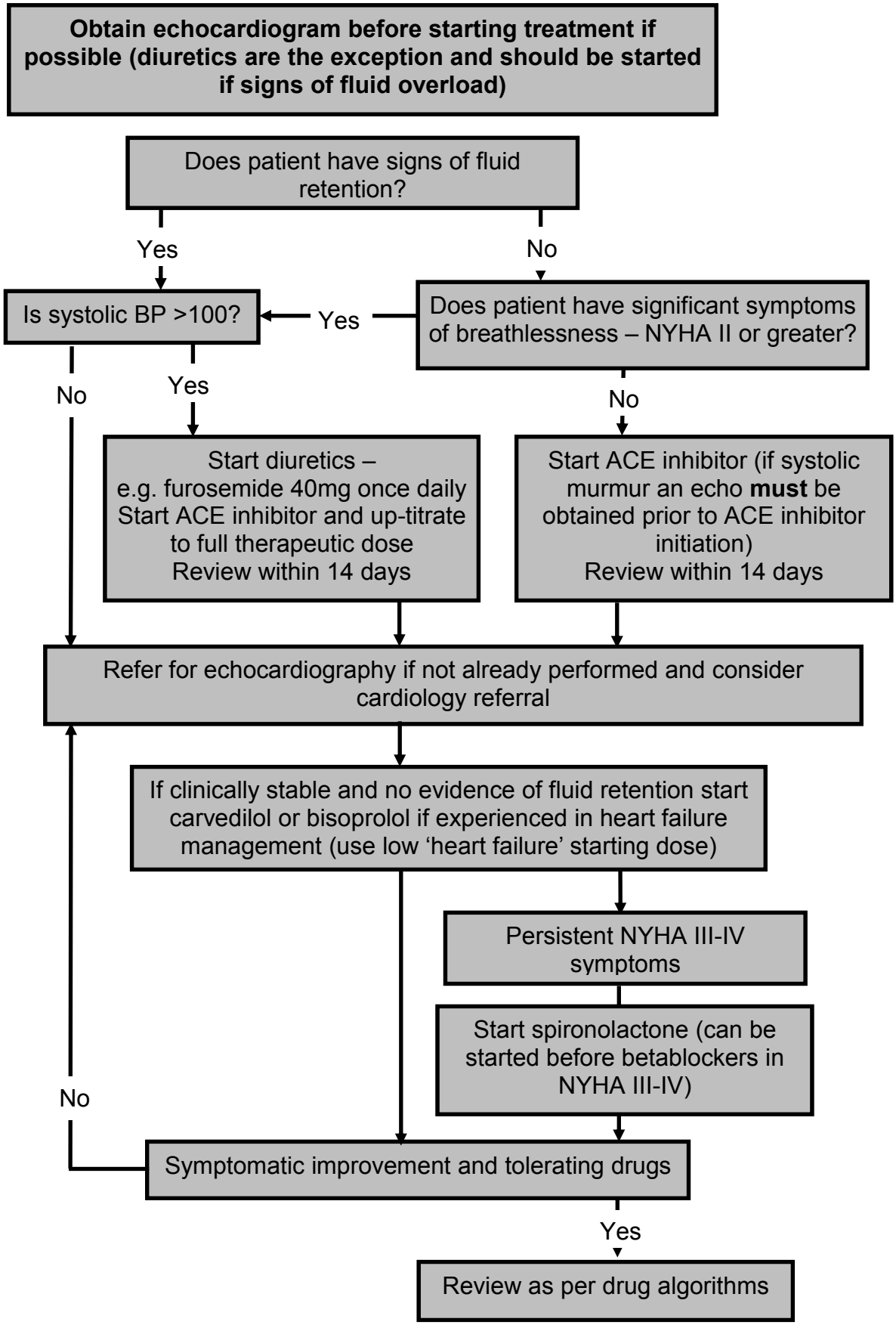
Underlying aetiology of chronic heart failure: These guidelines are designed to help with diagnosis and management in both primary and secondary care. Where the underlying diagnosis of CHF remains uncertain then referral to a cardiologist for more invasive testing such as coronary angiography is extremely important. This is particularly the case if there are **concomitant angina symptoms** (since revascularisation may be appropriate) or if there is a **heart murmur** present or significant valvular dysfunction on echo.

Algorithm for using direct access echocardiography



Algorithm for Initiating Treatment for CHF in Primary Care

Patients can be referred for a cardiology opinion at any time during this management guide



Algorithm for Initiating ACE-inhibitors (ACE I) in CHF in Primary Care

Confirmed left ventricular systolic dysfunction

Are any of the following present?

Significant renal impairment – creatinine >200µmol/l
Urea > 12mmol/l
Hyperkalaemia – K^+ > 5.0 mmol/l
Hyponatraemia – Na^+ <130mmol/l
Persistent symptomatic hypotension – systolic BP <90mmHg
Current diuretic use > 80mg Furosemide daily
Known or suspected renal artery stenosis or aortic stenosis
History of angioneurotic oedema

Yes → **Seek specialist advice before initiating ACE inhibitors (ACE I) in these circumstances**

No → **Suitable for ACE I initiation in the community**

Review current drug therapy:

Consider stopping NSAIDs
Consider reducing diuretic dose
Consider reducing other vasodilators
Stop potassium-sparing diuretic

Initiate ACE inhibitor

- Start with a low dose (see ACE I choices)
- Increase dose at weekly intervals (see full guidelines for details)
- Monitor blood chemistry and blood pressure (at 1-2 weekly intervals until maintenance dose achieved)

Adverse effects

Hypotension

- Asymptomatic low blood pressure – no change in therapy required
- Symptomatic low blood pressure -
  - consider stopping or reducing other drugs e.g. nitrates, calcium channel blockers or other vasodilators
  - If no signs of fluid retention consider reducing diuretics

Cough

- Consider other causes of cough e.g. respiratory disease
- Exclude pulmonary oedema
- If persistent and troublesome – consider changing to angiotensin receptor antagonist

Renal Impairment

- Some rise in urea and creatinine is common and requires no action if patient remains well
- An increase of 50% from baseline (e.g. 120 µmol/l to 180 µmol/l) or to 266 µmol/l is acceptable
- If creatinine rises by >50% from baseline
  - Consider stopping other vasodilators
  - Consider stopping any NSAIDs
  - Consider reducing diuretic if no signs of fluid retention
- If renal impairment persists - half dose of ACE inhibitor – recheck blood chemistry after 1 week

Hyperkalaemia

- <5mmol/l - is acceptable. 5 - 6mmol/l is also acceptable on <u>stable</u> doses of ACE I and diuretics
- During uptitration, K^+ 5.5 – 5.9mmol/L - recheck within 24hrs. If still at this level, consult with GP or appropriate cardiology registrar.
- >6mmol/l -Stop K^+ supplements, reduce potassium sparing drugs e.g. spironolactone. In the absence of these drugs, stop ACE I and consult with GP or cardiology registrar.

No adverse effects

Maintenance

- Aim for target doses (see ACE I choices) or highest tolerated dose
- Remember some ACE I is better than no ACE I
- Explain expected benefits to patient
- Ask patients to report principal adverse effects – dizziness, cough
- Warn patient about drug interactions – NSAID use

Algorithm for Initiating Beta Blockers in CHF in Primary Care

Confirmed left ventricular systolic dysfunction on echo – NYHA class I-IV

Are any of the following present?

- Asthma
- Signs of persistent fluid retention despite ACE and diuretic therapy – oedema, raised JVP, crepitations, ascites
- Second or third degree heart block on ECG
- Heart rate persistently less than 60 bpm
- NYHA class IV symptoms

Yes → **Seek specialist advice**

No → **Suitable for beta-blocker therapy initiation in the community? Discuss with cardiologist if necessary**

Yes → **Initiate beta-blocker therapy:**

Cautions – interactions with diltiazem, verapamil and amiodarone, avoid if possible
(Verapamil and diltiazem contraindicated in LV systolic dysfunction - stop)

- Explain expected benefits to patient
- Explain possible side effects to patient and ask them to report these – dizziness, fatigue, breathlessness
- Start with a low dose (see beta blocker choice)
- Increase dose as per protocol, if patient stable
- Monitor clinical status, heart rate and blood pressure at 1- 2 weekly intervals prior to uptitration
- Aim for target dose (see beta blocker choice) or maximum tolerated dose
- 20-30% of cases experience temporary

Adverse effects →

Hypotension

- Asymptomatic hypotension does not require action
- Symptomatic hypotension -
  - consider reducing other vasodilators e.g. calcium antagonists, nitrates
  - consider reducing diuretic if no signs of fluid retention

Low heart rate

- If less than 50 bpm and this is associated with hypotension, dizziness, excessive fatigue then reduce dose by 50%
- If <45bpm perform urgent ECG to exclude 2nd or 3rd degree heart block
- Review need for other rate slowing drugs – diltiazem, amiodarone, digoxin
- Review patient after 1-2 weeks

Worsening symptoms/signs of heart failure

- Increasing fluid congestion – half dose of beta blocker and double dose of diuretic
- Marked fatigue – half dose of beta blocker
- Review patient after 1-2 weeks

Persistent problems → **Seek specialist advice**

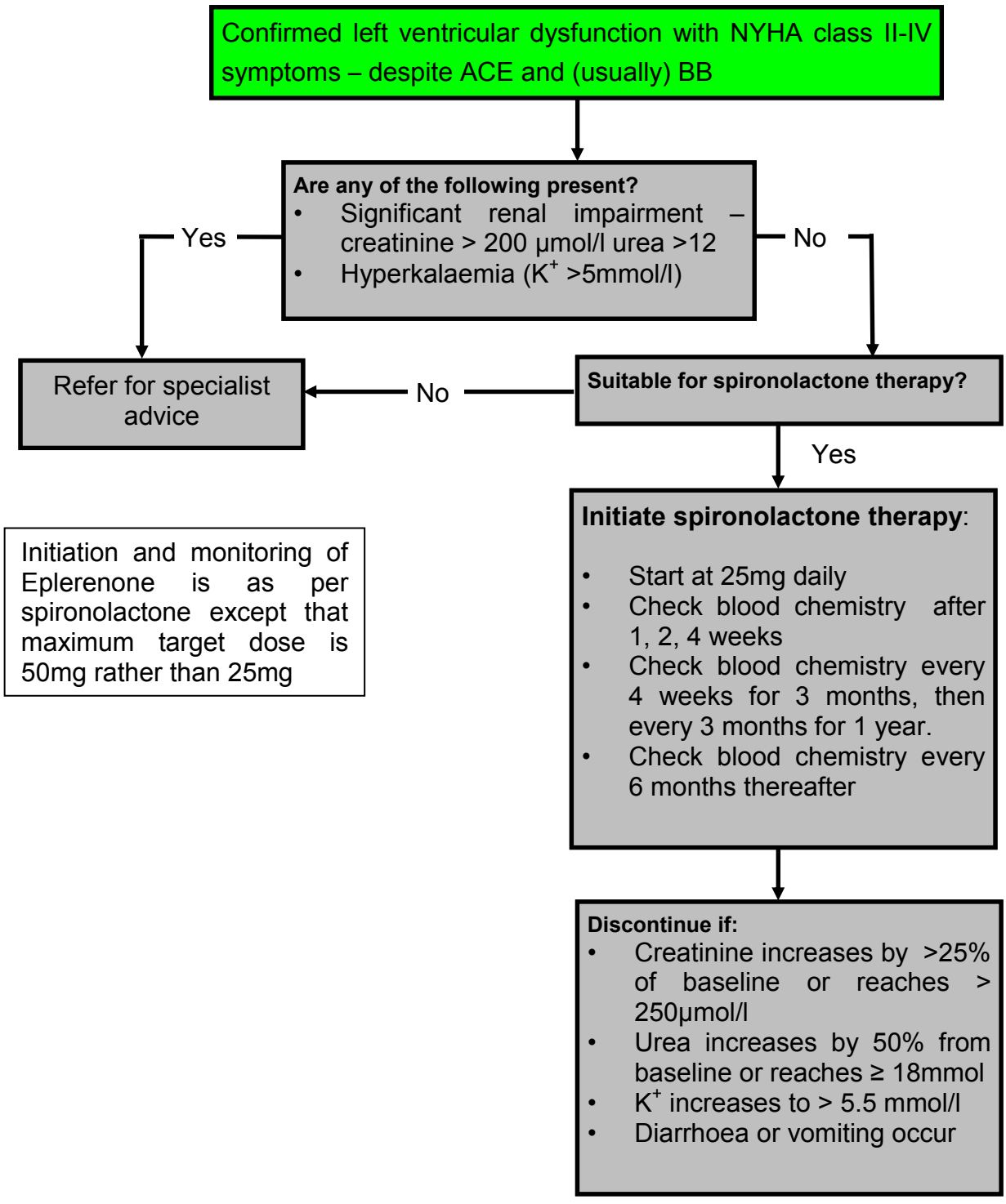
No adverse effects →

Maintenance

- Continue to aim for target doses (see beta blocker choice) or continue at maximum tolerated dose
- Encourage patient to weigh themselves daily

Algorithm for Initiating Spironolactone or Eplerenone in CHF in Primary Care

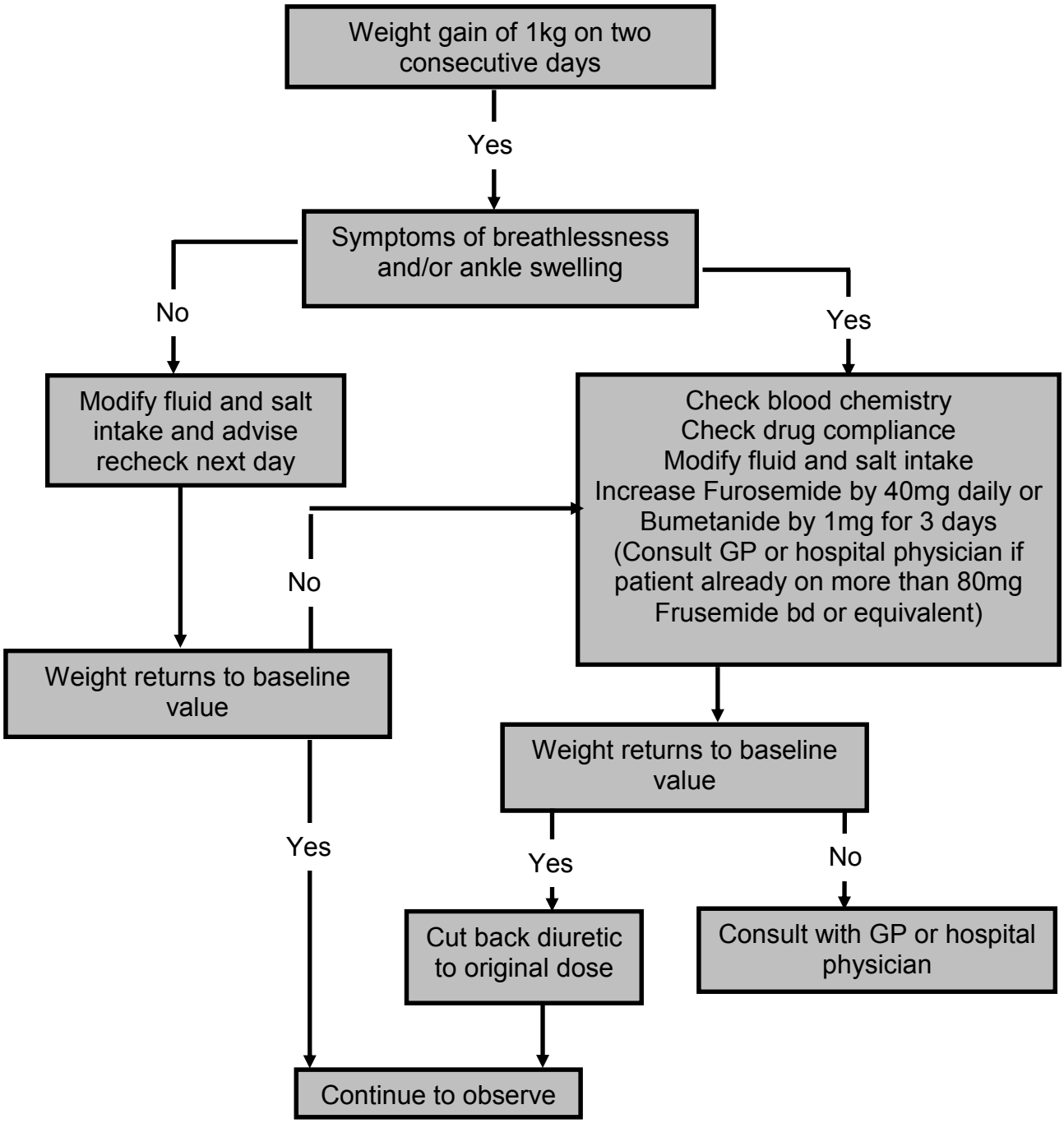
Note: Most patients with NYHA III-IV heart failure due to LVSD should be seen by a cardiologist for review of symptom control and assessment of other therapeutic options.



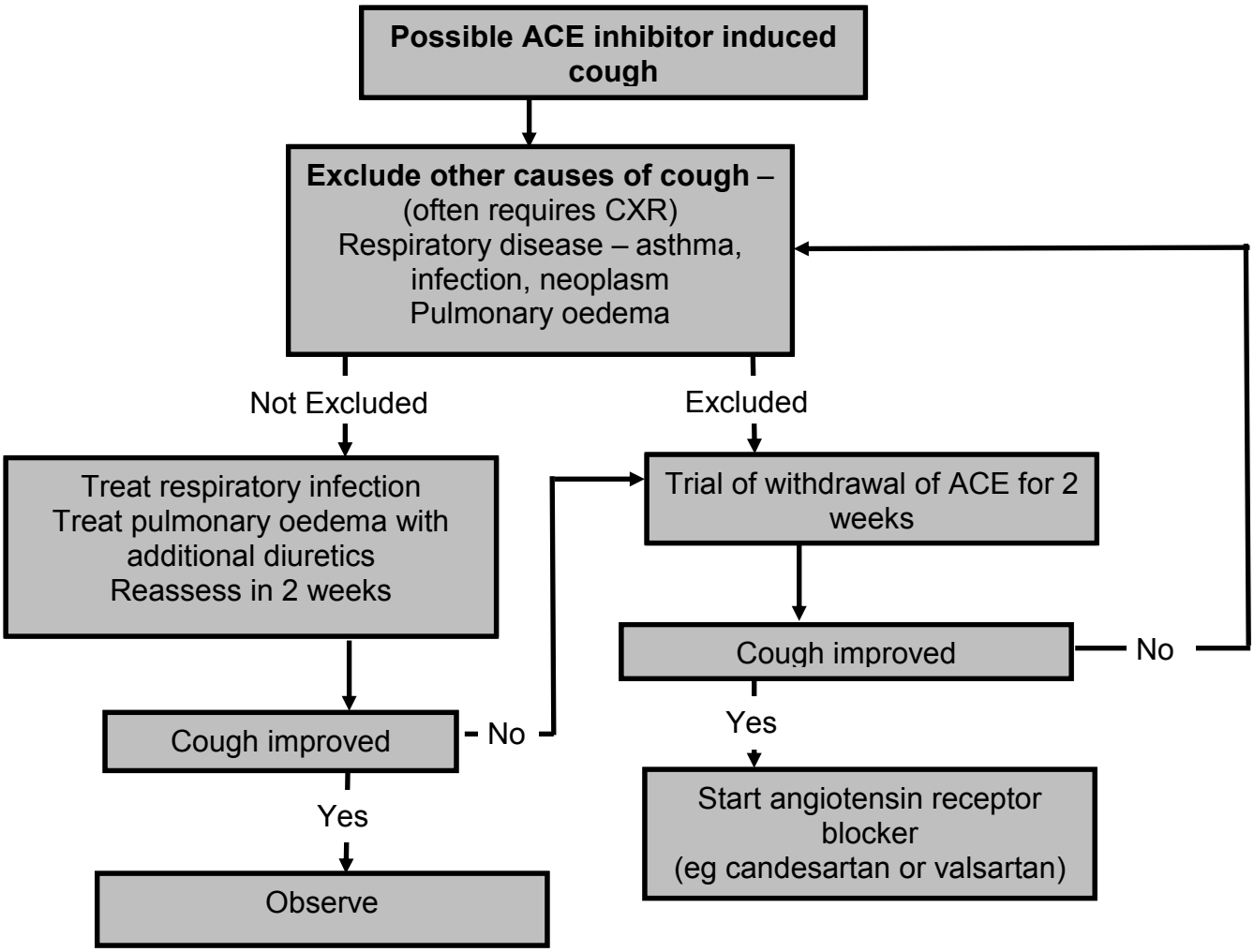
Initiation and monitoring of Eplerenone is as per spironolactone except that maximum target dose is 50mg rather than 25mg

Cautions:
- Avoid NSAIDs
- Avoid salt substitutes as these contain excess potassium
- Male patients may develop gynecomastia/breast discomfort
- Temporarily stop spironolactone if diarrhoea / vomiting develops

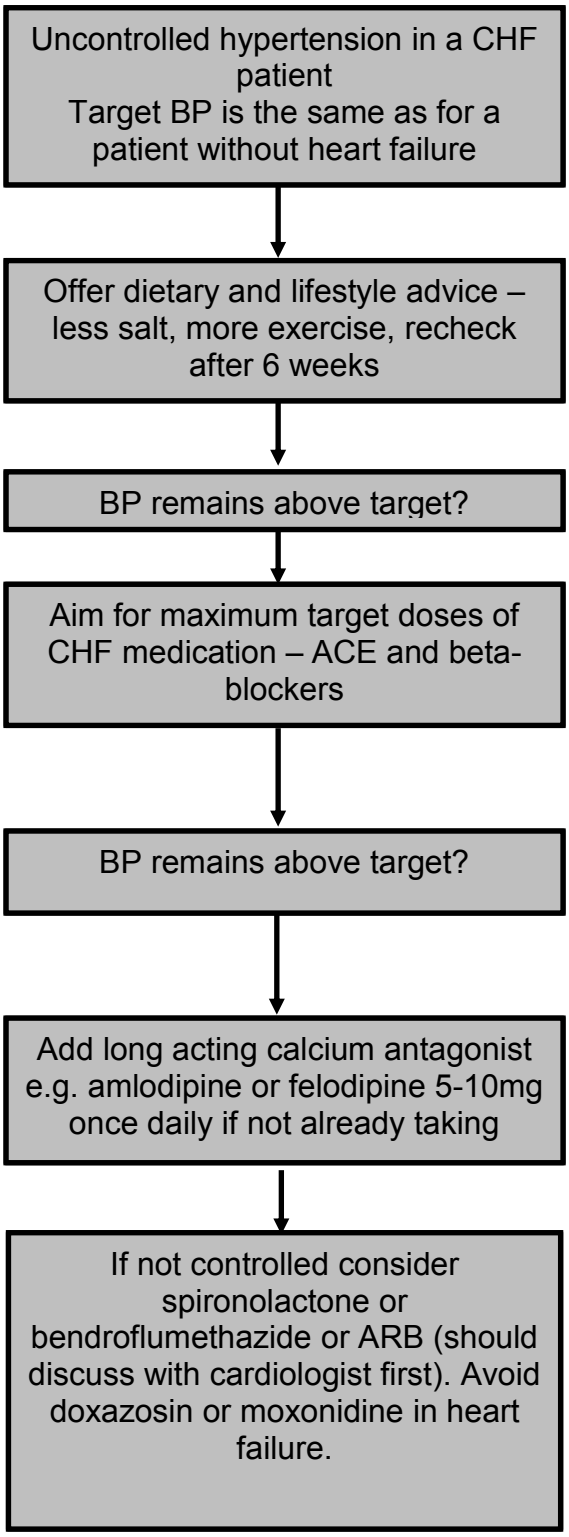
Management of Oedema and / or Weight Gain in patients with CHF



Management of Cough in patients with CHF



Management of Hypertension in Patients with CHF



Management of Gout in patients with CHF

Clinical features

- Painful inflamed joint usually first metatarsal/phalangeal joint, ankle, knees, wrists, fingers and especially on pressure points e.g. heel or elbow
- Always consider septic arthritis as a possible alternative cause
- Look for gouty tophi – pustular lesions around the joint, ears or skin
- Elevated serum Urate, leucocytosis

↓

Acute management

- If possible reduce loop diuretics, avoid stopping
- Start colchicine 500mcg twice daily till symptoms settle
- If not settled after 24-48 hours ask for a Rheumatolgy opinion
- Avoid use of NSAIDs
- Check serum urate but it may be normal early in the presentation; recheck in 1-2 weeks once settled

↓

Long-term management

- Allopurinol is the first line treatment for chronic or repeated episodes of gout, risk of precipitating acute gout is reduced by starting with a low dose such as 50 -100mg daily
- Maintenance dose is 100-300mg daily depending on severity and background renal function
- Doses of >300mg daily should only be used under supervision of a Rheumatologist

Gout- renal function

Allopurinol dose adjustment for patients with renal failure

Creatinine clearance Ml/min	**Dose**
1.	100mg every 3rd day
10.	100mg every 2nd day
20.	100mg daily
40.	150mg daily
60.	200mg daily
80.	250mg daily
>100	300mg daily

Drug Choices in Patients with CHF

Loop diuretics

- **Furosemide** – usual dose 40-80mg in a single daily dose; sometimes larger doses are required in more severe heart failure.

- **Bumetanide** – usual dose 1-2mg daily as a single morning dose; higher doses may be required in more severe heart failure.

ACE inhibitors

	Name	Usual start dose	Dose steps	Up-titration interval	Target dose
•	Enalapril	2.5mg bd	5, 7.5	1-2 weeks	10mg bd
•	Captopril	6.25mg tds	12.5, 25	1-2 weeks	50mg tds
•	Lisinopril	2.5mg od	5,10,15	1-2 weeks	20-30mg
•	Ramipril	2.5mg od	5	1-2 weeks	5mg BD/ 10mg OD

Angiotensin II receptor antagonists

- Candesartan 32mg once daily (starting dose 2mg od) is an alternative to ACE inhibitors when ACE inhibitors not tolerated. This drug is licensed for use in heart failure as an alternative to ACE inhibitors.
- Valsartan 160mg twice daily (starting dose 40mg bd) has also recently been shown to be effective as an alternative to ACE inhibitors in CHF; this drug is currently unlicensed for chronic heart failure.

.

Beta blockers

Name	Starting dose	Times daily	Up-titration interval	Target dose
Bisoprolol	1.25mg	1	1-2 weeks	10mg
Carvedilol	3.125mg	2	2 weeks	25mg bd (50mg bd if >85Kg)

Digoxin

- Usual maintenance dose 0.125-0.25mg.
- Consider a lower starting dose of 0.125mg daily in patients <50Kg.
- Check serum levels (>6hrs post dose) only if toxicity is suspected.
- Reduce dose in the elderly and in patients with renal impairment.
- Monitor potassium levels and avoid hypokalaemia which can exacerbate toxicity, use potassium supplements if required.

Spironolactone

- Usual maintenance dose 25mg daily.
- Monitor for hyperkalaemia.
- Observe male patients for tender gynaecomastia.
- Eplerenone 25-50mg is an alternative if gynaecomastia develops (licensed for post MI heart failure only at present).

Hypertension in CHF patients

In addition to those drugs described above, amlodipine or felodipine 5-10mg once daily may be used safely in patients with CHF to manage uncontrolled hypertension.

IMPORTANT REFERENCES AND USEFUL WEB-SITES

ACE INHIBITOR TRIALS

The CONSENSUS Trial sudy group. Effects of enalapril on mortality in severe congestive heart failure: results of the Cooperative North Scandinavian Enalapril Survival Study (CONSENSUS). N Engl J Med 1987;316: 1429-35

The SOLVD Investigators. Effect of enalapril on survival in patients with reduced ejection fractions and congestive heart failure. N Engl J Med 1991;325: 303-10

ANGIOTENSIN RECEPTOR BLOCKER TRIALS

Cohn JN, Tognoni G et al. A randomised trial of the angiotensin receptor blocker valsartan in heart failure. N Engl J Med 2001;345:1667-75

Granger CB, McMurray JJV et al. Effects of candesartan in patients with chronic heart failure and reduced left ventricular systolic function intolerant of ACE inhibitors: the CHARM alternative trial. Lancet 2003; 362: 772-6

McMurray JJV, Ostergren J et al. Effects of candesartan in patients with chronic heart failure and reduced left ventricular systolic function taking ACE inhibitors: the CHARM-added trial. Lancet 2003;362:777-81

ALDOSTERONE RECEPTOR BLOCKER TRIALS

Pitt B, Zannad F et al for the Randomised Aldactone Evaluation Study Investigators. The effect of spironolactone on morbidity and mortality in patients with severe heart failure. N Engl J Med 1999; 341: 709-17

Zannad F, McMurray J et al for the EMPHASIS-HF Study Group. Eplerenone in Patients with Systolic Heart Failure and Mild Symptoms. N Engl J Med 2011; 364:11-21

Pitt B, Remme W et al for the Eplerenone Post–Acute Myocardial Infarction Heart Failure Efficacy and Survival Study Investigators. Eplerenone, a Selective Aldosterone Blocker, in Patients with Left Ventricular Dysfunction after Myocardial Infarction. N Engl J Med 2003; 348:1309-1321

BETA-BLOCKER TRIALS

The Cardiac Insufficiency Bisoprolol Study II (CIBIS II): a randomised trial. Lancet 1999;353: 9-13

Packer M, Bristow MR et al for the US Carvedilol Heart Failure Study Group. The effect of carvedilol on morbidity and mortality in patients with chronic heart failure. N Engl j Med 1996;334: 1349-55

Packer M, Coats AJ et al. Effect of carvedilol on survival in severe chronic heart failure. N Engl J Med 2001; 344: 1651-8

IVABRADINE TRIAL

Swedberg K, Komajda M et al on behalf of the SHIFT Investigators. Ivabradine and outcomes in chronic heart failure (SHIFT): a randomised placebo-controlled study. Lancet Sep 2010;376: 875 - 885

HEART FAILURE SPECIALIST NURSE INTERVENTION

Rich, M.W., Beckham, V., Wittenberg, C., Leven, C.L., Freedland, K.E., Carney, R.M. A multidisciplinary intervention to prevent the readmission of elderly patients with congestive heart failure. New England Journal of Medicine 1995; 333: pp. 1190-1195

Stewart, S., Marley, J.E., Horowitz, J.D. Effects of a multidisciplinary, home-based intervention on unplanned readmissions and survival among patients with chronic congestive heart failure: a randomised controlled study. Lancet 1999; 354: pp.1077-1083.

Blue, L., Lang, E., McMurray, J.J.V., Davie, A.P., McDonagh, T.A., Murdoch, D.R., Petrie, M., Connolly, E., Norrie, J., Round ,C.E., Ford, I. and Morrison, C.E. Randomised controlled trial of specialist nurse intervention in heart failure. British Medical Journal 2001; 323: pp.715-718

McAlister A F, Stewart S, Ferrua S, McMurray JJV. Multidisciplinary Strategies for the Management of Heart Failure Patients at High Risk for Admission: A Systematic Review of Randomized Trials. Journal of the American College of Cardiology 2004; 44(4): 810-819

USEFUL WEBSITES

http://www.sign.ac.uk – Scottish Intercollegiate Guidelines

http://www.nice.org.uk – National Institute of Clinical Excellence

http://www.escardio.org – European society of cardiology (access to guidelines)

www.acc.org or www.americanheart.org – ACC / AHA Guidelines for the diagnosis and management of CHF in the adult