

Poster Session Highlights Diastolic Heart Failure

Ventricular Structure and Function in Hypertensive Patients with Heart Failure and a Normal Ejection Fraction: The Cardiovascular Health Study (CHS)

Mathew S. Maurer, MD, and colleagues at Columbia University Medical Center, presented data exploring ventricular structure and function in elderly hypertensive patients with normal ejection fractions.

Among elderly individuals with heart failure (HF), most have a normal ejection fraction (HFNEF) and hypertension (HT+HFNEF). The pathophysiology in this condition is usually attributed to left ventricular (LV) diastolic dysfunction in the context of either normal or reduced LV diastolic chamber size—despite greater than normal filling pressures, which results in reduced stroke volume (SV) and cardiac output (CO). However, population-based data regarding LV size and function in HFNEF are lacking.

The CHS is a large population study with 5,888 participants aged 65 years or older. Demographic and clinical characteristics and LV structure and function measured by 2D-echo were compared between healthy subjects, subjects with hypertension but not heart failure (HTN), and subjects with hypertension and heart failure with normal ejection fraction (HFNEF).

Study participants with HFNEF were older, more obese, and more often African American thus also had a higher prevalence of diabetes, CHD, anemia, and chronic renal disease than did subjects with HTN alone.

Conclusions: *HFNEF participants have increased LV diastolic chamber size, SV and CO compared to healthy and HTN participants. In addition, this cohort has an increased prevalence of multiple co-morbidities that can cause volume overload and a high cardiac output. These data suggest that extra-cardiac factors leading to volume overload, high basal output and elevated cavity pressures contribute to the pathophysiology of HFNEF in the elderly.*

Hypertensive Heart Failure with a Normal Ejection Fraction: Abnormal Load or Abnormal Ventricular Function?

In a related presentation, Dr. Maurer and associates at Columbia University examined cardiac dynamics in hypertensive heart failure with a normal ejection fraction (HTN+HFNEF). Based on the observation that patients with HTN+HFNEF exhibit a wide range of LV volumes, the investigators speculate that sub-groups may exist.

Healthy participants (n=66) and HTN+HFNEF participants (n=40) underwent freehand 3-D echo to measure LV volumes and mass. End systolic elastance (an index of contractility) and arterial elastance (an index of afterload), were both measured via non-invasive techniques. Stroke work (SW) was indexed to LV mass.

The investigators found that end diastolic volume was increased in the HTN+HFNEF group as compared to controls even though the HTN+HFNEF were older, more often female (70% vs. 52%), and shorter. Among 25 HTN+HFNEF individuals with an enlarged end diastolic volume, SV, CO, and SW were all increased compared to control subjects—but indexed SW did not differ from controls. Among the 15 HTN+HFNEF participants with a small end diastolic volume, SV and CO were lower, but end systolic and arterial elastance were increased compared to control subjects—but in these cases, SW was no different from the control group.

Conclusions: *SW and SW indexed to LV mass is normal or increased in HTN+HFNEF—suggesting that abnormal loading conditions (increased LV volume, preload or increased arterial stiffening, afterload) are mechanisms of hypertensive HFNEF.*

Increased Left Ventricular Myocardial Stiffness Is the Major Cause of Recurrent Decompensation in Patients with Diastolic Heart Failure

Satoshi Watanabe, MD, Kobe University Graduate School of Medicine, Kobe, Japan, and colleagues presented data supporting LV myocardial stiffness as a major etiology of clinical recurrence in patients with diastolic HF.

The investigators applied what they termed a “simplified echocardiographic and hemodynamic method to assess myocardial stiffness.” In 18 patients with initial decompensated HFNEF, plasma brain natriuretic peptide (BNP) levels were measured. Changes in LV dimensions, wall thickness and LV pressure were measured at baseline and during phenylephrine infusion to alter the loading conditions.

The diastolic myocardial stiffness constant (Km) was calculated via stress-strain analysis. After a mean follow-up period of 25 months, study participants were divided into two groups according to clinical evidence of recurrent HF.

There were 12 patients without evidence of recurrent HF, and 6 with recurrence. Plasma BNP levels were higher in the recurrence group than in the non-recurrence group. Multivariable analysis revealed that Km was the most significant and independent hemodynamic factor predicting the plasma BNP level. In addition, Km was higher in the recurrence group than the non-recurrence group.

Conclusions: *Increased myocardial stiffness is strongly related to the plasma BNP level, and is closely associated with recurrent decompensated heart failure and normal EF.*

Effect of Angiotension Receptor Blockade Alone or in Combination with Spironolactone on Left Ventricular Systolic and Diastolic Function in Chronic Heart Failure

John E. Sanderson, MD, Keele University Medical School, UK, along with colleagues from the Chinese University of Hong Kong, China, assessed the effect of angiotensin receptor blocking drugs (ARBs) alone or in combination with spironolactone on LV function in HF.

HF patients with LVEF <40% on standard therapy including ACEI for >6 months were randomly assigned to replace ACEI with an ARB (candesartan) 8 mg QD plus spironolactone 25 mg QD (C+S group), or candesartan 8 mg QD alone (C group) for 1 year. Standard 2D-echo including tissue Doppler imaging (TDI) of systolic and diastolic function were done at baseline, 6, and 12 months. Quality of Life (QoL) score and 6 minute walk were also measured.

48 subjects (23 C+S group + 25 C group) with comparable demographic data at baseline were studied. The C+S group showed significant reduction in diastolic filling pressure assessed by TDI from baseline (33.14±0.05) to 12 months (19.94±0.02), with a trend towards increased myocardial peak early diastolic annular velocity (3.1±0.4 to 3.7±0.4 cm/s). LA dimensions were decreased; LVEF and peak systolic annular velocity were significantly increased (both p<0.05). LV mass index was significantly decreased (236±22 to 179±11 g/M²). Cyclic variation of integrated backscatter was increased in the C+S group (10.3±0.7 to 13.8±1.0 dB, p<0.05). In the C group there was improvement in LVEF but no other significant changes (although QoL score and 6 minute walk were both significantly improved in both groups.)

Conclusions: *Combination therapy with candesartan and spironolactone in chronic heart failure significantly improves left ventricular systolic and diastolic function with reduction of LV mass over 1 year.*