Identifying and Treating Patients at High Risk for Heart Failure

Judith E. Mitchell, MD, FACC

Heart failure currently affects an estimated 4.9 million Americans and represents a significant mortality and morbidity burden in the United States. Heart failure is responsible for 265,000 US deaths and nearly 1 million hospitalizations annually,[1] with nearly 550,000 patients newly diagnosed with this condition each year. The 2001 American College of Cardiology and American Heart Association (ACC/AHA) heart failure guidelines emphasize the importance of the identification and treatment of patients with heart failure as well as those who are at high risk to develop heart failure due to the presence of certain comorbid conditions.[2] In addition to those with known left ventricular (LV) systolic dysfunction, millions of people have asymptomatic LV systolic dysfunction or are at high risk for developing heart failure. In the United States alone, an estimated 20 million people have asymptomatic LV systolic dysfunction and are likely to develop symptomatic heart failure within 1 to 5 years.[3] According to the recent ACC/AHA guidelines, additional populations at high risk for heart failure are patients with hypertension, coronary artery disease, or diabetes mellitus as well as patients using cardiotoxins or who have a family history of cardiomyopathy.[2] This article focuses on patients at high risk for developing heart failure. In reviewing these patient populations, the most recent treatment recommendations are discussed.

THE HEART FAILURE DISEASE CONTINUUM

The recent ACC/AHA guidelines emphasize the importance of identifying and treating heart failure risk factors as early in the heart failure disease process as possible. These guidelines identify 4 stages of heart failure: stages A, B, C, and D (**Table 1**). Patients in stages A and B do not qualify as patients with "traditional" clinical diagnoses of heart failure.[2] Stage A patients are in a "predisease state"—they are at high risk for developing heart failure but have no structural disorder of the heart and no symptoms of heart failure. The ACC/AHA guidelines classify Stage B patients as those who have LV dysfunction but have not developed symptoms of heart failure.[2]

Additionally, patients who have experienced a myocardial infarction, even if they have preserved LV function, are classified as Stage B patients. Stage C patients have past or current symptoms of heart failure associated with underlying structural heart disease. Stage D patients have end-stage heart disease that requires specialized treatment strategies.

This new heart failure classification system signals further progress in our understanding of the development of heart failure. Importantly, it emphasizes the fact that for at least some high-risk conditions, therapeutic interventions performed prior to the appearance of LV dysfunction or symptoms can reduce mortality and morbidity. As a progressive disease, heart failure will only worsen if adequate treatment is not employed. Unless the natural history of the heart failure disease process is slowed, arrested, or reversed (ie, reverse remodeling) with treatment, patients are expected to advance from one stage of heart failure to the next. In the new ACC/AHA staging system, once a patient develops symptoms (ie, stage C or D), that patient's "stage" can remain the same or progress; they cannot, however, revert to Stage B, emphasizing the progressive nature of the disease. Also, once symptomatic heart failure is present, it is more difficult to retard its progression. Evidence indicates that mean survival is only 1.7 years in men and 3.2 years in women after the onset of symptomatic heart failure.[4]

CONTROLLING RISK FACTORS FOR HEART FAILURE

The clinical suspicion of early heart failure should be raised in the presence of predisposing conditions recognized as risk factors for this disease.[5] Intervention should begin before patients show evidence of structural heart disease, with prevention as the goal. Treating hypertension, diabetes mellitus, and coronary artery disease as well as controlling vascular risk factors of

Dr. Mitchell is an assistant professor, Department of Medicine, and director, Heart Failure Center, State University of New York Health Science Center at Brooklyn, Brooklyn, NY.

Table 1. ACC/AHA Stages of Heart Failure

Stage	Description	Examples
A	Patients at high risk of developing HF because of the presence of conditions that are strongly associated with the development of HF. Such patients have no identified structural or functional abnormalities of the pericardium, myocardium, or cardiac valves and have never shown signs or symptoms of HF.	Systemic hypertension; coronary artery disease; diabetes mellitus; history of cardiotoxic drug therapy or alcohol abuse; personal history of rheumatic fever; family history of cardiomyopathy.
B	Patients who have developed structural heart disease that is strongly associated with the development of HF but who have never shown signs or symptoms of HF.	Left ventricular hypertrophy or fibrosis; left ventricular dilatation or hypocontractility; asymptomatic valvular heart disease; previous myocardial infarction.
C	Patients who have current or prior symptoms of HF associated with underlying structural heart disease.	Dyspnea or fatigue due to left ventricular systolic dysfunction; asymptomatic patients who are undergoing treatment for prior symptoms of HF.
D	Patients with advanced structural heart disease and marked symptoms of HF at rest despite maximal medical therapy and who require specialized interventions.	Patients who are frequently hospitalized for HF or cannot be safely discharged from the hospital; patients in the hospital awaiting heart transplantation; patients at home receiving continuous intravenous support for symptom relief or being supported with a mechanical circulatory assist device; patients in a hospice setting for the management of HF.

known atherosclerotic diseases (eg, of the coronary, cerebral, or peripheral blood vessels) can help control the risk of developing heart failure.

Many of these risk factors occur simultaneously, and treatment of each individual component is necessary to improve the ultimate clinical outcome. More than 85% of heart failure patients have antecedent hypertension or coronary artery disease, the two most common causes of heart failure.[6] Forty percent of heart failure patients have both hypertension and coronary artery disease.[6] Hypertension is also a significant independent risk factor for diabetes mellitus, and persons with both hypertension and diabetes mellitus are 2 to 4 times more likely to develop heart failure.[7] Hypertension is also correlated with insulin resistance, which predisposes patients not only to diabetes mellitus but also to cardiovascular disease.[8] According to Reaven and colleagues,[8] the sympathetic nervous system may be the link between insulin resistance and blood pressure. Other factors such as obesity, age, and dyslipidemia all contribute to insulin resistance and to heart failure. These factors may independently increase a person's risk of heart failure.[9]

Hypertension

The positive correlation between elevated systolic and diastolic blood pressure (SBP/DBP) and cardiovascular risk is well established. Today, 1 in 4 American adults have high blood pressure, which is defined as SBP 140 mm Hg or greater, DBP 90 mm Hg or greater, or taking antihypertensive medication.[10] Of those with blood pressure measurements that fit the established criteria of hypertension, approximately 32% are unaware that they have it. Among patients taking medication for hypertension, blood pressure is not adequately controlled in approximately 26%.[1] A significant proportion of cardiovascular disease occurs in persons with blood pressure greater than 120/80 mm Hg but not high enough for the patient to be diagnosed or treated as hypertensive. The JNC 7 report also emphasizes early detection of those patients who exist in a predisease state. In contrast to earlier reports, the JNC 7 created a new category designated "prehypertension." These patients, who have blood pressures in the 130–139/80–89 mm Hg range, are at twice the risk of developing hypertension compared to those with lower values.[10] In the general population, blood pressure tends to increase with age; with the aging of the population, the high incidence of heart failure in older persons suggests that our healthcare system will be severely taxed unless new strategies can be developed and implemented to prevent an epidemic.[11]

In the United States, American Indians and African Americans have higher rates of high blood pressure when compared to the general population. In fact, African Americans have among the highest prevalence of hypertension in the world.[1] Hypertension was described as the primary etiology of heart failure in blacks in several clinical trials, including the Studies of Left Ventricular Dysfunction (SOLVD) and the Vasodilator–Heart Failure Trial I (V-HeFT I).[12,13] The prevalence of hypertension in blacks enrolled in the SOLVD registry was 32% compared to 4% in whites.[12]

Controlling blood pressure has been shown in numerous studies to be effective in reducing the incidence of heart failure. In the Systolic Hypertension in the Elderly Program (SHEP) study, patients with a prior history of myocardial infarction and isolated systolic hypertension whose SBP was reduced with diuretic-based therapy to below 150 mm Hg had a 2% to 3% chance of developing heart failure within a 4-year period.[14] In contrast, patients who were treated with placebo had an 8% to 10% chance of developing heart failure. Like the SHEP trial, data from the Hypertension Optimal Treatment (HOT) trial showed that among patients treated with the calcium channel blocker felodipine (plus other agents), those who achieved a mean DBP of 82.5 mm Hg had the lowest incidence of major cardiovascular events such as nonfatal myocardial infarction. Because myocardial infarction is a major contributor to heart failure, these data reinforce the importance of lowering blood pressure in the prevention of heart failure. In this trial, the lowest overall risk of cardiovascular events occurred at a DBP of 86.5 mm Hg.[15]

A recent review of clinical trials indicates that patients with hypertension and diabetes mellitus require an average of 2.6 to 4.3 different antihypertensive medications to achieve target blood pressure goals.[16] The ACC/AHA guidelines state that drugs such as angiotensin-converting enzyme (ACE) inhibitors and β-blockers, which are useful for the treatment of both hypertension and heart failure, are preferred therapies for the at-risk hypertensive patient. Findings from a recent prospective study indicate that longstanding hypertension can cause increased neurohormonal activation and lead to early ventricular remodeling and a higher risk of post–myocardial infarction heart failure.[17] Antecedent hypertension in patients with prior myocardial infarction was associated with significantly higher levels of plasma neurohormones than was normal blood pressure.[17] The use of these agents is advisable because ACE inhibitors and β-blockers decrease neurohormonal activation and have been proven beneficial in the treatment of both hypertension and heart

failure and in the post–myocardial infarction patient with or without hypertension.

Data from the Heart Outcomes Prevention Evaluation (HOPE) trial support the importance of neurohormonal antagonism in treating patients with hypertension.[18] In this study, the reduction in blood pressure attributable to ramipril was modest (a fall of 3–4 mm Hg SBP and 1–2 mm Hg DBP). However, ramipril significantly reduced the rates of the composite outcomes of myocardial infarction, stroke, or death from other cardiovascular causes.[18] Similarly, data from the Fosinopril Versus Amlodipine Cardiovascular Events Randomized Trial (FACET) of patients with type 2 diabetes and hypertension found that those treated with fosinopril had a significantly lower risk of major cardiovascular events than those treated with amlodipine.[19] The Losartan Intervention For Endpoint reduction in hypertension (LIFE) trial demonstrated that both the angiotensin receptor blocker losartan and the β-blocker atenolol lower blood pressure and confer significant benefits in reducing cardiovascular morbidity and death in patients with essential hypertension.[20] With a similar reduction in blood pressure, losartan prevented more cardiovascular death and morbidity than atenolol. The recently completed Valsartan Antihypertensive Long-Term Use Evaluation (VALUE) trial showed that combined cardiac events, myocardial infarction, stroke, and mortality were almost identical in the valsartan and amlodipine group, but hospital admission for heart failure was significantly lower with valsartan when valsartan-amlodipine patient pairs were matched exactly for systolic blood pressure.[21]

The Antihypertensive and Lipid Lowering Treatment to Prevent Heart Attack Trial (ALLHAT) demonstrated that, even in moderately hypercholesterolemic hypertensive patients, statin use resulted in reduced risk of heart attack and stroke, although it did not reach statistical significance.[22] A number of small trials have shown that statins can decrease blood pressure.[23] The JNC 7[10] report and the National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATP III) report[24] recommend "fastidious" control of both blood pressure (≤ 140/90 mm Hg) and cholesterol levels. In patients who have asymptomatic LV dysfunction, recommended treatment includes ACE inhibitors and β-blockers. For those who have progressed to symptomatic disease, aldosterone blockers and loop diuretics should be added.

Insulin Resistance and the Metabolic Syndrome

Hypertension and insulin resistance put patients at high risk for diabetes mellitus, another condition that commonly precedes heart failure. Persons with diabetes

Table 2. Clinical Identification of the Metabolic Syndrome*

Risk Factor	Defining Level
Abdominal obesity	Waist circumference
Men	> 40 in (102 cm)
Women	> 35 in (88 cm)
Triglycerides	≥ 150 mg/dL (1.7 mmol/L)
HDL cholesterol	
Men	< 40 mg/dL (1 mmol/L)
Women	< 50 mg/dL (1.3 mmol/L)
Blood pressure	≥ 130/85 mm Hg
Fasting glucose	≥ 110 mg/dL (6.1 mmol/L)

Adapted from Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. Bethesda (MD): National Cholesterol Education Program, National Heart, Lung, and Blood Institute and National Institutes of Health; 2002:II–27. NIH publication no. 02-5215.

HDL = high-density lipoprotein.

*Identified by the presence of any 3 of the risk factors listed.

are 2 to 4 times more likely to develop heart disease than those without.[25] Hypertension and insulin resistance, along with abdominal obesity, atherogenic dyslipidemia, and prothrombotic and proinflammatory states, are factors characteristic of the metabolic syndrome.[24] The metabolic syndrome is defined by the presence of 3 or more of these risk factors (**Table 2**). It is estimated that 47 million Americans have the metabolic syndrome.[26] The metabolic syndrome is now recognized as a disease entity and a serious threat by the World Health Organization. It is an established and strong risk factor for premature and severe cardiovascular disease.[27] The prevalence of the metabolic syndrome increases from 7% among those 20 to 29 years of age to 43% among those 60 to 69 years of age.[1] The age-adjusted prevalence is similar for men and women; among African Americans, however, women have a 57% higher prevalence than men. Among Mexican Americans, women have a 26% higher prevalence than men.[1]

The ATP III report emphasizes the importance of treatment for the prevention of cardiovascular disease in patients with the metabolic syndrome.[24] Among the factors characteristic of the metabolic syndrome, hypertension, insulin resistance, and obesity are all associated with the activation of neurohormones such as the renin-angiotensin system and norepinephrine, which have been shown to increase the risk of cardiovascular events.[8] Despite the need to better understand the links among risk factors for heart failure, neurohor-

monal antagonists of both the renin-angiotensin system and the sympathetic nervous system are proven first-line therapies for hypertension and insulin resistance with hypertension, and current evidence-based treatment guidelines recommend ACE inhibitors and β-blockers for patients at risk of heart failure.

Diabetes Mellitus

The high prevalence of obesity in the United States and growing ethnic diversity help explain the increasing prevalence of type 2 diabetes mellitus.[9] Nearly 800,000 new cases of type 2 diabetes are diagnosed every year in the United States.[2] Today, approximately 13.9 million Americans have been diagnosed with diabetes, and it is estimated that another 5.9 million have undiagnosed diabetes.[9,26] Nearly 40% of patients newly diagnosed with diabetes mellitus are also hypertensive.[28] Furthermore, 67% of persons with diabetes mellitus die of some form of heart or blood vessel disease, and most of these deaths are due to complications of coronary artery disease.[29] Diabetes, hypertension, and coronary artery disease are common comorbidities, and the ACC/AHA guidelines classify diabetics as heart failure Stage A patients because diabetes mellitus significantly increases the risk of developing heart failure. Excess body fat and physical inactivity predispose one to type 2 diabetes, and several ethnic groups, including Hispanics, African Americans, Native Americans, and Asians, are especially susceptible to this disease.[9]

In large-scale clinical trials investigating heart failure, diabetic patients comprise approximately 25% of all patients.[30–33] In a recent prospective observational study of patients with acute decompensated heart failure, 44% had diabetes mellitus.[34] In a recent hospital registry study of patients admitted with heart failure that included a large proportion of minority patients (92% of patients were African American), an alarmingly high frequency of diabetes mellitus was found—nearly 50%.[35]

The Framingham Heart Study found heart failure to be twice as common in diabetic men and 5 times as common in diabetic women than in age-matched controls between the ages of 45 and 74 years.[36] In patients with diabetes mellitus, cases of heart failure almost doubled from 33 per 1000 in patients aged 45 to 55 years to 68 per 1000 in patients aged 55 to 64 years. Among diabetic patients between the ages of 65 and 74 years, the prevalence of heart failure is still higher—135 cases per 1000 patients.[36]

Recently, a large prospective analysis found that diabetic patients with no prior cardiovascular disease had the same long-term cardiovascular mortality and mor-

bidity as nondiabetic patients with established cardio-vascular disease.[37] These data are supported by another study investigating the incidence of heart failure in older subjects. In this study, diabetic patients were 1.3 times more likely to develop heart failure than those without diabetes (*P* < .0001).[38]

Although the link between diabetes mellitus and heart failure is well established, the pathophysiologic explanation for this comorbidity is less clear. Insulin resistance, hyperglycemia, and dyslipidemia as well as renin-angiotensin and sympathetic nervous system acti-vation have all been implicated in the pathogenesis of diabetic cardiomyopathies.[8,9,39] There is also pathologic and angiographic evidence that the high rate of coro-nary heart disease in diabetics may be the result of accel-erated atherosclerotic disease in this population.[29,40]

Control of hyperglycemia is a primary therapy in dia-betic patients.[2] In the UK Prospective Diabetes Study (UKPDS), glycemic levels were associated with a patient's risk for developing heart failure: for every 1% increase in HbA_{1c} levels, heart failure risk increased 12%.[41]

In the past, the use of β-blockade in patients with diabetes mellitus was of concern because these agents can mask hypoglycemia or make glucose more difficult to control.[42] However, metabolic studies evaluating the effects of vasodilating β-blockers (dilevalol, carvedilol, and celiprolol) on insulin sensitivity and atherogenic risk factors found that, unlike β-blockers without vasodilating properties, these agents did not decrease insulin sensitivity.[43] In fact, carvedilol has been shown to improve glucose and lipid metabolism and reduce lipid peroxidation, thereby offering potential advan-tages to patients with diabetes mellitus and hyperten-sion.[44] Additional studies indicate that adverse effects on carbohydrate and lipid metabolism and vasocon-striction often associated with β-blockade may be cir-cumvented by the use of carvedilol. In the Carvedilol Or Metoprolol European Trial (COMET), patients treated with carvedilol had a 22% risk reduction in new-onset diabetes when compared with those on metoprolol (*P* = 0.04) as well as a 17% risk reduction in mortality.[45] The recently published Glycemic Effects in Diabetes Mellitus: Carvedilol-Metoprolol Comparison in Hypertensives (GEMINI) trial reported that blood pressure–lowering therapy with the vasodilating β-blocker carvedilol did not adversely affect glycemic control in diabetic patients, unlike metoprolol tartrate. Whereas carvedilol had a neutral effect on mean HbA_{1c} levels, metoprolol significantly increased mean HbA_{1c} by 0.15%. Although insulin resistance nonsignif-icantly increased with metoprolol, it significantly de-creased with carvedilol, with a mean difference of 7.2%

between the treatment groups.[46]

Patients with diabetes and hypertension are also at risk for myocardial infarction. In the Diabetes Insulin Glucose in Acute Myocardial Infarction (DIGAMI) study of myocardial infarction in diabetic patients, heart failure was the most common cause of mortality.[42] Additionally, a recent study by Haffner et al[40] of more than 2000 subjects concluded that diabetic patients are at the same risk of heart failure as are patients who have had a myocardial infarction, and that diabetic patients should be treated as aggressively as post–myocardial infarction patients to prevent heart failure.

β-Blockers, ACE inhibitors, aspirin, and statins all have been shown to help reduce the incidence of car-diovascular events in people with diabetes mellitus.[29] In the UKPDS trial, hypertensive patients with type 2 dia-betes were treated with either captopril or atenolol.[28] Investigators reported that tight control of blood pres-sure led to substantially fewer myocardial infarctions, deaths, strokes, and microvascular disease in this pa-tient population. Improvements in these outcomes were seen in the β-blocker and ACE inhibitor treat-ment groups.[28] The ACC/AHA guidelines recommend treating diabetic patients with ACE inhibitors and β-blockers.[2] These guidelines state that long-term treat-ment with ACE inhibitors has been shown to lower the likelihood of cardiovascular death, myocardial infarc-tion, and heart failure as well as decrease the risk of renal disease in diabetic patients.[2] Because ramipril was shown to have a significantly beneficial effect on the composite endpoint of myocardial infarction, stroke, or death from cardiovascular causes in the HOPE trial, the ACC/AHA recommends this agent in particular for the treatment of patients with diabetes mellitus.[2,18]

A number of studies have shown that statin use in persons with diabetes reduces cardiovascular risk. These findings were recently supported by a meta-analysis of diabetes subgroups in several large studies examining both primary and secondary prevention of cardiovascular events.[47] Based on this evidence review, the American College of Physicians has issued guide-lines recommending that adults with type 2 diabetes and either diagnosed coronary artery disease or car-diovascular risk factors receive statin therapy.[48]

Coronary Artery Disease

Persons with coronary artery disease and those with previous myocardial infarction are in heart failure stages A and B, respectively, and thus are at risk of developing symptomatic heart failure. People with pre-vious myocardial infarction are at particular risk when factors such as multivessel coronary artery disease,

Optimum Drug Choices Without Compelling Indication*		Optimum Drug Choices With Compelling Indication*	
Stage 1 hypertension[†]	Stage 2 hypertension[‡]	Heart failure	Post–myocardial infarction
• Start with thiazide diuretic monotherapy • May add ACEI, ARB, BB, CCB if additional BP lowering is necessary	• Thiazide-type diuretic plus ACEI, ARB, BB, or CCB)	• Start with BB plus ACEI • Add ARBs, AAs, or loop diuretics if additional BP control is needed	• Start with ACEI, BB, or AA • Add agents if additional BP control is needed

Figure. Preferred therapy for persons at high risk for heart failure. AA = aldosterone antagonist; ACEI = angiotensin-converting enzyme inhibitor; ARB = angiotensin receptor blocker; BB = β-blocker; BP = blood pressure; CCB = calcium-channel blocker. *In patients without contraindications to particular antihypertensive drug classes. [†]Systolic BP 140–159 mm Hg or diastolic BP 90–99 mm Hg. [‡]Systolic BP ≥ 160 mm Hg or diastolic BP ≥ 100 mm Hg. (Based on recommendations from Chobanian AV, Bakris GL, Black HR, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report [published erratum appears in JAMA 2003;290:197]. National Heart, Lung, and Blood Institute Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, National High Blood Pressure Education Program Coordinating Committee. JAMA 2003;289:2560–72.)

decreased LV contractile reserve, and hypertension are present.[17,49] In the setting of acute myocardial infarction,[17] prompt treatment is critical, and "time is muscle" is the mantra. The use of percutaneous coronary intervention or thrombolytics in appropriate patients experiencing acute myocardial infarction can reduce the risk of progression to heart failure.

Administered shortly after an acute myocardial infarction, ACE inhibitors and/or β-blockers can decrease risk of reinfarction or death.[50] Results from the Survival and Ventricular Enlargement (SAVE) study suggest that the combination of ACE inhibition and β-blockade may produce complementary benefits in post–myocardial infarction patients with asymptomatic LV systolic dysfunction.[51] The Carvedilol Post-Infarct Survival Control in Left Ventricular Dysfunction (CAPRICORN) trial, a prospective, randomized, placebo-controlled trial of almost 2000 patients, showed the benefits of carvedilol on top of ACE inhibition in patients with a proven acute myocardial infarction and LV ejection fraction less than 40%.[52] In this study, carvedilol reduced all-cause mortality by 23%, nonfatal myocardial infarction by 41%, and the combined endpoint of all-cause mortality or nonfatal myocardial infarction by 29%. Carvedilol also decreased the risk of sudden death by 26%.[52]

According to the ACC/AHA guidelines, if no contraindication to β-blockade exists, β-blocker therapy is indicated for most patients with coronary artery disease who have a history of myocardial infarction. Furthermore, ACE inhibition improves survival in post–myocardial infarction patients who have coronary artery disease but normal LV ejection fraction and no clinical heart failure.[49,50] The ACC/AHA guidelines emphasize the importance of treating post–myocardial infarction patients with ACE inhibitors and β-blockers. Even prior to publication of the new ACC/AHA guidelines, the consensus recommendations for the management of heart failure recommended that ACE inhibitors be used in patients with LV systolic dysfunction even when they do not have symptoms of heart failure.[3]

The recommendations for patients with a history of myocardial infarction but preserved LV function are similar. Hypertension and hyperlipidemia should be treated vigorously, and ACE inhibitors and β-blockers should be used in these patients because they have been shown to reduce the risk of death.[2]

Statin therapy has an important role in the prevention of adverse outcomes in patients with heart disease. A meta-analysis of all pre-1997 randomized, placebo-controlled statin trials for primary and secondary coronary heart disease prevention found reductions in all-cause mortality (24%) and nonfatal myocardial infarction (33%).[53] The MRC/BHF Heart Protection Study, which included 8510 patients with average baseline low-density lipoprotein (LDL) cholesterol levels of 131 mg/dL and a history of myocardial infarction (not necessarily recent), reported that in this subgroup, 40 mg daily of simvastatin for 5 years resulted in a 24% reduction in the combined end point of coronary heart disease death or nonfatal reinfarction.[53] Cardiovascular benefits occurred even in patients with LDL

Optimum Drug Choices With Compelling Indication *(continued)*			
High risk for coronary heart disease	Diabetes mellitus	Chronic kidney disease	Recurrent stroke prevention
• Start with diuretic, BB, ACEI, or CCB • Add agents if additional BP control is needed	• Start with ACEI or ARB • Add diuretic, carvedilol, or CCB	• Start with ACEI or ARB • Add BB therapy and other agents if additional BP control is needed	• Start with diuretic or ACEI • Add BB therapy and other agents if additional BP control is needed

Figure. (*continued*)

cholesterol levels below 116 mg/dL, independent of other medications including β-blockers, ACE inhibitors, and aspirin. The Myocardial Ischemia Reduction with Aggressive Cholesterol Lowering (MIRACL) study demonstrated that the early initiation of treatment with a statin after an acute coronary syndrome can reduce the reoccurrence of ischemic events. In this setting, lipid-lowering therapy with 80 mg daily of atorvastatin reduced recurrent ischemic events in the first 16 weeks (mostly recurrent symptomatic ischemia requiring rehospitalization).[54] The use of statins in patients with acute coronary syndrome, hypertension, or diabetes appears to be beneficial. Evidence suggests that statin therapy may provide a beneficial cardioprotective effect even in certain groups of patients with seemingly "normal" lipid levels.

It has been demonstrated that aspirin and other antiplatelet agents administered after myocardial infarction decrease the incidence of recurrent myocardial infarction, stroke, or vascular death, regardless of age, sex, blood pressure, or presence of diabetes mellitus. The use of implantable cardiac devices (ICDs) for primary prevention of sudden cardiac death in patients with established heart failure has grown considerably over the past few years as the volume of clinical evidence pointing to a clear mortality benefit continues to mount. However, there is currently no role for ICD use in the prevention of heart failure in patients at a high risk for this disease. Preferred therapy for the various groups of patients at a high risk for heart failure is presented in the **Figure**.

CONCLUSION

Hypertension, insulin resistance, diabetes mellitus, and coronary artery disease put patients at high risk for heart failure. However, the pathophysiologic processes and mechanisms behind the progression of risk factors for heart failure are not yet fully understood. The negative physiologic effects of the renin-angiotensin system and sympathetic nervous system in cardiovascular disease progression have been established, and recent clinical trials show that ACE inhibitors and β-blockers have significant and positive effects in reducing heart failure disease progression. ACE inhibition and β-blockade are deemed necessary and important therapies for high-risk patients with hypertension, diabetes mellitus, and/or post–myocardial infarction. In addition, statins are proving to be cardioprotective in the high risk patient. New guidelines for the identification and management of heart failure reflect the importance of early identification and appropriate treatment of these high-risk patients in order to curb the heart failure epidemic.   **HP**

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