Reducing Readmissions for Congestive Heart Failure

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Hospital admission for congestive heart failure is extremely common and quite expensive, although it is frequently preventable. New drugs and therapies have been reported to reduce admissions, decrease morbidity and mortality, and improve the quality of life for these patients. Patients with an ejection fraction less than 40 percent (decreased systolic function) should be treated with medication to improve symptoms and prevent progression of heart failure. Angiotensin-converting enzyme (ACE) inhibitors are a mainstay of treatment in patients who can tolerate them; in patients who cannot take these drugs, angiotensin II receptor blocking agents offer an alternative. Patients with New York Heart Association class II or III heart failure should also receive a beta blocker (metoprolol, carvedilol or bisoprolol). Recent research has shown that treatment with spironolactone improves mortality and hospital readmission rates. An exercise program should also be recommended for all patients with heart failure unless their condition is unstable. (Am Fam Physician 2001;63:1593-8,1600.)

Congestive heart failure is the most common discharge diagnosis in patients older than 65 years. The incidence of heart failure in patients older than 80 years is 9 percent. Unfortunately, the prevalence of heart failure continues to rise and has resulted in an annual expenditure of $10 billion for diagnosis and treatment. The average hospital stay for treatment of this disease is nine days, and the overall five-year mortality rate is 50 percent.

Approximately 30 to 40 percent of patients with heart failure are readmitted within six months of hospitalization. Studies have concluded that readmissions for heart failure could be prevented in at least 40 percent of cases. Unnecessary readmissions contribute significantly to the cost of this disease. In the past five years, new drugs and strategies have been introduced that can help reduce the need for hospitalization. All physicians who care for patients with heart failure should be knowledgeable about the use of these new treatments.

Assessment and Treatment of Systolic Heart Failure

All patients with heart failure should undergo echocardiography or radionuclide ventriculography to confirm systolic dysfunction and determine the ejection fraction. The treatment of diastolic heart failure differs substantially from that of systolic dysfunction and is not addressed in this review. The range of symptoms in patients with compromised systolic function (ejection fraction less than 40 percent) may vary from absent to severe and life-threatening. These patients are routinely classified according to the New York Heart Association (NYHA) classes I through IV (Table 1). There are multiple reasons why a patient with heart failure may decompen-sate and require readmission to the hospital (Table 2).

Patients with NYHA class II, III or IV heart failure should generally be treated with a loop diuretic, digoxin and an angiotensin-converting enzyme (ACE) inhibitor. Unfortunately, these drugs are frequently prescribed incorrectly, and newer therapies are underutilized.

Neurohormonal Changes in Heart Failure

Increased knowledge about the pathophysiology of congestive heart failure has resulted in significant advances in the management of the disease. In the past, heart failure was considered solely a hemodynamic problem caused by a weak pump, resulting in symptoms of pulmonary congestion, edema and fatigue. For
that reason, diuretics and inotropic agents such as digoxin were used and, later, drugs were added to decrease preload and afterload. The significance of neurohormonal changes occurring in patients with heart failure has been elucidated more recently. Attention has focused on the activation of the renin-angiotensin and the sympathetic nervous systems in heart failure. Activation of one system will in turn activate the other, and both systems cause heart failure to worsen. In addition, the left ventricle can undergo changes (remodeling) that result in progression of heart failure. Therapies to block the renin-angiotensin and sympathetic nervous systems and those that favorably affect remodeling will improve the prognosis in patients with heart failure.

**SALT, WEIGHT AND BLOOD PRESSURE**

A low-salt diet (2 to 3 g of sodium per day) is a basic component in the treatment of heart failure. Another cornerstone of therapy is frequent measurement of body weight, preferably daily. Every patient should have a calculated target weight. Weight gain of 1.5 to 2.0 kg (3 to 5 lb) per week or new symptoms or signs may signal the need for a change in therapy and should precipitate a call to the physician. Standing blood pressure needs to be followed closely. Many patients with heart failure are elderly and are prone to orthostatic hypotension, especially when treated with diuretics and vasodilators.

**ANGIOTENSIN-CONVERTING ENZYME INHIBITORS**

ACE inhibitors have been shown to improve symptoms and survival, slow progression of disease and decrease hospital readmission rates in patients with heart failure. These agents have been the mainstay of therapy for left ventricular dysfunction since their substantial impact on symptoms was recognized. The trend in treating mild to moderate heart failure is to maximize the use of ACE inhibitors and minimize or possibly stop the use of loop diuretics. Remember that over-diuresis will activate both the sympathetic nervous system and the renin-aldosterone systems, which will in turn aggra-

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**TABLE 1**

**New York Heart Association Functional Classification of Congestive Heart Failure**

<table>
<thead>
<tr>
<th>Class</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Patients with cardiac disease but without limitations of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, dyspnea or anginal pain.</td>
</tr>
<tr>
<td>II</td>
<td>Patients with cardiac disease that results in slight limitation of physical activity. These patients are asymptomatic at rest. Ordinary physical activity results in fatigue, palpitation, dyspnea or anginal pain.</td>
</tr>
<tr>
<td>III</td>
<td>Patients with cardiac disease resulting in marked limitation of physical activity. These patients are usually asymptomatic at rest. Less than ordinary physical activity causes fatigue, palpitation, dyspnea or anginal pain.</td>
</tr>
<tr>
<td>IV</td>
<td>Patients with cardiac disease resulting in inability to carry on any physical activity without discomfort. Symptoms may be present even at rest; if any physical activity is undertaken, discomfort is increased.</td>
</tr>
</tbody>
</table>


**TABLE 2**

**Precipitators of Congestive Heart Failure**

- Noncompliance with medications or diet
- Ischemia: myocardial infarction, angina or silent
- Arrhythmias (e.g., atrial fibrillation)
- Worsening azotemia
- Comorbidities (pneumonia, pulmonary emboli, sepsis, etc.)
- Poorly controlled blood pressure
- Alcohol abuse

Angiotensin-converting enzyme inhibitors, in relatively large doses, have been shown to improve heart failure symptoms and survival, slow disease progression and decrease hospital readmission rates.
vate heart failure. Studies have confirmed that the dosages of ACE inhibitors commonly used by primary care physicians are lower than those suggested by clinical studies. These dosages are in the range of 150 mg of captopril (Capoten) per day or 20 mg of enalapril (Vasotec) per day (Table 3). As with all medications used in the elderly, a good rule is to “start low and go slow.” A weekly titration schedule is a reasonable approach.

Baseline and serial laboratory studies should be performed to evaluate serum potassium levels and renal function. With the addition of an ACE inhibitor, potassium supplements may no longer be necessary. Renal dysfunction and cough necessitate discontinuation of therapy in less than 10 percent of patients. Pregnancy, bilateral renal artery stenosis, angioedema, significant hyperkalemia, severe cough and renal dysfunction are absolute contraindications to the use of ACE inhibitors.

ANGIOTENSIN II RECEPTOR BLOCKING AGENTS

It may be reasonable to consider using an angiotensin II receptor blocking agent in patients who cannot tolerate or who have a contraindication to ACE inhibitors. Drugs in this class include losartan (Cozaar), valsartan (Diovan), irbesartan (Avapro) and candesartan (Atacand). The results of the Evaluation of Losartan in the Elderly (ELITE) I and II trials suggest that losartan is comparable in efficacy to captopril in the management of heart failure and is better tolerated.

Historically, patients who were intolerant to ACE inhibitors were given a combination of hydralazine and nitrates. Although this combination is clearly efficacious, it involves dosing three to four times daily and is associated with significant side effects. More studies will be necessary before the angiotensin II receptor blocking agents find a well-defined place in the treatment of heart failure.

DIURETICS

Most patients with NYHA class II, III or IV congestive heart failure will require a loop diuretic. Daily diuretics may not be necessary in patients who are on a strict low-sodium diet and have no signs or symptoms of congestion. Furosemide (Lasix), a commonly used loop diuretic, is dose-dependent (a dose threshold must be reached before a response is seen). If physical examination, weight or symptoms suggest that adequate diuresis has not been achieved, the dosage should be doubled and given as a single dose. The dosage of loop diuretics may have to be increased if

<table>
<thead>
<tr>
<th>Drug</th>
<th>Initial dosage (mg)</th>
<th>Targeted dosage</th>
<th>Maximal dosage</th>
<th>Hours until peak effect on blood pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Captopril (Capoten)</td>
<td>6.25 to 12.5</td>
<td>50 mg three times daily</td>
<td>100 mg three times daily</td>
<td>1 to 2</td>
</tr>
<tr>
<td>Enalapril (Vasotec)</td>
<td>2.5 to 5</td>
<td>10 mg twice daily</td>
<td>20 mg twice daily</td>
<td>4 to 6</td>
</tr>
<tr>
<td>Fosinopril sodium (Monopril)</td>
<td>5 to 10</td>
<td>20 mg daily</td>
<td>40 mg daily</td>
<td>2 to 6</td>
</tr>
<tr>
<td>Lisinopril (Zestril)</td>
<td>2.5 to 5</td>
<td>20 mg twice daily</td>
<td>40 mg twice daily</td>
<td>2 to 6</td>
</tr>
<tr>
<td>Quinapril (Accupril)</td>
<td>5 to 10</td>
<td>20 mg twice daily</td>
<td>40 mg twice daily</td>
<td>2 to 4</td>
</tr>
<tr>
<td>Ramipril (Altace)</td>
<td>1.25 to 2.5</td>
<td>5 mg twice daily</td>
<td>10 mg twice daily</td>
<td>4 to 6</td>
</tr>
</tbody>
</table>
The Randomized Aldactone Evaluation Study reported lower mortality and a 35 percent reduction in hospitalization rate when spironolactone was added to standard therapy for heart failure.

chronic renal insufficiency is present. Furosemide may have variable absorption requiring larger doses or use of other loop diuretics such as bumetanide (Bumex) or torsemide (Demadex). Twice-daily dosing may be necessary in severe cases because the half-life of loop diuretics is very short. Patients may become refractory to loop diuretics. Metolazone (Zaroxolyn) may be added if this occurs. Metolazone is a thiazide-like diuretic that affects different sites in the renal tubule, which results in a synergistic diuretic effect. Daily use of this drug should be avoided because of the potential for severe hypokalemia and hypotension. A reasonable strategy in patients who are refractory to loop diuretics is to give 5 mg of metolazone one hour before the morning dose of the loop diuretic. Patients may require only one dose every seven to 10 days to maintain their target weight.

SPIRONOLACTONE

The Randomized Aldactone Evaluation Study (RALES) reported lower mortality and a 35 percent lower hospitalization rate in patients given 25 mg spironolactone compared with those who received placebo when the drug was added to the standard treatment for heart failure. This study suggests that the benefit from spironolactone is derived from an aldosterone-blocking effect and not a diuretic effect. Spironolactone may help correct hypokalemia caused by large doses of diuretics. Serious hyperkalemia was rare in this trial even though most of the patients were also taking an ACE inhibitor. Patients with serum creatinine levels greater than 2.5 mg per dL (220 µmol per L) were excluded from this trial. Spironolactone appears to be a simple and useful therapy, although further studies will be necessary to determine its exact role in heart failure.

BETA BLOCKERS

Historically, beta blockers have been avoided in patients with heart failure. Recent studies of bisoprolol (Zebeta), metoprolol (Lopressor) and carvedilol (Coreg) demonstrate lower mortality rates (decreased sudden death) and hospitalization rates in patients with NYHA class II or class III heart failure who are treated with these agents. The benefit of beta blockers in class I and class IV patients has not yet been demonstrated. Carvedilol has alpha- and beta-blocking activity and has been labeled by the U.S. Food and Drug Administration for use in patients with heart failure. Beta blockers should be started at a low dose when the patient is stable. The dosage should be increased slowly with careful attention to hypotension or worsening heart failure. Patience is important, because the benefit of treatment may not be apparent for months. In addition, reevaluation by a cardiologist should be considered in class IV patients before initiating beta-blocker therapy.

DIGOXIN

Digoxin can improve symptoms of heart failure and reduce hospital admissions but survival benefits have not been proved. Digoxin should be used in cases of severe heart failure and should be considered in patients with moderate systolic heart failure.
who continue to have symptoms after optimal
doses of a diuretic, an ACE inhibitor and a
beta blocker have been reached.

**NONSTEROIDAL ANTI-INFLAMMATORY DRUGS**

Nonsteroidal anti-inflammatory drugs
(NSAIDs) block the effects of diuretics and
ACE inhibitors, causing some patients to
become refractory to treatment. One study\(^{18}\)
cited a twofold increase in hospitalizations for
heart failure in elderly patients taking diuret-
ic and NSAIDs.

**CALCIUM CHANNEL BLOCKERS**

Calcium channel blockers, with the exception
of amlodipine (Norvasc), should be avoided in
patients with heart failure. The results of the
Prospective Randomized Amlodipine Survival
Evaluation Study Group I and II trials demon-
strate a neutral effect on survival in patients
with heart failure treated with amlodipine.\(^{19,20}\)

**NONPHARMACOLOGIC THERAPIES**

A single home health visit may significantly
decrease hospital readmission for treatment of
heart failure.\(^{21}\) Telephone monitoring has
similar benefits.\(^{22}\) Such follow-up inquiries
may reveal multiple problems that need atten-
tion. Up to 50 percent of patients are found to
be noncompliant in following discharge
instructions from a previous hospitaliza-
tion.\(^{21,22}\) Many excellent heart failure proto-
cols and critical pathways are available for use
by home health nurses.\(^{24}\)

Although patients with heart failure have tra-
ditionally been advised not to exercise, recent
studies have shown that appropriate exercise
programs are safe for patients with mild to
moderate heart failure. Patients who exercise
may have reduced numbers of hospitalizations
and cardiac events and an improved quality of
life.\(^{25}\) Deconditioning may occur in any chronic
illness but can be minimized with an appropri-
ate exercise program.\(^{26}\) Reevaluation by a car-
diologist following hospitalization is reasonable
for patients with class III or IV heart failure.
Several studies have shown differences between
cardiologists and noncardiologists in the
understanding of the pathophysiology and
treatment of heart failure.\(^{27}\) Cardiologists are
more likely to follow clinical guidelines, and
their patients have lower hospital readmission
rates than patients of noncardiologists.\(^{28,29}\)

Table 4 summarizes the most important
points to remember when managing patients
with heart failure.

The authors thank Jo Ann Clay for her assistance in
the preparation of the manuscript.

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### Table 4

**The 10 Commandments of Heart Failure Treatment**

1. Maintain patient on 2- to 3-g sodium diet. Follow daily weight. Monitor
standing blood pressures in the office, as these patients are prone to
orthostasis. Determine target/ideal weight, which is not the dry weight.
In order to prevent worsening azotemia, some patients will need to have
some edema. Achieving target weight should mean no orthopnea or
paroxysmal nocturnal dyspnea. Consider home health teaching.

2. Avoid all nonsteroidal anti-inflammatory drugs because they block the effect
of ACE inhibitors and diuretics. The only proven safe calcium channel
blocker in heart failure is amlodipine (Lotrel).

3. Use ACE inhibitors in all heart failure patients unless they have an absolute
contraindication or intolerance. Use doses proven to improve survival and
back off if they are orthostatic. In those patients who cannot take an ACE
inhibitor, use an angiotensin receptor blocker like irbesartan (Avapro).

4. Use loop diuretics (like furosemide [Lasix]) in most NYHA class II through
IV patients in dosages adequate to relieve pulmonary congestive symptoms.
Double the dosage (instead of giving twice daily) if there is no response or
if the serum creatinine level is > 2.0 mg per dL (180 µmol per L).

5. For patients who respond poorly to large dosages of loop diuretics, consider
adding 5 to 10 mg of metolazone (Zaroxolyn) one hour before the dose of
furosemide once or twice a week as tolerated.

6. Consider adding 25 mg spironolactone in most class III or IV patients. Do not
start if the serum creatinine level is > 2.5 mg per dL (220 µmol per L).

7. Use metoprolol (Lopressor), carvedilol (Coreg) or bisoprolol (Zebeta)
(beta blockers) in all class II and III heart failure patients unless there is
a contraindication. Start with low doses and work up. Do not start if
the patient is decompensated.

8. Use digoxin in most symptomatic heart failure patients.

9. Encourage a graded exercise program.

10. Consider a cardiology consultation in patients who fail to improve.

ACE = angiotensin-converting enzyme.
Congestive Heart Failure

REFERENCES

11. ELITE II Study. 72nd Scientific Sessions of the American Heart Association, Atlanta, Ga.: Circulation 1999;100:IV-1,928.