

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.)

○ A patient information handout on managing congestive heart failure, written by the authors of this article, is provided on page 1600.

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on page 1483.

Congestive heart failure is the most common discharge diagnosis in patients older than 65 years.¹ The incidence of heart failure in patients older than 80 years is 9 percent.² Unfortunately, the prevalence of heart failure continues to rise and has resulted in an annual expenditure of \$10 billion for diagnosis and treatment.³ The average hospital stay for treatment of this disease is nine days,⁴ and the overall five-year mortality rate is 50 percent.¹

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.⁵ 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 decompensate 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

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.

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

TABLE 1
New York Heart Association Functional Classification of Congestive Heart Failure

Class	Characteristics
I	Patients with cardiac disease but without limitations of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, dyspnea or anginal pain.
II	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.
III	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.
IV	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.

Adapted with permission from Criteria Committee, New York Heart Association. Diseases of the heart and blood vessels. Nomenclature and criteria for diagnosis. 6th ed. Boston: Little, Brown, 1964:114.

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

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.^{6,7}

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-

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.^{8,9} 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.⁸

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 candesar-

tan (Atacand). The results of the Evaluation of Losartan in the Elderly (ELITE) I and II trials^{10,11} 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 3
Dosing of Angiotensin-converting Enzyme Inhibitors in Heart Failure

<i>Drug</i>	<i>Initial dosage (mg)</i>	<i>Targeted dosage</i>	<i>Maximal dosage</i>	<i>Hours until peak effect on blood pressure</i>
Captopril (Capoten)	6.25 to 12.5	50 mg three times daily	100 mg three times daily	1 to 2
Enalapril (Vasotec)	2.5 to 5	10 mg twice daily	20 mg twice daily	4 to 6
Fosinopril sodium (Monopril)	5 to 10	20 mg daily	40 mg daily	2 to 6
Lisinopril (Zestril)	2.5 to 5	20 mg twice daily	40 mg twice daily	2 to 6
Quinapril (Accupril)	5 to 10	20 mg twice daily	40 mg twice daily	2 to 4
Ramipril (Altace)	1.25 to 2.5	5 mg twice daily	10 mg twice daily	4 to 6

The Randomized Aldactone Evaluation Study (RALES) 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.¹² Daily use of this drug should be avoided because of the potential for severe hypokalemia and hyponatremia. 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.⁶ Patients may require only one dose every seven to 10 days to maintain their target weight.

SPIRONOLACTONE

The Randomized Aldactone Evaluation Study (RALES)¹³ 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 μ mol 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),¹⁴ metoprolol (Lopresor)¹⁵ and carvedilol (Coreg)¹⁶ 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.¹⁷ Digoxin should be used in cases of severe heart failure and should be considered in patients with moderate systolic heart failure

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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 study¹⁸ cited a twofold increase in hospitalizations for heart failure in elderly patients taking diuretics 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 demonstrate 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 attention. Up to 50 percent of patients are found to be noncompliant in following discharge instructions from a previous hospitalization.^{21,23} Many excellent heart failure protocols and critical pathways are available for use by home health nurses.²⁴

Although patients with heart failure have traditionally 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 appropriate exercise program.²⁶ Reevaluation by a cardiologist 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.

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 μ mol 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 μ mol 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.
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ACE = angiotensin-converting enzyme.

REFERENCES

1. Heart and Stroke Statistical Update. Dallas: American Heart Association, 1999.
2. Schocken DD, Arrieta MI, Leaverton PE, Ross EA. Prevalence and mortality rate of congestive heart failure in the United States. *J Am Coll Cardiol* 1992;20:301-6.
3. U.S. Department of Health and Human Services. Heart failure: evaluation and care of patients with left-ventricular systolic dysfunction. Rockville, Md.: Agency for Health Care Policy and Research, 1994; AHCPR publication no. 94-0612.
4. Graves EJ. Detailed diagnoses and procedures, National Hospital Discharge Survey, 1989. Hyattsville, Md.: National Center for Health Statistics, 1991.
5. Vinson JM, Rich MW, Sperry JC, Shah AS, McNamara T. Early readmission of elderly patients with congestive heart failure. *J Am Geriatr Soc* 1990; 38:1290-5.
6. Cohn JN. The management of chronic heart failure. *N Engl J Med* 1996;335:490-8.
7. Senni M, Redfield MM. Congestive heart failure in elderly patients. *Mayo Clin Proc* 1997;72:453-60.
8. ASHP therapeutic guidelines on angiotensin-converting-inhibitors in patients with left ventricular dysfunction. *Am J Health Syst Pharm* 1997;54:299-313.
9. Luzier AB, Forrest A, Adelman M, Hawari FI, Schertag JJ, Izzo JL. Impact of angiotensin-converting enzyme inhibitor underdosing on rehospitalization rates in congestive heart failure. *Am J Cardiol* 1998;82:465-9.
10. Pitt B, Segal R, Martinez FA, Meurers G, Cowley AJ, Thomas I, et al. Randomised trial of losartan versus captopril in patients over 65 with heart failure (Evaluation of Losartan in the Elderly Study, ELITE). *Lancet* 1997;349:747-52.
11. ELITE II Study. 72nd Scientific Sessions of the American Heart Association. Atlanta, Ga.: *Circulation* 1999;100:IA-VI,1-928.
12. Brater DC. Diuretic therapy. *N Engl J Med* 1998; 339:387-95.
13. Pitt B, Zannad F, Remme WJ, Cody R, Castaigne A, Perez A, et al. The effect of spironolactone on morbidity and mortality in patients with severe heart failure. *N Engl J Med* 1999;341:709-17.
14. The Cardiac Insufficiency Bisoprolol Study II (CIBIS-II): a randomised trial. *Lancet* 1999;353:9-13.
15. Merit-HF Study. 48th Annual Scientific Session of the American College of Cardiology, New Orleans, La. *J Am Coll Cardiol* 1999;33:1A-720A.
16. Packer M, Bristow MR, Cohn JN, Colucci WS, Fowler MB, Gilbert EM. The effect of carvedilol on morbidity and mortality in patients with chronic heart failure. U.S. Carvedilol Heart Failure Study Group. *N Engl J Med* 1996;334:1349-55.
17. The Digitalis Investigation Group. The effect of digoxin on mortality and morbidity in patients with heart failure. *N Engl J Med* 1997;336:525-33.
18. Heerdink ER, Leufkens HG, Herings RM, Ottervanger JP, Stricker BH, Bakker A. NSAIDs associated with increased risk of congestive heart failure in elderly patients taking diuretics. *Arch Intern Med* 1998;158:1108-12.
19. Francis GS. Calcium channel blockers and congestive heart failure. *Circulation* 1991;83:336-8.
20. Packer M, O'Connor CM, Ghali JK, Pressler ML, Carson PE, Belkin RN, et al. Effect of amlodipine on morbidity and mortality in severe chronic heart failure. Prospective Randomized Amlodipine Survival Evaluation Study Group. *N Engl J Med* 1996;335:1107-14.
21. Stewart S, Vandenbroek AJ, Pearson S, Horowitz JD. Prolonged beneficial effects of a home-based intervention on unplanned readmissions and mortality among patients with congestive heart failure. *Arch Intern Med* 1999;159:257-61.
22. Shah NB, Der E, Ruggerio C, Heidenreich PA, Massie BM. Prevention of hospitalizations for heart failure with an interactive home monitoring program. *Am Heart J* 1998;135:373-8.
23. Jaarsma T, Halfens RJ, Huijter-Abu Saad H. Readmission of older heart failure patients. *Prog Cardiovasc Nurs* 1996;11:15-20.
24. Barrella P, Della Monica E. Managing congestive heart failure at home. *AACN Clinical Issues* 1998; 9:377-88.
25. Belardinelli R, Georgiou D, Cianci G, Purcaro A. Randomized, controlled trial of long-term moderate exercise training in chronic heart failure: effects on functional capacity, quality of life, and clinical outcome. *Circulation* 1999;99:1173-82.
26. Coats AJ, Adamopoulos S, Radaelli A, McCance A, Meyer TE, Bernardi L, et al. Controlled trial of physical training in chronic heart failure. Exercise performance, hemodynamics, ventilation, and autonomic function. *Circulation* 1992;85:2119-31.
27. Baker DW, Hayes RP, Massie BM, Craig CA. Variations in family physicians' and cardiologists' care for patients with heart failure. *Am Heart J* 1999; 138:826-34.
28. Reis SE, Holubkov R, Edmundowicz D, McNamara DM, Zell KA, Detre KM, et al. Treatment of patients admitted to the hospital with congestive heart failure: specialty-related disparities in practice patterns and outcomes. *J Am Coll Cardiol* 1997;30:733-8.
29. Pilbin EF, Weil HF, Erb TA, Jenkins PL. Cardiology or primary care for heart failure in the community setting: process of care and clinical outcomes. *Chest* 1999;116:346-54.