Background
Chronic heart failure (CHF) is an increasingly common condition with increasing prevalence in the aging population. It has a significant mortality and is associated with a high incidence of hospitalisation and morbidity.

Objective
This article describes the aspects of modern therapy that can improve survival, reduce hospitalisation and improve quality of life for CHF patients.

Discussion
A careful history, physical examination and judicious investigation (including chest X-ray, electrocardiogram, complete blood profile and echocardiogram) can often identify the cause of CHF, the severity of CHF and help guide management. Treatments which have been shown to be of significant benefit include angiotensin converting enzyme inhibitors, beta-blockers, aldosterone antagonists and angiotensin receptor blockers. Loop diuretics, nitrates, digoxin, hydralazine and amiodarone may be used when patients do not respond to initial therapy. Review by a cardiologist is often useful to exclude myocardial ischaemia and to perform echocardiography which is a key investigation in assessment of CHF patients. Ongoing regular review with up titration of medications to achieve target blood pressure and pulse and exclude exacerbating conditions can lead to improvements in care and facilitate successful outcomes in CHF patients who are often very unwell.

Keywords: heart failure; therapy; general practice

Chronic heart failure (CHF) affects over 300 000 Australians with another 30 000 new cases diagnosed each year.1 Prevalence increases with age, from 2.5% in people aged 55–64 years to 8.2% in those aged over 75 years.1 Despite improved understanding of the pathophysiology and management, morbidity and mortality remain high, with CHF causing 43 000 hospitalisations and 2200 deaths in 2006. This underestimates the burden of disease as it does not include indirect deaths and hospitalisations due to CHF.1 A sound understanding of modern therapies is crucial as general practitioners play a central role in the management of CHF.

The National Heart Foundation and Cardiac Society of Australia and New Zealand Guidelines for the prevention, detection and management of chronic heart failure2 is a valuable reference for GPs (available at www.heartfoundation.org.au).

Initial clinical assessment

History
Early CHF symptoms include exertional dyspnoea and fatigue, with orthopnoea, paroxysmal nocturnal dyspnoea and ankle oedema occurring later. Less obvious symptoms include persistent cough, especially when supine or nocturnal, fatigue, nausea and anorexia. The New York Heart Association functional classification3 should be documented initially and with each review to monitor progress. Their classification of CHF symptoms is:

- Class I – asymptomatic left ventricular dysfunction
- Class II – symptoms with normal activities
- Class III – symptoms with less than normal activities
- Class IV – symptoms at rest.

Careful history to identify conditions or medications to explain the aetiology of CHF is important. This should include a history of myocardial infarction, risk factors for coronary artery disease, long standing hypertension, alcohol intake, antecedent viral illness, and prior rheumatic fever or murmurs. Table 1 lists the common causes of CHF.

Examination
Physical examination should focus on signs of the underlying condition (eg. murmur), ventricular strain (gallop rhythm, tachycardia)
Table 1. Causes of chronic heart failure

More common causes
Ischaemic heart disease
Hypertension
Valvular heart disease (stenosis or regurgitation)
Idiopathic dilated cardiomyopathy

Less common causes
Diabetes
Myocarditis (postviral or inflammatory)
Congenital heart disease
Drug induced, eg. alcohol or chemotherapy (anthracyclines)
HIV infection
Peripartum cardiomyopathy
Thyroid disease, eg. hypo- or hyper-thyroidism
Infiltrative conditions, eg. sarcoidosis, amyloidosis
Connective tissue diseases
Iron overload
Arrhythmia or tachycardia, eg. tachycardia induced cardiomyopathy

and signs of severity of heart failure. Mild heart failure patients may present with mildly elevated jugular venous pressure, basal inspiratory crepitations and mild peripheral or sacral oedema. More severe heart failure exhibits signs such as markedly elevated jugular venous pressure, crepitations beyond the mid-zones of the lungs, oedema above the mid tibia, pulsatile hepatomegaly and ascites.

Initial investigations
Initial investigations include chest X-ray, electrocardiogram (ECG), blood tests (including electrolytes, renal function, liver enzymes, full blood count, thyroid function, iron studies, autoimmune screen) and a transthoracic echocardiogram – this is the key investigation in management of heart failure. Chest X-ray will identify cardiomegaly and pulmonary congestion, while the ECG will identify arrhythmia, tachycardia and evidence of previous myocardial infarction (Q-waves). Blood results identify causes and aggravating factors such as anaemia or thyroid dysfunction. Measurement of the plasma brain natriuretic peptide (BNP), which is released by ventricular myocardium in response to pressure or volume stress, may help ‘rule out’ CHF. A BNP <100 pg/mL makes the diagnosis of CHF very unlikely. However, BNP levels may be elevated in renal impairment, pulmonary embolism, or in patients with a history of CHF who present with other illnesses. BNP levels may also be mildly elevated in women and in those aged over 60 years with other severe illness.

All patients with heart failure should undergo a transthoracic echocardiogram to assess left ventricular (LV) systolic function. However, up to one-third of CHF patients have normal LV systolic function. In the presence of abnormal diastolic function on echocardiography, diastolic heart failure may be considered. This typically occurs in the elderly and in females with hypertension, but can also occur in those with diabetes, obesity and coronary artery disease (CAD).

The echocardiogram can assess response of LV function to therapy by serial measurement of ejection fraction and identifying other causes of CHF, eg. valvular heart disease, LV hypertrophy, pulmonary hypertension and regional wall motion abnormalities suggesting CAD.

In all newly diagnosed CHF patients, assessment of CAD should be considered, as this represents a potentially reversible cause of CHF. This makes a critical difference in the management of patients with heart failure because if there is significant coronary artery disease and the patient is revascularised, this will improve ventricular function and prognosis. When there is a high clinical suspicion of CAD (ie. angina, risk factors or prior history of myocardial infarction (MI), echocardiographic or ECG evidence of silent MI) coronary angiography should be considered. If CAD is less likely then a noninvasive imaging test should be undertaken (eg. stress echocardiogram or nuclear perfusion scan). If CAD is identified, then revascularisation needs to be considered in patients with myocardial viability (eg. by dobutamine stress echocardiography, PET scan or cardiac magnetic resonance imaging [MRI]).

Management
Management aims to improve CHF symptoms, reduce hospitalisation and mortality. This involves identification and treatment of reversible causes and institution of proven medical and device therapies. To achieve this, the clinician must understand the pathophysiology of CHF. In CHF, there is activation of the renin-angiotensin-aldosterone system and the sympathetic nervous system. This is detrimental to ventricular structure and function. Chronic heart failure therapies, including angiotensin converting enzyme inhibitors (ACEIs), angiotensin receptor blockers (ARB) and beta blockers, target these activated pathways (Figure 1).

Many CHF treatments promote peripheral vasodilatation and relative bradycardia to enhance ventricular function. It is recommended to achieve a target heart rate of 55–60 bpm and systolic blood pressure of 105–110 mmHg.

Table 2 outlines important aspects of nonpharmaceutical therapies in CHF.

Pharmacological therapies
ACEIs and ARBs
Angiotensin converting enzyme inhibitors are indicated in all classes of CHF, including asymptomatic patients with LV dysfunction and following MI. They improve mortality, reduce hospitalisation and improve symptoms. ACEIs should be started at low doses and titrated upward over 3–4 weeks. Renal function and electrolytes should be checked within 2 weeks of commencement and the drug discontinued if potassium levels exceed 5.5 mmol/L or...
Creatinine increases by more than 20% from baseline. Renal function and electrolytes should be re-checked after 1 month and then 3–6 monthly. The most common reasons for discontinuation include cough, symptomatic hypotension, and renal or electrolyte disturbance. Day time hypotension may be avoided by giving the ACEI at night (Table 3).

Angiotensin receptor blockers have been shown to have similar improvements in mortality, hospitalisations and symptoms compared to ACEIs. ² They should be considered in patients intolerant of ACEIs due to cough, or in addition to ACEIs in CHF patients who remain symptomatic or hypertensive. Titration of ARBs and measurement of renal function and electrolytes is similar to that of ACEIs.

**Beta blockers**

Beta blockers are indicated in all patients with CHF. They improve both mortality and morbidity.² Beta blockers with a proven mortality benefit include carvedilol, bisoprolol, nebivolol and extended release metoprolol.² Beta blockers should be commenced at small doses when the patient is euolaemic and titrated upward over a 1–2 month period. Patients should be haemodynamically stable with a systolic BP >85 mmHg without symptomatic postural drop, minimal peripheral oedema and no pulmonary crackles (rales) before prescribing beta blockers. Rapid uptitration may lead to adverse effects and inappropriate discontinuation of the drug. Beta blocker dose should be reduced if the heart rate falls below 55 bpm. Hypotension can be treated by reducing doses of diuretics or other vasodilating drugs first, rather than reducing the dose of the beta blocker.

Side effects include hypotension, fatigue, bronchoconstriction in patients with reversible airways obstruction (>15% improvement in FEV₁ with bronchodilators) and mild worsening of CHF symptoms initially. It is important to warn patients of this last side effect before initiation. Nonvasodilatory beta blockers (bisoprolol or extended release metoprolol) may be helpful in patients with hypotension and cardioselective beta blockers (eg. bisoprolol, nebivolol) may be trialled in COPD patients without reversible airways obstruction. Nebivolol has been shown to be effective in patients over 70 years of age, regardless of ejection fraction (Table 4).

**Aldosterone antagonists**

Spironolactone has been shown to have a mortality benefit in patients with Class III/IV CHF.² Eplerenone, a selective aldosterone antagonist, has been shown to reduce mortality in patients with post-MI LV dysfunction² and has a much less risk of gynaecomastia than spironolactone. Careful monitoring of electrolytes and renal function is important as aldosterone antagonism may cause hyperkalaemia. Both drugs are contraindicated in significant renal impairment (GFR <30 mL/min).

**Diuretics**

Diuretics are used to treat congestive symptoms due to salt and fluid overload and do not have a long term mortality benefit.² Once patients are euolaemic, diuretics may be reduced or weaned, especially if this will improve blood pressure and allow initiation of drugs with a proven mortality benefit (eg. beta blockers and ACEIs).
**Digoxin**

In patients with persistent symptoms, despite the above therapies, digoxin has been shown to improve symptoms and reduce hospitalisations, but has no effect on mortality. Digoxin is particularly valuable when the patient also has atrial fibrillation. Small doses are recommended, eg. 62.5 µg/day or every 2–3 days in patients with renal impairment.

**Other drug therapies**

Nitrates and hydralazine offer alternative vasodilatation in patients intolerant of ACEIs and ARBs. Nitrates are particularly useful in reducing nocturnal dyspnoea, pulmonary hypertension, myocardial ischaemia and peripheral oedema. Isosorbide mononitrate may be commenced at 30 mg nocte, titrating up to 120 mg over 1–2 weeks. Nitrate patches are less well absorbed in patients with poor peripheral perfusion.

Amiodarone has not been shown to improve mortality, but may control ventricular arrhythmia and atrial fibrillation in CHF. Monitoring for complications including thyroid dysfunction, pulmonary fibrosis, hepatic dysfunction, corneal deposits, peripheral neuropathy, photosensitivity and skin discolouration is important. Amiodarone should be initiated only by a cardiologist/specialist or in consultation with a specialist.

Warfarin is indicated in patients with CHF who have atrial fibrillation or cardiac thrombus. Patients with ischaemic cardiomyopathy should receive aspirin. There is no strong evidence however, for the use of anticoagulants or antiplatelets in patients with nonischaemic cardiomyopathy.

**Device therapies**

An implantable cardioverter defibrillator may be an option for patients with an LV ejection fraction <35% for both primary and secondary prevention of ventricular arrhythmia, with a reduction in mortality in both of these settings.

Cardiac dysynchrony is seen in approximately one-third of CHF patients and leads to further impairment of LV function, abnormal remodelling and secondary mitral regurgitation. Pacing the left and right ventricles simultaneously, in order to resynchronise LV contraction, cardiac resynchronisation therapy (CRT) has been shown to improve symptoms, functional capacity, CHF hospitalisations and mortality. The criteria for recommending CRT are LV ejection fraction <35%, evidence of cardiac dysynchrony (QRS duration >120 ms) and Class III/IV symptoms despite optimal medical therapy.

**Summary**

Chronic heart failure carries a major health burden, with significant morbidity and mortality. Accurate diagnosis, treatment of reversible causes and institution of proven medical and device therapies are key facets of management. This involves regular follow up, appropriate initiation and titration of medications, referral to a consultant cardiologist as needed and liaison with multidisciplinary team members.

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**References**


* In patients >85 kg, the carvedilol dose can be increased to 50 mg bd

| Table 3. Target doses of ACEIs in heart failure |
| Ramipril | Perindopril | Enalapril | Fosinopril | Lisinopril | Trandolopril | Captopril | Fosinopril |
| 10 mg/day | 10 mg/day | 20 mg bd | 20 mg/day | 30 mg/day | 4 mg/day | 25 mg tds | 20 mg/day |

| Table 4. Titration of beta blockers in heart failure |
| Week | Carvedilol | Bisoprolol | Nebivolol | Extended release metoprolol |
| 0–2 | 3.125 mg bd | 1.25 mg/day | 1.25 mg/day | 23.75 mg/day |
| 2–4 | 6.25 mg bd | 2.5 mg/day | 2.5 mg/day | 47.5 mg/day |
| 4–6 | 12.5 mg bd | 5 mg/day | 5 mg/day | 95 mg/day |
| 6 onward | 25 mg bd* | 10 mg/day | 10 mg/day | 190 mg/day |

* In patients >85 kg, the carvedilol dose can be increased to 50 mg bd