



The *Heart* of the Matter

Cardiology Associates, P.C.

Tuesday, January 25

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A Message from Cardiology Associates, P.C.



Dear Colleagues,

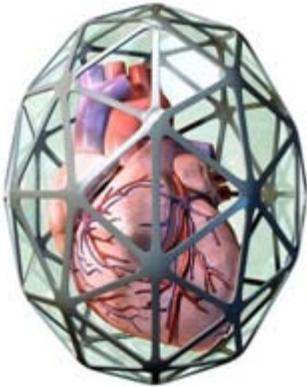
Happy New Year! Our January, 2011 Referring Physician newsletter focuses on the diagnosis and treatment of Diastolic Heart Failure (DHF). This is one of the latest heart conditions recognized by cardiologists in the last several years. DHF is prevalent in as many as one-third of all patients with obvious heart failure and normal ejection fraction. Dr. Valeriani Bead discusses the symptoms, diagnosis, and treatment of a patient with DHF who was recently cared for in our facility.

About the Author

Dr. Valeriani R. Bead sees patients in our Annapolis and Bowie office locations. He is board-certified in internal medicine with a cardiology sub-specialty. Dr. Bead has a special interest in consultative cardiology, differentiation in cardiovascular health, nuclear cardiology, and cardiac

imaging. Dr. Bead is the former Assistant Chief of Service at Johns Hopkins Bayview Medical Center, and he is a member of the American Heart Association.

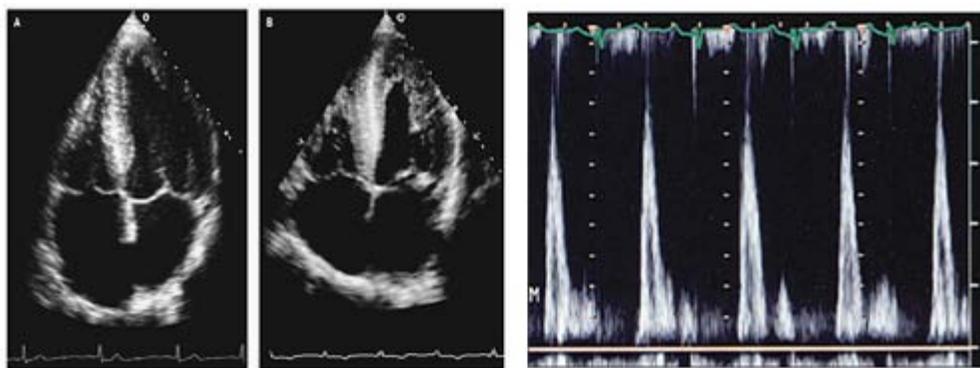
DHF: The "New" Type of Heart Problem



Presentation of Case

- Janice is a 64-year-old African-American woman with a history of long-standing hypertension, Type II diabetes and high cholesterol. She has never smoked.
- She presents to clinic for evaluation of dyspnea on exertion, which has been progressive over the past several months.
- On exam, her blood pressure is 170/90 mmHg with a heart rate of 98 bpm, she has jugular venous distension and peripheral edema.
- Her ECG shows normal sinus rhythm and left ventricular hypertrophy.
- Her echocardiogram (Figure 1) confirms left ventricular hypertrophy; there is also left atrial enlargement and the left ventricular function is normal at > 60%.
- The transmitral Doppler pattern (Figure 2) is abnormal and shows severe impaired relaxation consistent with severe diastolic dysfunction.

Does she have congestive heart failure? How should she be managed?



Figures 1 and 2: 4-chamber echo images of A. a normal person and B. a person with diastolic dysfunction. The corresponding transmitral Doppler pattern of the person with diastolic dysfunction demonstrates severe (restrictive) diastolic dysfunction

Definition and Epidemiology

Diastolic Heart Failure (DHF), in simple terms, is defined as an abnormality of diastolic filling or relaxation of the left ventricle despite the fact the ejection fraction is normal or abnormal and whether or not the patient is symptomatic or asymptomatic. DHF occurs when the ability of the left ventricle to accept blood is impaired. This leads to an elevation of the ventricular filling pressure which leads to pulmonary or systemic venous congestion or both. Systolic ventricular and arterial stiffening are important contributors to DHF.

The last two decades have seen the emergence of DHF as an important clinical entity. It appears to be common, especially in the elderly. The typical subject with DHF is an elderly woman with hypertension, such as the patient in our case presentation. DHF is also seen in other conditions associated with left ventricular (LV) hypertrophy, such as hypertrophic cardiomyopathy and aortic valve disease. Previous studies, looking at patients with chronic heart failure (HF) and preserved LV systolic function, have reported a prevalence varying from 13%-74%. More recent epidemiologic studies have estimated that 30%-50% of patients with chronic HF in the community have normal systolic function. Due to the aging of the western populations, the overall prevalence of HF (both systolic and diastolic) is on the rise and leading to a considerable financial and social burden. In the United States, DHF currently accounts for >25% of the total cost of chronic HF. Although the mortality rate of DHF is better than the mortality rate of Systolic Heart Failure (SHF), the morbidity associated with DHF is similar to that associated with SHF.

Despite its emerging importance, no simple or universally accepted definition of DHF has yet been established. Currently, a diagnosis of DHF is often made if a patient presenting with symptoms and signs suggestive of HF are found to have normal LV systolic function and no significant valvular disease on echocardiography. It is important to exclude conditions like pulmonary disease, obesity, and myocardial ischemia before considering a diagnosis of primary DHF.

Pathophysiology

DHF is determined by the passive elastic properties of the left ventricle and by the process of active relaxation. An increase in myocardial mass and alterations in the extramyocardial collagen network can both alter the passive elastic properties of the left ventricle leading to DHF. The usual underlying mechanisms that cause increased resistance to LV diastolic filling are myocardial hypertrophy, fibrosis, ischemia, and infiltration. Age-related changes in the heart and vasculature can also play an important role. Reduced LV filling volume causes decreased stroke volume and symptoms of low cardiac output. Atrial fibrillation commonly ensues and frequently coincides with the onset of symptoms. Patients with DHF with or without overt heart failure have exercise intolerance due to reduced lung compliance secondary to elevated left ventricular diastolic and pulmonary venous pressures as well as inadequate cardiac output during activity which leads to early fatigue.

Diagnostic Techniques

The physical examination, ECG, and chest x-ray do not provide sufficient information to distinguish diastolic from systolic heart failure. The gold standard for diagnosis of diastolic dysfunction is cardiac catheterization with simultaneous LV pressure volume measurement at rest and during exercise. This is not feasible in routine clinical practice. Therefore, echocardiography plays a critical diagnostic role in patients who are suspected to have DHF. However, conventional Doppler echocardiography has its limitations. Newer techniques such as pulmonary venous flow, color M-mode recording of LV diastolic inflow, and tissue Doppler imaging of mitral annular motion have been introduced in an attempt to overcome some of these limitations (see Figure 1 above).

Further help may come from natriuretic peptides (or BNP). If a patient with possible HF has normal systolic but abnormal diastolic function and a raised natriuretic peptide, this increases the certainty of diagnosis. On echocardiography, apart from abnormalities of LV diastolic filling, two other features that support the diagnosis of DHF are the presence of left atrial dilatation and left ventricular hypertrophy (see Figure 1 above).

Management

Although there is substantial evidence to guide therapy for patients with SHF, there is a paucity of randomized clinical trials that have been conducted with patients with DHF. Therefore, current treatment guidelines are empirical and are based on small clinical studies. Without recommending specific agents, the guidelines from the American College of Cardiology and the American Heart Association emphasize:

1. blood pressure control
2. use of diuretics to relieve congestion
3. treatment of ischemia, and
4. control of the heart rate and eliminate tachycardia.

Table 1 outlines the principle management strategies for treating patients with DHF

Goal	Treatment*	Daily Dose of Medication†
Reduce the congestive state	Salt restriction	< 2 g of sodium per day Furosemide, 10–120 mg Hydrochlorothiazide, 12.5–25 mg Enalapril, 2.5–40 mg Lisinopril, 10–40 mg Candesartan, 4–32 mg Losartan, 25–100 mg
	Diuretics	
	ACE inhibitors	
Maintain atrial contraction and prevent tachycardia	Angiotensin II–receptor blockers	Atenolol, 12.5–100 mg Metoprolol, 25–100 mg Verapamil, 120–360 mg Diltiazem, 120–540 mg
	Cardioversion of atrial fibrillation	
	Sequential atrioventricular pacing	
	Beta-blockers	
Treat and prevent myocardial ischemia	Calcium-channel blockers	Isosorbide dinitrate, 30–180 mg Isosorbide mononitrate, 30–90 mg Atenolol, 12.5–100 mg Metoprolol, 25–200 mg Diltiazem, 120–540 mg Verapamil, 120–360 mg
	Radiofrequency ablation modification of atrioventricular node and pacing	
	Nitrates	
	Beta-blockers	
	Calcium-channel blockers	
Control hypertension	Coronary-artery bypass surgery; percutaneous coronary intervention	Chlorthalidone, 12.5–25 mg Hydrochlorothiazide, 12.5–50 mg Atenolol, 12.5–100 mg Metoprolol, 12.5–200 mg Amlodipine, 2.5–10 mg Felodipine, 2.5–20 mg Enalapril, 2.5–40 mg Lisinopril, 10–40 mg Candesartan, 4–32 mg Losartan, 50–100 mg
	Antihypertensive agents	
Measures with Theoretical Benefit in Diastolic Heart Failure		
Promote regression of hypertrophy and prevent myocardial fibrosis	ACE inhibitors	Enalapril, 2.5–40 mg Lisinopril, 10–40 mg Ramipril, 5–20 mg Captopril, 25–150 mg Candesartan, 4–32 mg Losartan, 50–100 mg 25–75 mg
	Angiotensin-receptor blockers	
	Spironolactone	

Conclusions and Recommendations

DHF occurs when the ability of the left ventricle to accept blood is impaired and is quite common in the elderly, especially in elderly women with hypertension. Morbidity for DHF is comparable to that of SHF. Both groups of patients have similar rates of recurrent hospitalization and cost of care. With the aging of the population, the numbers of patients with DHF will continue to rise and are likely to contribute significantly to the burden of disease caused by heart failure. Currently, the diagnosis of DHF is often made by exclusion, and treatment is empirical given the fact that there are no large-scale, randomized, controlled trials in this area.

Our patient, described in the case presentation, has DHF based on her clinical assessment, which is consistent with heart failure, evidence of left ventricular hypertrophy, and preserved ejection fraction. Additionally, Doppler findings are consistent with diastolic dysfunction with high filling pressures. Her treatment should include diuretics to reduce her congestive state and reduction of concomitant risk factors (hypertension and tachycardia). She needs adequate blood pressure control with a beta-blocker as well as an ACE inhibitor. Given her risk factors and presentation, she should also undergo further evaluation to rule out underlying ischemia, such as a stress test.

References

1. Aurigemma GP, Gaasch WH. Diastolic Heart Failure. NEJM 2004; 351:1097-105.
2. Banerjee P, Clark AL, et al. Diastolic Heart Failure: A Difficult Problem in the Elderly. Medscape online. Published 02/05/2004.
3. ACC/AHA 2005 Guideline Update for the Diagnosis and Management of Chronic Heart Failure in the Adult-Summary Article. Circulation. 2005; 112:1825-1852.

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