# Assessment and Management of Heart Disease Related to Complex Care of Older Adults

**Deborah A. Chyun, PhD, RN, FAHA**
**Associate Professor, College of Nursing, New York University**

**Jessica Coviello, MSN, APRN**
**Yale University School of Nursing, Adult Advanced Practice Program**

**Sharon A. Stephen, PhD, RN, GNP-BC**
**Legacy Health System Geriatric Medicine, Good Samaritan Hospital**
**Portland Oregon**

This module is:


Reviewed and endorsed by
The National Gerontological Nursing Association (NGNA),
May 2007. http://www.ngna.org

## Background

### Demographics of Hypertension

Cardiovascular disease (CVD), which includes hypertension (HTN) and heart failure (HF), along with coronary heart disease (CHD), stroke, arrhythmias, peripheral vascular disease (PVD) and valvular heart disease are major contributors to mortality and morbidity in the elderly, accounting for 40 percent of all deaths in those aged seventy-five to eighty-five and 48 percent of all deaths in those eighty-five and older (Thom, et al., 2006 [Level VI]). Almost one out of three adults has HTN; it is more common in women over the age of fify-four and among African Americans. Although control of HTN has improved over the past decade, target blood pressure goals are often not achieved in the elderly (Thom, et al., 2006 [Level VI]). Untreated or under-treated HTN strongly increases the risk of other comorbidities such as stroke, myocardial infarction (MI), HF, end-stage renal disease and dementia. Treatment of HTN in the elderly for five years is estimated to prevent nineteen cases of dementia for each one thousand cases (Forette, et al., 1998 [Level II]). The incidence of HTN increases with age. The Framingham Heart Study showed that subjects younger than sixty years of age had a 26.9 percent incidence of HTN, while those between sixty and seventy-nine years had a 58 percent incidence, and those eighty or older had a 70.9 percent incidence (Lloyd-Jones, Evans, & Levy, 2005 [Level IV]). And despite the increase in incidence of HTN with advancing age, there was no corresponding increase in the percentage of those receiving treatment, suggesting that HTN is under-treated in the elderly.

Untreated or under-treated HTN leads to left ventricular hypertrophy (LVH), which is an important marker for adverse cardiac outcomes. The presence of LVH increases with age. In those seventy years and older, LVH occurs in 33 percent of men and 49 percent of women.

### Etiology of Hypertension

HTN is not an inevitable consequence of aging. However, there are age-related changes in the cardiovascular system associated with HTN. For example, changes within the walls of the blood vessels can cause arterial wall stiffness leading to HTN. With increasing age the aorta enlarges and there is a decrease in compliance. Increased systemic vascular resistance, increased systolic blood pressure (SBP), decreased diastolic blood pressure (DBP) and a widened pulse pressure result, thus leading to an age-associated increase in left ventricular (LV) mass. Increased LV mass places an increased mechanical demand upon the heart. The pulse pressure is determined by the interaction between the direct effect of ventricular ejection and the elastic properties of the large arteries. After age sixty, SBP continues to rise while DBP decreases creating a wide pulse pressure. Data from the Framingham Heart Study show that CHD risk increases at any level of SBP greater than or equal to 120 mm Hg. Neither SBP nor DBP was superior to pulse pressure in predicting risk (Franklin, et al., 1997 [Level IV]). Increased vascular stiffness also disrupts blood pressure regulation, making the elderly more sensitive to changes in preload and afterload and hampering their ability to adapt to small increases or decreases in plasma volume. Thus, orthostatic hypotension is a common problem in the elderly. Factors such as low sodium levels, rapid postural changes, urination or defecation and medications used to treat HTN or HF can lead to orthostatic hypotension.

A variety of genetic and environmental factors contribute to the development of HTN among older adults, including diet, physical inactivity, toxins and psychosocial

factors (Appel, et al., 2006 [Level IV]). In addition, older adults, especially those with isolated systolic HTN, often have concomitant diseases and impaired target-organ function including reductions in renal, hepatic and cardiac function. Arthritis is a common comorbidity in this age group and may be treated with non-steroidal anti-inflammatory agents (NSAIDS). In multiple clinical trials, NSAIDS are associated with statistically significant increases in blood pressure of three to six mm Hg which may explain increases in CVD event rates (Johnson, 1997 [Level IV]).

Of all of the changes in blood pressure with age, orthostatic hypotension is one of the most dangerous. With little warning, older adults may or may not experience symptoms associated with sudden drops in blood pressure with changes in position. Comorbidities, such as diabetes mellitus (DM), blunt the postural symptoms of lightheadedness or dizziness associated with standing when the blood pressure drops as a result of changes in position (orthostatic hypotension). Symptoms of lightheadedness may be delayed or absent altogether, thus giving no signal or warning of an impending fall. Falls to the floor do occur from unrecognized or untreated orthostatic hypotension.

In older adults, orthostatic hypotension is a result of several factors associated with aging. In healthy young patients, muscle contraction increases venous return to the heart and prevents blood from pooling in the lower extremities. The autonomic nervous system responds to changes in position by constricting veins and arteries and increasing heart rate and cardiac contractility. Several potential causes of orthostatic hypotension in the older adult include medications, non-neurogenic causes such as impaired venous return, hypovolemia and impaired cardiac contractility as well as multi-system atrophy and diabetic neuropathy. Like HTN, orthostatic hypotension is readily detected on physical assessment by measuring postural vital signs. Orthostatic hypotension can coexist with elevated blood pressure. Thus, in practice, the nurse may have a patient with a systolic blood pressure of 190/60 supine and 170/50 standing, diagnostic for both orthostatic hypotension and systolic HTN.

**Demographics of Heart Failure**

HF is a major public health problem, affecting more than five million Americans and responsible for most hospital admissions in the elderly (Thom, et al., 2006 [Level VI]). The prevalence of HF increases with age; more than 75 percent of those affected are older than sixty-five. Development of HF is associated with the male sex, lower level of education, low levels of physical activity, cigarette smoking, obesity, DM, HTN, valvular heart disease, LVH and CHD (Ho, Pinsky, Kannel, & Levy, 1993 [Level IV]). A majority of individuals (75 percent) with HF have antecedent HTN (Thom, et al., 2006 [Level VI]). Both the incidence and prevalence of HF will continue to rise as our population ages.

The presence of multiple comorbidities among older adults, such as DM, renal dysfunction and liver disease, along with age-related physiologic changes complicate the assessment and management of both HTN and HF. DM is a potent contributor to HF; women with DM and individuals treated with insulin are at high risk for HF. In elderly Medicare patients with DM, 22 percent had a diagnosis of HF, becoming more prevalent with increasing age (Bertoni, et al., 2004 [Level IV]). In addition, the presence of DM is associated with higher HF-related morbidity and mortality. After MI or coronary revascularization procedures, individuals with DM have a high morbidity and mortality, partly due to the development of HF. In elderly Medicare patients in the year following

MI, 11 percent of patients without DM, 17 percent of patients with DM on oral agents and 25 percent of those treated with insulin were admitted for HF (Chyun, et al., 2002 [Level IV]). Older age, female gender, insulin treatment, previous MI, coronary artery bypass graft surgery, renal insufficiency, HTN, low left ventricular ejection fraction or clinical HF are all associated with an increased risk of subsequent HF admission. (Chyun, et al., 2002 [Level IV]; Lewis, et al., 2003 [Level II]).

**Etiology of Heart Failure**

Atherosclerotic CHD is the most common etiology of HF in the US, followed closely by HTN alone and valvular disease. Thyroid dysfunction and excessive alcohol intake may also lead to HF. Abnormalities in contractile function (systolic dysfunction) and filling (diastolic dysfunction) may result from myocardial ischemia. It is important to consider the possibility of asymptomatic or silent ischemia or infarction as a cause of HF, particularly in the elderly, who tend to present atypically with CHD. These patients may benefit from myocardial revascularization (angioplasty or coronary artery bypass surgery) and anti-ischemic medications, including nitrates and beta-blockers. HF is frequently seen with acute MI, as well as during long-term follow-up after acute coronary syndromes.

In patients without CHD, HTN is the most common cause of HF, accounting for 24 percent of the cases of HF (Ho, Pinsky, Kannel, & Levy, 1993 [Level IV]). In addition, HTN is common in type 2 DM, occurring in 40-60 percent of these individuals (Hypertension in Diabetes Study Group, 1993 [Level IV]). Women with DM are at extremely high-risk of developing HF (Levy, Larson, Vasan, Kannel, & Ho, 1996 [Level IV]). Individuals with HTN and DM often develop HF despite normal systolic function (ejection fraction > 40 percent) (Piccini, Klein, Gheorghiade, & Bonow, 2004 [Level V]).

Older adults diagnosed with HTN and/or HF often experience geriatric syndromes as a direct consequence of their cardiac disease or from the treatment effects. Consider this case in point: a seventy-year-old female newly diagnosed with isolated systolic HTN that is managed with an oral diuretic such as hydrochlorothiazide (HCTZ). Typically she consumes little oral fluids during the day, and after two weeks of treatment she complains of dizziness and a recent fall. When seen in the ambulatory clinic for HTN management, she is found to have orthostatic hypotension. As a result of the diuretic use, this older adult is at risk for orthostatic hypotension, fluid disturbances, additional falls and other geriatric syndromes (for more information visit www.ConsultGeriRN.org and select Geriatric Topics related to falls, urinary incontinence and hydration management) if not re-assessed for these problems. Table 1 outlines some common comorbidities and treatment effects of HTN and HF associated with geriatric syndromes.

Pre-existing comorbidities such as plasma volume depletion from fluid loss or dehydration, Parkinson's disease and numerous medications can accentuate orthostatic hypotension. Orthostatic hypotension is easy to recognize, and treatment is important to avoid additional geriatric syndromes such as falls.

Other preexisting comorbidities of concern for the older adult with HTN and HF include valvular regurgitation and obesity, which can contribute to LVH. The presence of LVH is associated with reductions in coronary blood flow, lethal ventricular arrhythmias and systolic and diastolic dysfunction, all of which may lead to myocardial ischemia, sudden cardiac death and HF.

Additionally, lower socioeconomic status, older age, the female sex, longer diabetes duration, insulin use, poorer glycemic control, higher serum creatinine and the presence of diabetes-related comorbidities, particularly nephropathy, have been linked with an increased risk of HF in individuals with DM (Nichols, Erbey, Hillier, & Brown, 2001 [Level IV]; Bertoni, et al., 2004 [Level IV]; Bibbins-Domingo, et al., 2004 [Level IV] ; Iribarren, et al., 2001 [Level IV]; Stratton, et al., 2000 [Level IV]). In very elderly patients in a long-term healthcare facility, 39 percent of those with DM developed HF compared to 23 percent of those without diabetes (Aronow & Ahn, 1999 [Level IV]). Treatment of HF in the very elderly in nursing homes has been shown to be lacking both in terms of underutilization and improper utilization of medications (Litaker & Chou, 2003 [Level VI]). Thus, HF, HTN and DM frequently coexist particularly in the very elderly.

Decreases in valve circumference and mild valvular calcification, while common in the elderly do not cause HF; however, more severe calcification may lead to critical aortic stenosis, occurring in approximately 9 percent of older adults. Degenerative calcific changes of the mitral or tricuspid valves are also common and can lead to HF. Chronic obstructive pulmonary disease (COPD) contributes to right ventricular dysfunction that can lead to biventricular dysfunction and HF.

In the absence of CVD, systolic function of the heart remains relatively unchanged in the elderly. However, diastolic function is often impaired in the elderly, even in the absence of other CVDs such as HTN, CHD or hypertrophic cardiomyopathy. Isolated diastolic dysfunction does not generally precipitate HF, but diastolic dysfunction caused by HTN, aortic stenosis or CHD often leads to HF. Diastolic dysfunction is characterized by an exaggerated heart rate with activity, which may be the first sign. Similarly, HTN, CHD and hypertrophic cardiomyopathy are exacerbated by tachycardia. Thus, avoiding high heart rates in all elderly individuals is important.

Healthy older adults generally have a normal exercise tolerance that is preserved with diastolic dysfunction. One of the ways to distinguish between systolic and diastolic HF is that activity tolerance is not compromised in diastolic HF to the extent that it is in systolic HF. Fatigue that limits exercise and weakness triggered by performing physical activities are common symptoms in systolic HF.

Cardiomyopathies (CM)—dilated, hypertrophic and restrictive—are also important contributors to HF in the elderly. Dilated CM is more common in the elderly than previously recognized, and the elderly appear to have a worse prognosis than younger patients. Older patients with dilated CM are less likely to be referred for heart transplantation compared to younger patients with dilated CM.

History of previous MI is an important risk marker for older adults. The literature supports the observation that older age has consistently been associated with poorer long-term outcomes—death and recurrent MI and HF—following MI (Chyun, et al., 2002 [Level IV]). Prognostic factors for development of death, recurrent MI and HF after discharge in the elderly include increasing age, prior HF, MI, PVD, stroke, renal insufficiency, DM, and CABG, poorer mental status, presence of HF, lower SBP and higher HR and serum potassium levels, poorer EF, Q-wave MI, and HF during hospitalization and use of nitrates and diuretics at discharge. The medical record of elderly patients hospitalized for MI or HF should be carefully assessed for these comorbidities and complications as they provide important prognostic information and

may signal the need for closer follow up and increased support following hospital discharge.

**Health Promotion and Risk Reduction**

**Levels of Prevention**

Older adults diagnosed or at risk for either HTN or HF benefit from primary and secondary levels of preventative intervention. Nursing intervention for primary prevention includes obtaining a thorough history and review of systems related to the cardiovascular system. Previous elevations of blood pressure or presence of the new onset of other diseases (such as HF or DM) are critical to obtain during the health history**.** For older adults diagnosed with HTN, orthostatic hypotension or HF, the health history is directed at monitoring symptoms, sitting and standing blood pressure measurements and periodic cardiovascular assessment. Screening for hypertension is critical; although side effects of pharmacotherapy are common, serious events are rare and current recommendations re-affirm the benefits of screening (Wolff & Miller, 2007 [Level V]). The initial health screening may include diagnostic tests such as an ECG, chest x-ray and pertinent labwork (fasting lipid panel and glucose, complete blood count and comprehensive metabolic profile that includes electrolytes and baseline renal and hepatic functioning). Refer to the American Geriatric Society or the American Medical Directors Association [AMDA] for Clinical Practice Guidelines for Heart Failure.

**Risk Reduction**

Given the significance of the diagnosis of HTN and/or HF in older adults and the association of certain comorbidities such as DM, the aim of a routine health history and physical examination is to detect HTN, HF and their comorbidities early. There is value in assessing height and weight and screening for obesity so that plans of care can be directed at weight reduction if necessary. In addition, all individuals should be asked about their smoking history and whether they are still smoking. Unfortunately, smoking cessation counseling is least effective during health-screening programs and when part of a multifactorial secondary prevention program, but quitting smoking is promoted when a health professional such as a nurse advises smoking cessation (Rice, 2006 [Level I]).

Although age-related changes in diastolic function are usually not enough to cause overt HF, the presence of other comorbidities may contribute to the development of HF. Recently, the importance of HF prevention has been highlighted and major and minor clinical risk factors have been identified (Schocken, et al., 2008 [Level VI]). Major clinical risk factors include: older age; male sex; hypertension; LVH; myocardial infarction; diabetes mellitus, valvular heart disease; and obesity.

**Assessment**

The nursing assessment of the older adult with heart disease such as HTN or HF begins with a thorough health history and review of systems followed by a physical examination. The nurse is mindful that the diagnostic criteria for HTN, orthostatic hypotension and HF include the following parameters:

**Parameters for a Diagnosis of HTN:**

Blood pressure is classified according to four stages in adults eighteen and older: 1) Normal, < 120/80 mm Hg; 2) Pre-hypertension, SBP 120-139 or DBP 80-89 mm Hg; 3) Stage 1 HTN, SBP 140-159 or DBP 90-99 mm Hg; and 4) Stage 2 HTN, SBP $\geq$ 160 or DBP $\geq$ 100 mm Hg. The diagnosis of HTN depends on two or more properly measured seated BP readings on each of two or more office visits using the mean value (Chobanian, et al., 2003 [Level VI]).

**Parameters for a Diagnosis of HF:**

The diagnosis of HF is made based on clinical symptoms. The gold standard since 1964 has been to classify the severity of HF using the New York Heart Association functional classification that includes Classes I through IV. Recently the American Heart Association and the American College of Cardiology proposed a new classification system that categorizes HF into stages (A through D); these stages guide evidenced-based treatments (Hunt, et al., 2005 [Level VI]).

The New York Heart Association functional classification identifies functional limitations. Class I includes patients with cardiac disease but without resulting limitations of physical activity; Class I patients are asymptomatic. Class II includes patients with cardiac disease resulting in a slight limitation in physical activity. These individuals are comfortable at rest; however, ordinary physical activity results in fatigue, palpitations, dyspnea or angina. Class III includes patients with cardiac disease resulting in marked limitations of physical activity; patients in Class III are comfortable at rest, but less than ordinary activity causes fatigue, palpitations, dyspnea or angina. Class IV includes patients with cardiac disease resulting in inability to carry on any physical activity without discomfort; patients in Class IV have symptoms of HF or angina continuously, even at rest.

The American College of Cardiology/American Heart Association Task Force (ACC/AHA) guidelines classify HF in four stages (Hunt, et al., 2005 [Level VI]). In Stages A and B individuals are not actually in HF, but are at high risk of developing HF. Stage A includes individuals with HTN, atherosclerotic disease, DM, obesity or metabolic syndrome; those using cardiotoxic substances; or those with a family history of cardiomyopathy. Stage B includes individuals with previous MI, LVH, low ejection fraction and symptomatic valvular disease. Stage C includes individuals with known heart disease and symptoms—shortness of breath, fatigue and reduced exercise tolerance. Stage D includes individuals with refractory HF requiring the use of specialized interventions and patients with marked symptoms at rest despite maximal medical therapy.

**Health History for Older Adults with HTN and HF:**

Assessment of the individual with HTN is aimed at assessing lifestyle and CVD risk factors, causes of HTN, presence or absence of end-organ damage (heart, brain, kidneys, PVD, retinopathy) and coexisting CVD (Chobanian, et al., 2003 [Level VI]).

The nursing assessment in individuals with both HTN and HF should identify the patient's response to treatment, which can then be used to assist the individual in subsequent management of symptoms and the underlying condition, health promotion and disease prevention activities and chronic disease management. Awareness of the patient's own perception of why they sought medical care and a detailed analysis of the symptoms will assist in assessing both the patient's and caregiver's ability to identify

symptoms, their knowledge regarding their heart condition, its prognosis and general health beliefs, along with their prior ability to manage their medical conditions.

Knowledge of the past medical history will help to anticipate problems related to other conditions, as their presence may complicate assessment and management of HTN and HF. Cardiac risk factors, levels of physical activity and control of lipids, HTN, obesity, DM and smoking need to be determined. The presence of DM may necessitate monitoring of blood glucose; renal and liver disease may affect pharmacodynamics; anemia may affect oxygenation; and COPD may necessitate special precautions when assessing and managing oxygen therapy and beta-blockers. Assessment of regular physical activity and functional status is critical, as is nutritional status. Undernourishment or malnutrition, common in the elderly, may contribute to impaired cardiac function, making it vital that nutritional deficiencies be identified early and corrected.

Current prescription and over-the-counter medications should be assessed, along with any alternative therapies. Many elderly who are eligible for aspirin, beta-blockers and angiotensin-converting enzyme (ACE) inhibitors do not receive these medications, despite the important role that these agents have in reducing CHD-related morbidity and mortality. Medications to treat HTN and lipid abnormalities may not be well tolerated and the potential for side effects and drug interactions is increased in the setting of polypharmacy.

Psychosocial factors, personal beliefs and behaviors and environmental and cultural influences all contribute to management of chronic disease. The importance of depression and social support has been well documented in the elderly; therefore these factors need to be assessed.

HTN or HF may be detected routinely through community screening or a visit to a provider, as well as on presentation to the acute care setting with the individual in hypertensive crisis or overt HF or pulmonary edema. HF may also result from symptomatic or asymptomatic MI. The clinical presentation of HF may include a variety of symptoms reflective of pulmonary congestion and decreased cardiac output. Important health history aspects to include and/or observe during the health encounter are:

- Difficulty in breathing
- Shortness of breath at rest or with talking
- Dyspnea on exertion
- Tachypnea (respiratory rate of twenty-six breaths per minute or more at rest)
- Orthopnea/paroxysmal nocturnal dyspnea
- Fatigue, weakness and a decrease in exercise tolerance
- Swelling in feet, ankles and legs (edema) or ascites
- Weight gain
- Weakness, dizziness or lightheadedness (presyncope)
- Disrupted sleep from nocturia or paroxysmal nocturnal dyspnea

**Physical Examination of Older Adults with HTN:**

The presence of HTN requires careful measurement of SBP and DBP, a procedure that is often performed haphazardly. A variety of environmental factors can influence BP determination, therefore the room should be of a comfortable temperature, the patient as relaxed as possible and a five minute rest taken before the first reading; clothing that

covers the area where the cuff will be placed should be removed and the individual should be seated comfortably, with legs uncrossed and the back and arm supported; the middle of the cuff on the upper arm should be level with the right atrium (Pickering, et al., 2005 [Level VI]). The initial BP reading should be taken in both arms. Proper cuff size is critical to obtaining an accurate measurement, as many individuals are obese with large arm circumference; bladder length should be 80 percent of the arm circumference and width at least 40 percent. The midline of the bladder should be placed above the brachial artery, 2 to 3 cm above the antecubital fossa, where the artery should have first been palpated. When using the auscultatory method, which remains the gold standard for blood pressure measurement, palpating the radial pulse first while inflating the cuff will identify the point at which the pulse disappears. For the subsequent auscultatory measurement, the cuff should then be inflated to at least 30 mmHg above this point. The rate of deflation is also extremely important with a rate of 2 to 3 mmHg second recommended. The first and last audible sounds are the SBP and DBP respectively. Two readings, taken five minutes apart, should be averaged and if there is greater than 5 mm Hg difference, additional readings should be obtained.

Pseudohypertension is a phenomenon resulting from non-compressibility of thickened arteries and, if not recognized, will result in the recording of falsely high BP when indirect methods are used. This tendency for peripheral arteries to become rigid with aging may result in a need to increase cuff pressure in order to compress the artery. This is common in the elderly, particularly in men or those with HTN or stroke. If suspected, an intra-arterial reading is the most accurate way to determine blood pressure. The elderly are also more likely to exhibit white-coat HTN, where the blood pressure is elevated in the presence of a healthcare worker with pressures greater than 140/90 mm Hg, while an ambulatory reading is usually lower. Isolated systolic HTN is also common in the elderly and is defined by a SBP greater than or equal to 140 and DBP less than 90 mm Hg. Therefore, assessment of the blood pressure not only requires careful attention to technique, but consideration of the physiologic abnormalities associated with aging. Standing blood pressure should also be assessed because orthostatic hypotension is common in the elderly. Orthostatic hypotension is diagnosed when the SBP falls by at least 20 mm Hg or the DBP by 10 mm Hg within three minutes after a change in position. Older adults with comorbidity and who may be frail often require assistance with transitioning from a supine position to a sitting position; this is especially true if orthostatic hypotension is present. Additional assistance during postural maneuvers may be necessary to prevent a fall.

Nursing assessment entails accurate measurement of height, weight and waist circumference and assessment of apical and peripheral pulses along with absence or presence of edema. Body mass index (BMI) is then computed from the height and weight. Measurement of oxygen saturation is important to include when obtaining vital signs in patients with HF. An ECG is performed during baseline assessment and may be repeated in response to symptoms such as chest pain, dyspnea, syncope or palpitations. The ECG is also useful in detecting LVH; however, echocardiography is a more sensitive measure for LVH. In addition, serial measures such as fasting blood glucose and lipid profile, hematocrit, serum electrolytes, creatinine, calcium and urinalysis may be requested. In addition, because the elderly are prone to abnormalities in thyroid function,

they should have baseline thyroid studies (TSH) due to the association of several cardiac disorders with thyroid dysfunction.

**Physical Examination of the Older Adult with HF:**

It is quite possible that during the physical examination, the older adult with HF may become increasingly fatigued with multiple changes in position. Therefore, efforts must be made to prevent fatigue. Limiting the frequency in which the patient position is changed is one strategy. Another technique is to take time between positional changes while continually re-assessing the older adult for symptoms of compromise. The physical examination findings consistent for HF include the following:

- Hepatomegaly/splenomegaly
- Jugular venous distention (JVD)
- Hepatojugular reflux
- Basilar crackles, bronchospasm and wheezing
- Presence of S3 or S4 gallop; heart murmur
- Displaced apical impulse
- Elevated heart rate and blood pressure
- Pulses alterans
- Cool extremities
- Peripheral edema

The clinical presentation of HF may be atypical in the elderly and often the diagnosis is difficult. In the patient with diastolic HF, there is an increased resistance to passive filling of the ventricles during early diastole or relaxation. In contrast, there is a decrease in the contractility of the heart in systolic HF. Both the high ventricular filling pressure and the poor pumping ability of the heart can lead to pulmonary congestion and diminished cardiac output resulting in a similar presentation of both diastolic and systolic HF. However, it is important to distinguish the two, as management is influenced by the type of dysfunction present. Dyspnea may be absent, and although the presence of peripheral edema and basilar rales are common findings in younger patients with HF, they are unreliable diagnostic signs in the elderly. With a low cardiac output and decrease in perfusion to the periphery and other organs the patient may present with a gangrenous extremity, confusion or worsening dementia. Cognitive impairment, memory and attention deficits and slowed motor response times and difficulties with problem solving are common in elderly individuals with HF, probably resulting from cerebral infarction and/or cerebral hypoperfusion (Bennett & Sauve, 2003 [Level VI]; for additional information visit www.ConsultGeriRN.org and select Geriatric Topics: Delirium and Dementia). In addition, gastrointestinal symptoms such as anorexia, early satiety, postprandial hypotension, abdominal fullness and fatigue during meals are common in elderly patients with HF. In advanced HF with restricted cardiac output, patients may have symptoms of mesenteric ischemia following meals. Elderly patients on warfarin may develop an unexplained elevation in their ProTime due to hepatic congestion signaling worsening of their HF prior to development of overt symptoms.

With increasing disability related to HF and cachexia, elderly patients are prone to decubiti, making skin assessment imperative and prevention of decubiti a high priority. Baseline assessment of cardiac and respiratory function, including heart rate and rhythm,

blood pressure, heart and lung sounds and peripheral perfusion is essential. Neurological assessment is often overlooked; however, changes in heart rate and rhythm, a decrease in cardiac output and side effects of cardiac medications may cause significant changes in mental status. Initial laboratory evaluation of older patients presenting with symptoms of HF should include complete blood count, urinalysis, serum electrolytes including calcium and magnesium, blood urea nitrogen, serum creatinine, fasting blood glucose, glycosylated hemoglobin A1c, lipid profile, liver function tests and thyroid stimulating hormone. B-type natriuretic peptide (BNP) can be useful in the evaluation of symptomatic patients presenting in the urgent care setting in whom the clinical diagnosis of HF is uncertain. Review of diagnostic tests results is important. Electrolyte abnormalities are common in the elderly, particularly in individuals on chronic diuretic therapy. Anemia is frequently observed and may contribute to hypoxia and myocardial ischemia. Cardiac enzymes assist in determining the presence of acute MI.

An ECG and chest x-ray (PA and lateral) should be performed on all patients presenting with symptoms of HF. A baseline ECG is vital so that ST and T waves, axis changes, prolongation in PR, QRS and QT intervals can be assessed in response to medications and ongoing myocardial ischemia. Two-dimensional echocardiography with Doppler should be performed during the initial evaluation to assess left ventricular ejection fraction, LV size, wall thickness and valve function. Radionuclide ventriculography may be performed to assess ventricular volumes, left ventricular ejection fraction and myocardial perfusion abnormalities. Cardiac catheterization is recommended in patients presenting with symptoms of HF who have angina or significant myocardial ischemia or who have known, suspected or are at high-risk for CHD. However, cardiac catheterization may be deferred in patients who are not eligible for revascularization (e.g., end-stage renal disease).

Holter monitoring may be considered in patients presenting with HF who have a history of MI and/or syncope and are being considered for an electrophysiology study to document inducibility of ventricular tachycardia. In addition, other candidates for electrophysiology include those with a left ventricular ejection fraction of 30 percent or less with a wide QRS complex (greater than 0.12 milliseconds). Patients who meet the criteria may receive a dual chamber pacemaker in combination with an automatic implantable defibrillator in order to prevent sudden death from arrhythmia, as well as improve left ventricular function (Hunt, et al., 2005 [Level VI]).

**Management of older adults with HTN and HF**

The primary goal in the treatment of HTN is attaining a blood pressure of less than 140/90 mm Hg, or in individuals with DM or chronic kidney disease, of less than 130/80 mm Hg. The use of home blood pressure monitoring in older adults is advocated (Pickering, et al., 2008 [Level V]). Both lifestyle interventions and medications are often required. In individuals with HF, prior MI, high CHD risk, DM, chronic kidney disease or stroke, a variety of anti-hypertensive drugs (diuretics, ACE inhibitors, angiotensin-receptor blockers [ARBs], beta-blockers or calcium channel blockers) may be used. In individuals without these conditions, in stage one HTN, thiazide diuretics are recommended, while for those individuals with stage two HTN, a two-drug combination is usually required. Recent evidence suggests that beta-blockers should not be considered

first-line therapy in older adults in the absence of HF or CHD (Khan & McAlister, 2006 [Level I]), diuretics may be especially effective in the elderly (Kostis, et al., 2005 [Level II]), as well as in African Americans (Wright, et al., 2005 [Level II]). Dosages and additional drugs are added until the blood pressure goal is reached, however, in the elderly lower initial doses may be required to avoid symptoms and orthostatic hypotension (Chobanian, et al., 2003 [Level VI]). Lifestyle modifications can contribute to blood pressure reduction and include weight reduction to a BMI of less than 25 $kg/m^2$; adoption of Dietary Approaches to Stop Hypertension (DASH) eating plan; sodium restriction to 2.4 grams per day; increases in physical activity to at least thirty minutes per day, most days of the week; and limiting alcohol consumption to a maximum of two drinks per day (Appel, et al., 2006: [Level VI]; Chobanian, et al., 2003 [Level VI]; Cook, et al., 2007 [Level II]). A 4 to 8 percent decrease in body weight is associated with a 3 mm Hg reduction in SBP and DBP (see Cochrane review). However, weight reduction in the very old has been associated with an increased risk of death and hip fractures (Ensrud, et al., 2003). The management of obesity in the very old remains a conundrum, and data are desperately needed to guide the practice of making lifestyle recommendations in this vulnerable population.

Initial goals in the acute management of HF are to alleviate symptoms, improve oxygenation and circulation and correct the underlying causes of the HF. Longer term goals are to improve exercise tolerance and functional capacity, reduce hospital readmission rates and decrease mortality. The management of HF follows standard American College of Cardiology/American Heart Association Task Force (ACC/AHA) recommendations, including intensive treatment of coexistent HTN, CHD and renal disease (Hunt, et al., 2005 [Level VI]). Importantly, optimal treatment of HTN is critical to both the prevention and treatment of HF. Although the blood pressure level at which medication should be started is still debated (Chobanian, et al., 2003 [Level VI]), the blood pressure should be reduced to below 130/80 mm Hg. However, this recommendation may need to be individualized in very old patients since there is no data on treatment of HTN in the oldest cohort and for those living in nursing facilities.

There are key prognostic indicators of four-year mortality for older adults diagnosed with HF. Patients with renal dysfunction, pulmonary disease, a BMI of less than 25 $kg/m^2$, diabetes, HTN and cancer, as well as those who continue to smoke have a greater risk of mortality when coupled with a decrease in functional status. Those with a functional deficit in activities of daily living (difficulty bathing, managing finances, walking several blocks or pushing or pulling heavy objects) coupled with one or more of the above are at greater risk for mortality. A chart review and history during hospitalization should then include not only the standard accepted cardiac risk factors but also the key indicators as listed above. Detecting these additional prognostic indicators can aid in developing interventions that can improve quality of life and survival (Lee, et al., 2006 [Level IV]). Goals for therapy should include reaching target goals for blood pressure, fasting blood sugar, hemoglobin A1c, cholesterol and HF therapy through the use of evidence-based standards of care.

In Stage A HF, HTN and lipid disorders are treated, and smoking cessation and regular exercise are encouraged. Metabolic syndrome is controlled, and use of alcohol intake and illicit drug use is discouraged. ACE inhibitors or ARBs are used to treat patients with vascular disease and those with DM. In Stage B, these same interventions

are employed, with ACE inhibitors, ARBs and beta-blockers used in select patients. In Stage C, dietary sodium restriction is added to this regimen, and diuretics prescribed to treat fluid retention. In Stage C, ACE inhibitors and beta-blockers are prescribed unless they are contraindicated. Some patients will be treated with aldosterone antagonists, ARBs, digitalis and hydralazine/nitrates. Patients with arrhythmias may require a pacemaker or implantable defibrillators. In Stage D, referral to palliative care/hospice may be indicated for symptom management and to provide end-of-life care. Extraordinary measures such as heart transplantation, chronic inotrope therapy, permanent mechanical support and experimental drugs or surgery are considered in Stage D. In patients with advanced age, extraordinary measures may be offered with a palliative goal instead of a curative one. The nurse has an important role in assisting the individual and their caregivers in understanding the disease process and treatment goals, including end-of-life care.

Open and honest discussion regarding the chronic, progressive nature of HF must begin early in the disease process since the natural history of HF involves declining physical as well as psychological functioning. Although depression is commonly seen in the elderly, as well as individuals with CVD, there are few studies that have addressed this important problem in the elderly with HF (Lane, et al., 2006 [Level I]). As pharmacotherapy and behavioral interventions have demonstrated effectiveness, all older individuals should be screened for depression and treated appropriately. Early discussions related to the goals of care, and advanced directives with frequent revisiting of patient understanding of the disease course and patient preferences as the illness progresses ensures patient participation in decision making. This is best done utilizing a multidisciplinary team approach where not only the caregivers and the patient/family unit are involved but also a spiritual and/or a psychological representative.

The benefits of the multidisciplinary team to provide care to HF patients have been discussed for the last several years. In most cases, this has been related to the use of the team approach to help keep patients stable in order to prevent hospital readmissions (Barrella, et al., 1998 [Level VI]; Inglis, Pearson, Treen, Gallasch, Horowitz, & Stewart, 2006 [Level II]; Kwok, Lee, Woo, Lee, & Griffith, 2008 [Level II]; Naylor, et al., 1994 [Level II]). Comprehensive transitional care interventions have been shown not only to reduce costs and cardiac outcomes, but also to have a beneficial effect on hospitalization for comorbid conditions (Naylor, et al., 2004 [Level II]). In the case of the patient with advanced HF, a multidisciplinary team approach across the continuum of care is cost-effective because patients are matched with the services that they need and desire, thus reducing fragmentation and duplication of care (Coviello, et al., 2002 [Level VI]).

Treatment of elderly persons with HTN, even those aged 80 or older (Beckett, et al., 2008 (Level II]), has been shown to reduce CVD morbidity and mortality (Mulrow, et al., 2006 [Level I]) related to HTN, as well as to HF (Dulin & Krum, 2006 [Level VI]). An important nursing consideration is monitoring for adverse effects of medications used to manage HF, as well as HTN, along with patient and caregiver education. ACE inhibitors are important in the management of systolic HF and may also be helpful in diastolic failure. In the Heart Outcomes Prevention Evaluation (HOPE) Study, ACE inhibitors prevented cardiac events in high-risk patients without HF or known low ejection fractions (HOPE Investigators, 2000 [Level II]). In addition, ACE inhibitors have a renal protective benefit that is extremely important in preventing the development

or worsening of HF, especially in patients with DM. Recent evidence suggests that use of ACE inhibitors is associated with a larger lower extremity muscle mass, which may have benefit in wasting syndromes and prevention of disability (Di Bari, et al., 2004 [Level IV]). These agents have been particularly efficacious in the elderly (Wing, et al., 2003 [Level II]). ARBs are also used widely for the prevention and treatment of HF, particularly when patients are unable to tolerate ACE inhibitors due to the development of cough (Brenner, et al., 2001 [Level II]; Lindholm, et al., 2002 [Level II]). Renal function and hyperkalemia should be assessed when using both classes of agents, especially in the presence of underlying renal dysfunction.

Beta-blockers are useful in the management of diastolic HF due to their negative chronotropic effect, thereby decreasing heart rate and increasing time for diastolic filling. Beta-blockers have been shown to be beneficial in the treatment of systolic HF, where they are usually begun after acute symptoms have resolved and initiated at low doses. Use of beta-blockers in combination with ACE inhibitors has demonstrated both an improvement in left ventricular ejection fraction and functional capacity once titrated to tolerance. Although beta-blockers may potentially worsen insulin resistance and mask hypoglycemia in individuals with DM or aggravate orthostatic hypotension in the elderly, these agents have been shown to contribute to improved outcomes. Therefore, careful monitoring and treatment for side effects is required.

Diuretics are used in both systolic and diastolic HF to relieve congestive symptoms by promoting the excretion of sodium and water and by decreasing cardiac filling pressures, thereby decreasing preload. They should be used cautiously with diastolic dysfunction, where maintaining an adequate cardiac output is heavily preload dependent, in order to avoid syncope, falls and confusion. When diuretics are used, serum potassium levels should be monitored due to an increased risk of hyperkalemia with potassium-sparing agents and of hypokalemia with loop diuretics. Loop diuretics may be useful for patients who are volume sensitive or who have a tendency to retain fluid because of renal impairment. Aldosterone antagonists prevent hypokalemia resulting from loop diuretics; however, serum potassium levels should be monitored due to an increased risk of hyperkalemia, compounded when ACE inhibitors are used. Recent evidence suggests that many individuals, particularly African Americans, may still require potassium supplementation (Cavallari, et al., 2004 [Level IV]). In addition, dehydration is an important problem in the elderly taking diuretics and appears to be an even greater concern in African Americans (Lancaster, Smiciklas-Wright, Heller, Ahern, & Jensen, 2003 [Level IV]), making assessment of hydration status an important nursing priority.

Use of diuretic agents increase the risk for sudden loss of urinary control (urinary incontinence) in older adults, a very common, potentially reversible geriatric syndrome (for more information visit www.ConsultGeriRN.org and select Try This: Urinary Incontinence Assessment). Practice with an older adult population requires frequent monitoring and detection of symptoms related to the onset of urinary incontinence, which is often signaled by symptoms of urinary frequency, urgency or nocturia. These symptoms may actually be present in the older adult from other coexisting comorbidities. Nocturia develops in patients with heart disease because increases in vascular return when supine can precipitate a need to get up more frequently at night to urinate. With nocturia comes the possibility of the older adult incurring a nighttime fall. Pre-existing

comorbidities such as visual impairment or osteoarthritis of the hip and knees make timing and distance to the bathroom facilities a factor in the prevention of nighttime falls. Overall, management considerations for the older adult with heart disease and the new development of urinary incontinence or falls include re-evaluation of medication regimen, activity tolerance considerations and the use of additional adaptive aides to minimize the risk of falls. Use of a nighttime urinal or bedside commode, frequent toileting rounds and reduction of nighttime fluids all are possible solutions.

Digoxin increases contractility and decreases heart rate. It is not used routinely with diastolic HF; however, it may be useful in those patients with persistent symptoms despite diuretic and ACE inhibitor therapy. The most common indication for digoxin is in patients who have atrial fibrillation. Assessment should be made for digoxin toxicity as well as for interactions with quinidine, amiodarone, verapamil and vasodilators; hypokalemia should be avoided. Other medications that have a positive inotropic effect are dopamine and dobutamine. Both of these drugs can improve contractility and subsequent cardiac output, however, they also increase myocardial oxygen demand. Amrinone and milrinone are phosphodiesterase inhibitors that have been shown to be beneficial in the management of the hospitalized patient with HF, providing a positive inotropic effect, as well as vasodilation.

Vasodilators are also useful in the treatment of systolic and diastolic failure through reduction in afterload and preload. As with diuretics, they should be used cautiously in those with diastolic HF. The combination of hydralazine and isosorbide reduces both preload and afterload, relieving symptoms and improving exercise tolerance. This combination is commonly used when patients do not tolerate ACE therapy. In addition, recent studies have shown that the combination of hydralazine and isosorbide is more effective in reducing morbidity and mortality in African Americans (Taylor, et al., 2007 [Level II]). Morphine sulfate, often used in an emergent situation, also has a peripheral vasodilating effect and is useful with pulmonary edema or in patients with breathlessness at end-of-life.

Patients and caregivers need to understand the warning signs of HF and recurrent MI such as chest pain or chest pressure, shortness of breath, indigestion, nausea, dizziness, palpitations, confusion, weakness and weight gain. A rehearsed plan for obtaining immediate medical attention should be developed. This is especially important if the elderly person lives alone; a “medical alert” system may be helpful. The medication regimen is often complex and confusing, necessitating the assessment of the understanding and ability to take the medications as prescribed. The need to maintain certain cardiac medications (beta-blocker, nitrates and antiarrhythmics) is vital since abruptly stopping them can be dangerous. All medications should be reviewed with the patient and their caregivers, stressing desired effects, common side effects and possible interactions with over-the-counter medications (for more information visit www.ConsultGeriRN.org and select Geriatric Topics: Medication). The nurse needs to review what to do if medications are accidentally omitted or become too costly to maintain. Long-term management of HF requires a multidisciplinary team approach; the pharmacist contributes to improving medication adherence and safety (Phillips, et al., 2004 [Level I]). Furthermore, even though many older individuals with HF, particularly women, are debilitated, exercise training has been shown to improve functional ability

(McKelvie, et al., 2002 [Level II]; Piepoli, et al., 2004 [Level I]; Rees, et al., 2006 [Level I]).

The prevention and treatment of HF in patients with DM requires optimal management of coexistent HTN, CHD and left ventricular dysfunction. Poorly controlled HTN, tachycardia, atrial fibrillation, active myocardial ischemia,and volume overload can all potentially exacerbate HF especially in the context of DM, and these conditions need to be avoided (Piccini, Klein, Gheorghiade, & Bonow, 2004: [Level VI]; Zile & Brutsaert, 2002 [Level VI]). The presence of DM makes aggressive blood pressure control, sodium restriction and diuretics even more important in symptomatic individuals (Piccini, Klein, Gheorghiade, & Bonow, 2004 [Level VI]). In addition, control of hyperglycemia is an important issue, as the presence of HF affects the choice of medications selected to treat type 2 DM. Although insulin and insulin secretagogues are considered safe for use in individuals with HF, metformin and thiazolidinediones are not recommended in individuals with moderate-to-severe HF, although recent data suggest that they may lower the risk of death (Masoudi, et al., 2005 [Level IV]). Decreased clearance of metformin in individuals with HF due to hypoperfusion or renal insufficiency can lead to potentially dangerous lactic acidosis. Thiazolidinediones are sometimes associated with fluid retention, pedal edema and weight gain, particularly when used in conjunction with insulin, and occasionally contribute to HF; however, this is relatively infrequent, usually occurring with higher doses, concomitant insulin treatment or active HF (Nesto, et al., 2004 [Level VI]; Tang, Francis, Hoogwerf, & Young, 2003 [Level IV]). Therefore these agents are not recommended in New York Heart Association functional class three and four HF. Careful clinical assessment prior to initiation of thiazolidinediones, lower doses with slow dose escalation and careful ongoing monitoring should be implemented when these drugs are used in the presence of known structural heart disease or a prior history of HF.

The rapid expansion of knowledge about cardiac disorders in the elderly has added to the challenge of providing competent care for a vulnerable group of patients with complex regimens. The presence of comorbidities contributes to the complexity of care. Non-pharmacological interventions, such as exercise training and relaxation may improve physical symptoms and quality of life (Yu, Lee, Woo, & Hui, 2007 [Level II]; Kozac, et al., 2007 (Level I]). There is a growing body of intervention studies that are using technology to improve adherence to prescribed treatments, improve quality of life and reduce unplanned hospitalization (Chaudhry, et al., 2007 [Level V]). A nurse-delivered telephone intervention was effective in reducing hospital admissions and improving quality of life; nurses provided education, counseling and monitoring of symptoms in outpatients with chronic HF (GESICA investigators, 2005 [Level II]). Senior nursing students delivered a telephone intervention to patients with HF under the supervision of community nursing staff and demonstrated a positive effect on quality of life and number of HF symptoms (Wheeler & Waterhouse, 2006 [Level III]). A trial is in process that tests the effectiveness of a tailored message targeted for a patient's race and gender and delivered via a computerized program to improve provider's adherence to national guidelines, patient-provider interaction, health-related quality of life and patient satisfaction (Bennett, Litzelman, Wright, et al., 2006 [Level III]). Interventions that employ the latest technology offer advantages such as efficiency, automation and safety; however, the receptiveness of elderly individuals to technology-based interventions needs

to be evaluated. Nursing presence has been described as an integral component of a successful community-based case management program for older patients with heart failure (Anderson, 2007 [Level IV]). In addition, family caregivers of patients with HF have many needs for information and support (Saunders, 2003 [Level VI]).

Table 1 Geriatric Syndromes Associated with the Management of HTN/HF

| **Treatment Used** | **Effect** | **Geriatric Syndrome(s)** |
|---|---|---|
| Diuretic medication | involuntary loss of urine | new urinary incontinence |
| | volume depletion | dehydration; delirium |
| | | electrolyte imbalance |
| | volume depletion + orthostatic hypotension | falls |

Table 2 Some Comorbidities Contributing to Orthostatic Hypotension in Older Adults

Comorbidity/condition:

- Parkinson's disease
- Type 2 diabetes mellitus
- Volume depletion (dehydration)
- Medications (diuretics, vasodilators)
- Autonomic dysfunction

Appendix A Levels of Evidence Cited:

Level I:

Appel, L.J., Brands, M. W., Daniels, S. R., Karanja, N., Elmer, P. J., & Sacks, F. M. (2006).
Cook, N.R., Cutler, J.A. Obarzanek, E. Buring, J.E., Rexrode, K.M., Kumanyika, S.K., Appel, L.J., Whelton, P.K. for the Trials of Hypertension Prevention Collaborative Research Group. (2007).
Gonseth, J., Guallar-Castillon, P., Banegas, J. R., & Rodriguez-Artajo, F. (2004).
Khan, N., & McAlister, F.A. (2006).
Kozac, A.T, Rucker-Whitaker, C., Basu, S., Mendes de Leon, C.F., Calvin, J.E., Grady, K.L., Richardson, D., Powell, L.H. (2007).
Lane, D.A., Chong, A.Y., Lip, G.Y.H. (2006).
Mulrow, C., Lau, J., Brand, M. (2006).
Phillips, C. O., Wright, S. M., Kern, D. E., Singa, R. M., Shepperd, S., & Rubin, H. R. (2004).
Piepoli, M. F., Davos, C., Francis, D. P., Coats, A., & Collaborative, E. (2004).
Rees, K., Taylor, R. S., Singh, S., Coats, A. J. S., & Ebrahim, S. (2006).
Wolff, T., & Miller, T. (2007).

Level II:

Beckett, N.S., Peters, R., Fletcher, A.E., Stassen, J.A., Liu, L., Dumitrascu, D., Stoyanovsky, V., Antikainen, R.L., Nikitin, Y., Anderson, C., Belhani, A., Forette, F., Rajkumar, C., Thijs, L., Banya, W., Bulpitt, C.J., for the HYVET Study Group. (2008).
Brenner, B. M., Cooper, M. E., de Zeeuw, D., Keane, W. F., Mitch, W. E., Parving, H., et al. (2001).
Cook, N.R., Cutler, J.A. Obarzanek, E. Buring, J.E., Rexrode, K.M., Kumanyika, S.K., Appel, L.J., Whelton, P.K. for the Trials of Hypertension Prevention Collaborative Research Group. (2007)
Forette, et al. (1998).
The HOPE Investigators. (2000).
Inglis, S.C., Pearson, S., Treen, S., Gallasch, T., Horowitz, J.D., & Stewart, S. (2006).
Johnson, A. G. (1997).
Inglis, S.C., Pearson, S., Treen, S., Gallasch, T., Horowitz, J.D., & Stewart, S. (2006)
Kostis, J. B., Wilson, A. C., Freudenberger, R. S., Cosgrove, N. M., Pressel, S. L., & Davis, B. R. (2005).
Kwok, T., Lee, J., Woo, J., Lee, T.F., & Griffith, S. (2008).
Lewis, E. F., Moye, L. A., Rouleau, J. L., Sacks, F. M., Arnold, J. M., Warnica, J. W., et al. (2003).
Lindholm, L. H., Ibsen, H., Borch-Johnsen, K., Olsen, M. H., Wachtell, K., Dahlof, B., et al. (2002).
McKelvie, R. S., Teo, K. K., Roberts, R., McCartney, N., Humen, D., Montague, T., et al. (2002).

Appendix A continued

Naylor, M., Brooten, D., Campbell, R.L., Maislin, G., McCauley, K.M., Schwartz, J.S. (2004).
Naylor, M., Brooten, D., Jones, R., Lavizzo-Mourey, R., Mezey, M., Pauly, M. (1994).
Taylor, A.L., Ziesche, S., Yancy, C.W., Carson, P., Ferdinand, K., Taylor, M., et al. (2004).
Taylor, A.L., Ziesche, S., Yancy, C.W., Carson, P., Ferdinand, K., Taylor, M., et al. (2007).
Wing, L.M., Reid, C.M., Ryan, P., Beilin, L.J., Brown, M.A., Jennings, G.L., et al. (2003).
Wright, J. T. J., Dunn, J. K., Cutler, J. A., Davis, B. R., Cushman, W. C., Ford, C. E., et al. (2005).
Yu, D.S., Lee, D.T., Woo, J., & Hui, E. (2007).

Level III:

Level IV:

Bertoni, A. G., Bonds, D. E., Hundley, W. G., Burke, G. L., Massing, M. W., & Goff, D. C. (2004)
Cavallari, L. H., Fashingbauer, L. A., Beitelshees, A. L., Groo, V. L., Southworth, M. R., Viana, M. A. G., et al. (2004).
Di Bari, M., van de Poll-Franse, L. V., Onder, G., Kritchevsky, S. B., Newman, A., Harris, T. B., et al. (2004).
Franklin, et al., (1997).
Ho, K. K., Pinsky, J. L., Kannel, W. B., & Levy, D. (1993).
Hypertension in Diabetes Study Group. (1993).
Lancaster, K. J., Smiciklas-Wright, H., Heller, D. A., Ahern, F. M., & Jensen, G. (2003).
Lee, S.J., Lindquist, K., Segal, M.R., Covinsky, K.E. (2006).
Lloyd-Jones, D., Evans, J. C., & Levy, D. (2005).
Masoudi, F. A., Inzucchi, S. E., Wang, Y., Havranek, E. P., Foody, J. M., & Krumholz, H. (2005).
Tang, W. H., Francis, G. S., Hoogwerf, B. J., & Young, J. B. (2003).

Level V:

Aronow, W. S., & Ahn, C. (1999).
Bibbins-Domingo, K., Lin, F., Vittinghoff, E., Barrett-Connor, E., Hulley, S. B., Grady, D., et al. (2004).
Chaudhry, S.I., Phillips, C.O., Stewart, S.S., Riegel, B.J., Mattera, J.A., Jerant, A.F., Krumholz, H.M. (2007).
Chyun, D., Vfdaccarino, V., Murillo, J., Young, L., & Krumholz, H. (2002).
Iribarren, C., Karter, A. J., Go, A. S., Ferrara, A., Liu, J. Y., Sidney, S., et al. (2001).
Levy, D., Larson, M. G., Vasan, R. S., Kannel, W. B., & Ho, K. K. (1996).
Appendix A continued

Nichols, G. A., Erbey, J. R., Hillier, T. A., & Brown, J. B. (2001).

Pickering, T.G., Miller, N.H., Ogedegbe, G., Krakoff, L.R., Atrinian, N.T., and Goff, D. (2008).
Stratton, I. M., Adler, A. I., Neil, H. A., Matthews, D. R., Manley, S. E., Cull, C. A., et al. (2000).

Level VI:

Barrella, P., & Monica, E.D. (1998)
Bennett, S. J., & Sauve, M. J. (2003).
Chobanian, A. V., Bakris, G. L., Black, H. R., Cushman, W. C., Green, L. A., Izzo, J. L., et al. (2003).
Coviello, J.S., Borges, L.H., Masulli, P.S. (2002).
Dulin, B.R., & Krum, H. (2006 ).
Hunt, S. A., Abraham, W. T., Chin, M. H., Feldman, A. M., Francis, G. S., Ganiats, T. G., et al. (2005).
Litaker, J. R., & Chou, J. Y. (2003).
Nesto, R. W., LeWinter, M., Bell, D., Bonow, R. O., Semenkovich, C. F., Fonseca, V., et al. (2004).
Piccini, J. P., Klein, L., Gheorghiade, M., & Bonow, R. O. (2004).
Pickering, T. G., Hall, J. E., Appel, L. J., Falkner, B. E., Graves, J., Hill, M. N., et al. (2005).
Schocken, D.D., Benjamin, E., Fonarow, G.C., Krumholz, H.M., Levy, D., Mensah, G.A., Narula, J., Shor E.S., Young, J.B., & Hong, Y. (2008).
Thom, T., Haase, N., Rosamond, W., Howard, V. J., Rumsfeld, J., Manolio, T., et al. (2006).
Zile, M. R., & Brutsaert, D. L. (2002).

Appendix B Web-based Resources

www.ConsultGeriRN.org

Try This Assessment Series:
- Medication
- Urinary Incontinence Assessment

Need Help STAT:
- Multiple Medications

Geriatric Topics:
- Falls
- Hydration Management

American Heart Association Council on Cardiovascular Nursing: available online at www.myamericanheart.org.

Preventive Cardiovascular Nurses Association: available online at: www.pcna.net. Additional information available at www.learn.gwtg.americanheart.org.

American Association of Heart Failure Nurses: available online at www.aahfn.org.
- Failure is Not an Option campaign
- Patient education modules

The University of Iowa College of Nursing Evidence-based Practice Guidelines: order sheets available online at www.nursing.uiowa.edu/centers/gnirc/rtdcore.htm. This site could not be found
- Assessing Heart Failure in Long Term Care Facilities

Practice Guidelines from American Medical Directors Association (AMDA): available online at www.amda.com.
- Dehydration and Fluid Management

- HeartFailure

Appendix C  Examples of Teaching Pedagogies for Hypertension/Heart Failure in Older Adults

| Content Area/Topic | Recommended Pedagogy |
|---|---|
| Recognize risk for comorbidities associated with HF, e.g., fluid overload | Review accompanying case study with students, then break into small groups to discuss case, asking students to identify and list important subjective information needed from the patient<br>Interview hospitalized older adult to determine total fluid and sodium intake over a 24 hour period of time; calculate intake and output; calculate amount of free water from various food sources.<br>Estimate intake and output over 24 hour period.<br>Identify sources of sodium naturally occurring in foods<br>Meet with dietician to determine a meal plan for an older adult receiving a 1200 cc fluid restrictive diet<br>Perform daily weights of a patient with HF: weigh at different points in time during an 8 hour shift, compare and analyze differences and identify the best time of day for obtaining daily weights.<br>Review the chart to determine patient's dry weight.<br>Review/teach older adult key signs and symptoms of fluid overload.<br>Assess where patient usually retains excess fluid (e.g., feet, legs, abdomen, sacral region, lungs).<br>Discuss meal provisions with family caregiver and patient upon discharge. |

Appendix C  Examples of Teaching Pedagogies for Hypertension/Heart Failure in Older Adults

| Content Area/Topic | Recommended Pedagogy |
|---|---|
| Identify health promotion strategies for the primary prevention of hypertensive heart disease in community residing older adults. | Visit a community based senior center that offers counseling on primary prevention interventions to:<br><br>Screen a cohort of older adults for high blood pressure by performing routine blood pressure testing.<br><br>Review with older adult the factors that raise blood pressure and contribute to HTN.<br><br>Prepare written documentation about HTN for distribution to older adults.<br><br>Teach the end-organ effects of HTN to a cohort of older adults.<br><br>Identify web-based and community resources/referrals for older adults with HTN.<br><br>Teach/review with an older adult the basic procedures for self-checking blood pressure and monitoring blood pressure at home. Develop a log for recording blood pressures.<br><br>Develop a checklist of primary prevention strategies to review with the older adult at risk for HTN. |

References

Appel, L. J., Brands, M. W., Daniels, S. R., Karanja, N., Elmer, P. J., & Sacks, F. M. (2006). Dietary approaches to prevent and treat hypertension. *Hypertension, 47*, 296-308. Evidence Level I: Systematic Review.

Aronow, W. S., & Ahn, C. (1999). Incidence of heart failure in 2,737 older persons with and without diabetes mellitus. *Chest, 115*(3), 867-868. Evidence Level V: Review.

Barrella, P., Monica, ED. (1998). Managing congestive heart failure at home. *AACN Clinical Issues*, 9(2), 377-388. Evidence Level VI: Expert Opinion.

Beckett, N.S., Peters, R., Fletcher, A.E., Stassen, J.A., Liu, L., Dumitrascu, D., Stoyanovsky, V., Antikainen, R.L., Nikitin, Y., Anderson, C., Belhani, A., Forette, F., Rajkumar, C., Thijs, L., Banya, W., Bulpitt, C.J., for the HYVET Study Group. (2008). Treatment of hypertension in patients 80 years of age or older. *N Engl J Med*, 358(20), 1887-1892. Evidence Level II: RCT.

Bennett, S. J., & Sauve, M. J. (2003). Cognitive deficits in patients with heart failure: A review of the literature. *Journal of Cardiovascular Nursing, 18*(3), 219-242. Evidence Level VI: Expert Opinion.

Bertoni, A. G., Bonds, D. E., Hundley, W. G., Burke, G. L., Massing, M. W., & Goff, D. C. (2004). Heart failure prevalence, incidence, and mortality in the elderly with diabetes. *Diabetes Care, 27*, 699-703. Evidence Level IV: Non-experimental Study.

Bibbins-Domingo, K., Lin, F., Vittinghoff, E., Barrett-Connor, E., Hulley, S. B., Grady, D., et al. (2004). Predictors of heart failure among women with coronary disease. *Circulation, 110*, 1424-1430. Evidence Level V: Review.

Brenner, B. M., Cooper, M. E., de Zeeuw, D., Keane, W. F., Mitch, W. E., Parving, H.-H., et al. (2001). Effects of losartan on renal and cardiovascular outcomes in patients with type 2 diabetes and nephropathy. *N Engl J Med, 345*(12), 861-869. Evidence Level II: RCT.

Cavallari, L. H., Fashingbauer, L. A., Beitelshees, A. L., Groo, V. L., Southworth, M. R., Viana, M. A. G., et al. (2004). Racial differences in patients' potassium concentrations during spironolactone therapy for heart failure. *Pharmacotherapy, 24*(6), 750-756. Evidence Level IV: Non-experimental Study.

Chaudhry, S.I., Phillips, C.O., Stewart, S.S., Riegel, B.J., Mattera, J.A., Jerant, A.F., Krumholz, H.M. (2007). Telemonitoring for patients with chronic heart failure: A systemiatic review. *J Card Fail, 13*, 56-62. Evidence Level V: Review.

Chobanian, A. V., Bakris, G. L., Black, H. R., Cushman, W. C., Green, L. A., Izzo, J. L., et al. (2003). The seventh report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure. *JAMA, 289*, 1560-1572. Evidence Level VI: Expert Opinion.

Chyun, D., Vaccarino, V., Murillo, J., Young, L., & Krumholz, H. (2002). Mortality, heart failure and recurrent myocardial infarction in the elderly with diabetes. *Am J Critical Care, 11*(504-19). Evidence Level V: Review.

Cook, N.R., Cutler, J.A. Obarzanek, E. Buring, J.E., Rexrode, K.M., Kumanyika, S.K., Appel, L.J., Whelton, P.K. for the Trials of Hypertension Prevention Collaborative Research Group. (2007). *BJM*, doi: 10.1136/bjm.39147.604896.55. Evidence Level II: RCT.

Coviello, J.S., Borges, L.H., Masulli, P.S. (2002). Accomplishing quality of life in end-stage heart failure: A hospice multidisciplinary approach. *Home Healthcare, 20(3), 193-198.* Evidence Level VI: Expert Opinion.

Di Bari, M., van de Poll-Franse, L. V., Onder, G., Kritchevsky, S. B., Newman, A., Harris, T. B., et al. (2004). Antihypertensive medications and differences in muscle mass in older persons: the Health, Aging and Body Composition Study. *Journal of the American Geriatrics Society, 52*(6), 961-966. Evidence Level IV: Non-experimental Study.

Dulin, B.R., & Krum, H. (2006 ). Drug therapy of chronic heart failure in the elderly: the current state of clinical trial evidence. *Curr Opin Cardiol, 21*(4), 393-399.

Forette, F., Seaux, M. L., Staessen, J., Thijs, L., Birkenhager, W. H., Barbarskiene, M. R., et al. (1998). Prevention of dementia in randomized double-blind placebo-controlled Systolic Hypertension in Europe trial. *Lancet, 352* (9137 ), 1347-1351. Evidence Level II: RCT.

Franklin, S. S., Gustin, W. G., Wong, N. D., Larson, M. G., Weber, M. A., Kannel, W. B., et al. (1997). Hemodynamic patterns of age-related changes in blood pressure: The Framingham Heart Study. *Circulation 96*, 308-315.Evidence Level IV: Non-experimental Study.

Gonseth, J., Guallar-Castillon, P., Banegas, J. R., & Rodriguez-Artajo, F. (2004). The effectiveness of disease managament programmes in reducing hospital re-admission in older persons with heart failure: A systematic review and meta-analysis of published reports. *European Heart Journal, 25*(18), 1570-1595. Evidence Level I: Systematic Review.

Ho, K. K., Pinsky, J. L., Kannel, W. B., & Levy, D. (1993). The epidemiology of heart failure: the Framingham Study. *J Am Coll Cardiol, 22*(4 Suppl A), 6A-13A. Evidence Level IV: Non-experimental Study.

The HOPE Investigators. (2000). Effects of an angiotensin-converting enzyme inhibitor, ramipril, on cardiovascular events in high-risk patients. *N Engl J Med, 342*, 145-153. Evidence Level II: RCT.

Hunt, S. A., Abraham, W. T., Chin, M. H., Feldman, A. M., Francis, G. S., Ganiats, T. G., et al. (2005). ACC/AHA 2005 Guideline update for the diagnosis and management of chronic heart failure in the adult [Electronic Version]. *Circulation*, e154-e235. Evidence Level VI: Expert Opinion.

Hypertension in Diabetes Study Group. (1993). HDS 1: Prevalence of hypertension in newly presenting type 2 diabetic patients and the association with risk factors or cardiovascular disease. *J Hypertension, 11*, 309-317. Evidence Level IV: Non-experimental Study.

Inglis, S.C., Pearson, S., Treen, S., Gallasch, T., Horowitz, J.D., & Stewart, S. (2006). Extending the horizon in chronic heart failure. *Circulation, 114*, 2466-2473. Evidence Level II: RCT.

Iribarren, C., Karter, A. J., Go, A. S., Ferrara, A., Liu, J. Y., Sidney, S., et al. (2001). Glycemic control and heart failure among adult patients with diabetes. *103*(2668-2673). Evidence Level V: Review.

Johnson, A. G. (1997). NSAIDS and increased blood pressure. What is the clinical significance? . *Drug Safety, 17*, 277-289. Evidence Level II: RCT.

Khan, N., & McAlister, F.A., (2006). Re-examining the efficacy of B-blockers for the treatment of hypertension: a meta-analysis. *CMAJ, 174,* 1737-1742. Evidence Level: Level I.

Kostis, J. B., Wilson, A. C., Freudenberger, R. S., Cosgrove, N. M., Pressel, S. L., & Davis, B. R. (2005). Long-term effect of diuretic-based therapy on fatal outcomes in subjects with isolated systolic hypertension with and without diabetes. *American Journal of Cardiology, 95,* 29-35. Evidence Level II: RCT.

Kozac, A.T., Rucker-Whitaker, C., Basu, S., Mendes de Leon, C.F., Calvin, J.E., Grady, K.L., Richardson, D., Powell, L.H. 2007. Elements of nonpharmacologic interventions that prevent progression of heart failure: a meta-analysis. *Congestive Heart Failure*. *13*(5), 280-287. Evidence Level I: Meta-analysis.

Kwok, T., Lee, J., Woo, J., Lee, T.F., & Griffith, S. (2008). A randomized controlled trial of a community nurse-supported hospital discharge programme in older patients with chronic heart failure. *J Clin Nursing, 17,* 109-117. Evidence Level II: RCT.

Lancaster, K. J., Smiciklas-Wright, H., Heller, D. A., Ahern, F. M., & Jensen, G. (2003). Dehydration in black and white older adults using diuretics. *Annals of Epidemiology, 13*(7), 525-529. Evidence Level IV: Non-experimental Study.

Lane, D.A., Chong, A.Y., Lip, G.Y.H. (2006). Psychological interventions dor depression in heart failure. Cochrane Database of Systematic Reviews, 2. Evidence Level I: Systematic Review.

Lee, S.J., Lindquist, K., Segal, M.R., Covinsky, K.E. (2006). Development and validation of a prognostic index for 4-year mortality in older adults. JAMA, 295(7), 801-807. Evidence Level IV: Non-experimental Study.

Levy, D., Larson, M. G., Vasan, R. S., Kannel, W. B., & Ho, K. K. (1996). The progression from hypertension to congestive heart failure. *JAMA, 275*(20), 1557-1562. Evidence Level V: Review.

Lewis, E. F., Moye, L. A., Rouleau, J. L., Sacks, F. M., Arnold, J. M., Warnica, J. W., et al. (2003). Predictors of late development of heart failure in stable survivors of myocardial infarction: the CARE study. *Journal of the American College of Cardiology., 42*(8), 1446-1453. Evidence Level II: RCT.

Lindholm, L. H., Ibsen, H., Borch-Johnsen, K., Olsen, M. H., Wachtell, K., Dahlof, B., et al. (2002). Risk of new-onset diabetes in the Losartan Intervention For Endpoint reduction in hypertension study. *J Hypertens, 20*(9), 1879-1886. Evidence Level II: RCT.

Litaker, J. R., & Chou, J. Y. (2003). Patterns of pharmacologic treatment of congestive heart failure in elderly nursing home residents and related issues: A review of the literature. *Clinical Therapeutics, 25*(7), 1918-1935. Evidence Level VI: Expert Opinion.

Lloyd-Jones, D., Evans, J. C., & Levy, D. (2005). Hypertension in adults across the age spectrum. *JAMA, 294*(4), 466-472. Evidence Level IV: Non-experimental Study.

Masoudi, F. A., Inzucchi, S. E., Wang, Y., Havranek, E. P., Foody, J. M., & Krumholz, H. (2005). Thiazolidinediones, metformin, and outcomes in older patients with diabetes and heart failure. *Circulation, 111*(583-590). Evidence Level IV: Non-experimental Study.

McKelvie, R. S., Teo, K. K., Roberts, R., McCartney, N., Humen, D., Montague, T., et al. (2002). Effects of exercise training in patients with heart failure: The exercise

rehabilitation trial (EXERT). *American Heart Journal, 144*(1), 23-30. Evidence Level II: RCT.

Mulrow, C., Lau, J., Brand, M. (2006). Pharmacotherapy for hypertension in the elderly. Cochrane Database of Systematic Reviews, 2. Evidence Level I: Systematic Review.

Naylor, M., Brooten, D., Campbell, R.L., Maislin, G., McCauley, K.M., Schwartz, J.S. (2004). Transitional care of older adults hospitalized with heart failure: A randomized, controlled trial. JAGS. 52:675-684. Evidence Level II: RCT.

Naylor, M., Brooten, D., Jones, R., Lavizzo-Mourey, R., Mezey, M., Pauly, M. (1994). Comprehensive discharge planning for the hospitalized elderly. A randomized clinical trial. Annals of Internal Medicine, 120:999-1006. Evidence Level II: RCT.

Nesto, R. W., LeWinter, M., Bell, D., Bonow, R. O., Semenkovich, C. F., Fonseca, V., et al. (2004). Thiazolidinedione use, fluid retention, and congestive heart failure. *Diabetes Care, 27*, 256-263. Evidence Level VI: Expert Opinion.

Nichols, G. A., Erbey, J. R., Hillier, T. A., & Brown, J. B. (2001). Congestive heart failure in type 2 diabetes. *Diabetes Care, 24*, 1614-1619. Evidence Level V: Review.

Phillips, C. O., Wright, S. M., Kern, D. E., Singa, R. M., Shepperd, S., & Rubin, H. R. (2004). Comprehensive discharge planning with postdischarge support for older persons with congestive heart failure. *JAMA, 291*(11), 1358-1367. Evidence Level I: Systematic Review.

Piccini, J. P., Klein, L., Gheorghiade, M., & Bonow, R. O. (2004). New insights into diastolic heart failure: role of diabetes mellitus. *Am J Med, 116 Suppl 5A*, 64S-75S. Evidence Level VI: Expert Opinion.

Pickering, T. G., Hall, J. E., Appel, L. J., Falkner, B. E., Graves, J., Hill, M. N., et al. (2005). Recommendations for blood pressures measurements in humans and experimental animals. *Circulation, 45*, 142-161. Evidence Level VI: Expert Opinion.

Pickering, T.G., Miller, N.H., Ogedegbe, G., Krakoff, L.R., Atrinian, N.T., and Goff, D. (2008). A call to action on use and reimbursement for home blood pressure monitoring. A joint scientific statement from the American Heart Association, American Society of Hypertension, and Preventive Cardiovascular Nurses Association. *Hypertension, 52.* DOI:10.1161/hypertension.107.189010.

Piepoli, M. F., Davos, C., Francis, D. P., Coats, A., & Collaborative, E. (2004). Exercise training meta-analysis of trials in patients with chronic heart failure (ExTraMATCH). *BMJ, 328*(7433), 189-192. Evidence Level I: Systematic Review.

Rees, K., Taylor, R. S., Singh, S., Coats, A. J. S., & Ebrahim, S. (2006). Exercise-based rehabilitation for heart failure, *Cochrane Database of Systematic Reviews* (Vol. 1). Evidence Level I: Systematic Review.

Schocken, D.D., Benjamin, E., Fonarow, G.C., Krumholz, H.M., Levy, D., Mensah, G.A., Narula, J., Shor E.S., Young, J.B., & Hong, Y. (2008). Prevention of heart failure: A Scientific Statement from the American Heart Association Councils on Epidemiology and prevention, Clinical Cardiology, Cardiovascular Nursing, and

High Blood Pressure Research; Quality of Care and Outcomes Research Interdisciplinary Working Group; and Functional Genomics and translational Biology Interdisciplinary Working Group. *Circulation*, doi.10.1161/circulationaha.107.188965. Evidence Level VI: Expert Opinion.

Stratton, I. M., Adler, A. I., Neil, H. A., Matthews, D. R., Manley, S. E., Cull, C. A., et al. (2000). Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35); a prospective observational study. *BMJ, 321*, 405-412. Evidence Level V: Review.

Tang, W. H., Francis, G. S., Hoogwerf, B. J., & Young, J. B. (2003). Fluid retention after initiation of thiazolidinedione therapy in diabetic patients with established chronic heart failure. *J Am Coll Cardiol, 41*(8), 1394-1398. Evidence Level IV: Non-experimental Study.

Taylor, A.L., Ziesche, S., Yancy, C.W., Carson, P., Ferdinand, K., Taylor, M., et al. (2004). Early and sustained benefit on event-free survival and heart failure hospitalization from fixed-dose combination of isosorbide dinitrate/hydralazine. *Circulation, 115*,1747-1753. Evidence Level II: RCT.

Thom, T., Haase, N., Rosamond, W., Howard, V. J., Rumsfeld, J., Manolio, T., et al. (2006). Heart Disease and Stroke Statistics--2006 Update: A Report From the American Heart Association Statistics Committee and Stroke Statistics Subcommittee [Electronic Version]. *Circulation*, 113, e85-151. Retrieved June 16, 2006 from http://circ.ahajournals.org. Evidence Level VI: Expert Opinion. Evidence Level VI: Expert Opinion.

Wing, L.M., Reid, C.M., Ryan, P., Beilin, L.J., Brown, M.A., Jennings, G.L., et al. (2003). A comparison of outcomes with angiotensin-converting-enzyme inhibitors and diuretics for hypertension in the elderly, *New England Journal of Medicine, 348*, 583-592. Evidence Level II: RCT.

Wolff, T., & Miller, T. (2007). Evidence for the reaffirmation of the U.S. Preventive Services Task Force recommendations on screening for high blood pressure. *Ann Intern Med, 147*, 787-791. Evidence Level I: Systematic Review.

Wright, J. T. J., Dunn, J. K., Cutler, J. A., Davis, B. R., Cushman, W. C., Ford, C. E., et al. (2005). Outcomes in hypertensive black and nonblack patients treted with chlorthalidone, amlodipine, and lisinopril. *JAMA, 293*, 1595-1608. Evidence Level II: RCT.

Yu, D.S., Lee, D.T., Woo, J., & Hui, E. (2007). Non-pharmacological interventions in older people with heart failure: effects of exercise training and relaxation therapy. *Gerontology, 53*, 74-81. Evidence Level II: RCT.

Zile, M. R., & Brutsaert, D. L. (2002). New concepts in diastolic dysfunction and diastolic heart failure: Part II: causal mechanisms and treatment. *Circulation, 105*(12), 1503-1508. Evidence Level VI: Expert Opinion.