Diastolic Heart Failure

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No Time to Relax

There are 4.6 million people in the US with heart failure (HF), and 550,000 new cases are reported annually. Approximately 30-50% of these HF patients have normal or near normal left ventricular ejection fraction (LVEF).[1] In these patients, once acute ischemic events or acute presentation of valvular heart disease are excluded, HF is usually due to diastolic dysfunction (*impaired diastolic relaxation: LVEF >45%*). Despite its high prevalence, diastolic heart failure (DHF) receives far less attention than its systolic counterpart (SHF: LVEF <40%). The increasing prevalence, rates of hospitalization and the healthcare costs associated with DHF rival those of SHF.

Isolated DHF is a legitimate and important cardiac condition that needs to be taken more seriously. Evidence-based treatment guidelines are not available (studies in progress). "The deficits in our knowledge about DHF serve to remind us that *it is not time to relax."*[2] This *Heartbeat* will describe the scope of the DHF problem and the current recommended treatment to prevent and manage this condition more effectively.

Short Shrift

While numerous studies have elucidated the pathophysiology, prognosis and therapy for HF with reduced systolic function, there is a notable lack of data about patients with HF and normal systolic function with no valvular disease. Most HF treatment trials to date have focused on patients with LVEF < 40%. Recent data would suggest that these studies exclude as many as 80% of the elderly population, especially women, who are markedly under-represented in the large HF trials. This is even more relevant since the incidence of isolated DHF increases with age and is much more common in women than men (seen in 67% of women compared to 42% of men).

Investigation has been hampered by the difficulty in proving a diagnosis of DHF. First, the routine use of cardiac catherization, the gold standard for demonstrating LV diastolic dysfunction (i.e. elevated filling pressure is necessary to achieve normal ventricular filling), is not feasible. Secondly, most clinical echocardiography labs do not routinely evaluate LV diastolic function because it is technically demanding and time consuming, with difficult-to-interpret results.

Many hypothesize that since LVEF is usually evaluated after the patient's clinical status has stabilized and resolved, it is possible that the initial presentation was not the result of diastolic dysfunction but was due to transient systolic dysfunction or acute mitral regurgitation produced by hypertension, myocardial ischemia or both.[3 4]

More Evidence

Evidence of the high occurrence of isolated DHF continues to emerge. A recent study showed that 8.8% of the elderly population, which included 4842 independent, community dwelling people over 65 years old, had some sort of HF upon clinical evaluation.[5] Among those with HF, 80% had normal or near normal LV function per echocardiography. Another study set out to

prove the hypothesis that HF in association with hypertension is frequently due to transient systolic dysfunction.[6]

Contrary to their supposition, findings revealed that segmental wall motion and LVEF, measured during the acute episode, were similar to those measured after the resolution of the congestion when blood pressure was controlled. None of the patients had mitral stenosis, aortic stenosis or aortic regurgitation. Some had mitral regurgitation (MR), but most of these were minimal, with a few having moderate MR. No one had severe MR.

These findings suggest that isolated DHF is a much more important and prevalent condition than previously believed.

Diagnosis of DHF

Although DHF is clinically and radiographically indistinguishable from SHF, knowledge of which patients are at risk for DHF, the common clinical profiles, and the common echocardiographic findings enhances the clinician's ability to diagnose DHF with confidence. An accurate diagnosis of the clinical syndrome of HF is the most crucial step in diagnosing DHF. Dyspnea, particularly paroxysmal nocturnal dyspnea, exercise intolerance and edema are common signs and symptoms. Definitive evidence of HF typically consists of the presence of the usual signs and symptoms compatible with HF, a chest x-ray that supports this diagnosis and, most importantly, a typical clinical response to diuretics.

The second step in establishing a diagnosis of DHF is to document normal LV systolic function in proximity (usually 72 hours) to the episode. An LVEF >45%, obtained either with echocardiography or radionuclide angiography, will rule out systolic dysfunction as a cause. Echo is a better choice, both practically and economically. Thirdly, definitive objective evidence of ventricular diastolic dysfunction requires cardiac catheterization demonstrating an increased LV end-diastolic filling pressure in the presence of normal or reduced LV end-diastolic volume. Often when the first two criteria are fulfilled, it is not possible to obtain objective evidence of diastolic dysfunction. It is not feasible to subject all HF patients to cardiac catheterization. Furthermore, by the time they are studied (after diuresis and stabilization), the data may not be accurate. Non-invasive echocardiography assessments of LV diastolic function are imprecise. Simple echocardiography criteria may be helpful in the absence of comprehensive diastolic assessment. Left atrial enlargement and/or LVH support the diagnosis of DHF because of their association with diastolic dysfunction.

Under these circumstances, it is reasonable to accept that the cause of HF in patients with an LVEF of >45% is *probably* DHF once mitral valve disease, cor pulmonale, primary volume overload conditions (i.e. hyperthyroidism, anemia), are excluded. Other factors that would support the diagnosis would be markedly elevated blood pressure (>160/100mm Hg) during the episode of DHF or a tachycardia that shortens the diastolic filling time. Approximately 30% of patients with DHF, present with recent-onset atrial fibrillation or flutter. Patients with underlying diastolic dysfunction rely on "atrial kick" to maintain filling with normal mean atrial pressures. Loss of atrial kick and tachycardia result in the need for higher atrial pressures to maintain filling in the presence of underlying diastolic dysfunction and may precipitate HF.

When DHF occurs in patients <60 years of age, rare causes of DHF (hypertrophic or restrictive cardiomyopathies and constrictive pericarditis) should be considered.

For now, the evaluation and treatment of patients with diastolic HF remains empirical. ***The "working" diagnostic criteria for DHF are the classic findings of HF with an LVEF of >45% and no evidence of valvular disease.***

Documentation of diastolic dysfunction is preferable but not mandatory, and it is not practical. The chief risk factors are advancing age, hypertension, diabetes, LVH, and coronary heart disease (CHD). In contrast to SHF, DHF affects women and blacks disproportionately. Prognosis varies a great deal depending on severity and etiology. It is better than SHF but still poor. Annual mortality is ~ 5% per year for DHF patients with CHD compared to 10-15% per year for SHF. In the absence of CHD, but with LVH, annual mortality is ~2%.

General Approach To Treatment:

The mechanism for diastolic HF (stiff LV-impairment of diastolic filling) is different from SHF (impairment of emptying), but the hemodynamic consequences are the same. Elevated left ventricular end-diastolic pressure results in elevated left atrial pressure, elevated pulmonary venous pressure and subsequent HF. Chronic SHF or DHF results in neuroendocrine activation and progression of disease.

The main goal of therapy is to control the symptoms of HF by reducing ventricular filling pressure without reducing cardiac output. The best treatment for DHF is prevention. Treat the underlying etiologies (hypertension, coronary artery disease) and the precipitating factors (labile hypertension, ischemia, tachyarrhythmias). ***Because hypertension is the most common factor leading to DHF, the aggressive management of hypertension cannot be over-emphasized.*** (Bring BP to 140/90 and lower if possible.) Improving ventricular relaxation and preventing neurohormonal activation are recommended for prevention and should improve morbitity and mortality. Clinical data and dosages to support their efficacy are not yet available. A few large trials are ongoing. Use dosages of beta-blockers (BBs), ACE inhibitors and angiotensin receptor blockers (ARBs) that are necessary to control heart rate and blood pressure.

Therapy for DHF:

Reduce congestion
- Ø Low sodium diet
- Ø Diuretics, to decrease symptoms without excessive reduction of preload
- Ø Nitrates, for their preload-reducing and anti-ischemic effects

Maintain atrial contraction
- Ø BB's, to restore and maintain NSR, and/or slow the HR to improve diastolic filling

Correct underlying precipitating factors
- Ø BBs, nitrates and calcium blockers, to treat acute ischemia
- Ø Anti-hypertensive agents, to bring BP to a goal of <135/85.
- Ø ACE inhibitors, proven most beneficial to reverse LVH.

Improve ventricular relaxation
- Ø BBs, ACE inhibitors and ARBs, to block the rennin-angiotensin system
- Ø ACE inhibitors and ARBs, to enhance nitric oxide

Attenuate neurohormonal activation
- Ø BBs
- Ø ACE inhibitors

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See www.newsrounds.com under "cardiology".

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