Patterns of Left Ventricular Remodeling in Chronic Heart Failure: The Role of Inadequate Ventricular Hypertrophy

FL. Dini¹, P. Capozza¹, P. Fontanive², MG. Delle Donne¹, V. Santonato¹, E. Orsini¹, P. Caravelli¹, V. Di Bello¹, M. Marzilli¹ - (1) University Hospital, Cardiac and Thoracic Department, Pisa, Italy (2) Santa Chiara Hospital, Cardiovascular Diseases Unit 2, Pisa, Italy
BACKGROUND

The hallmarks of ischemic and nonischemic dilated cardiomyopathy are the presence of increased left ventricular (LV) end-systolic and end-diastolic volumes in association with depressed LV ejection fraction (EF) and increased LV mass. In these patients, there are strong data showing that an increase in LV mass is associated with increased mortality rates. LV chamber dilatation (but not necessarily an increase in LV mass) is also clearly associated with increased mortality rates in patients with prior myocardial infarction. It has been recently pointed out that most patients with chronic systolic heart failure (HF) are described by LV enlargement and low EF; many of them display increased LV end-diastolic volume that is out of proportion to the increased LV mass. Assessment of the degree of LV hypertrophy and the LV wall thickness-to-cavity radius may be useful to further characterize them into different LV remodeling patterns.
AIM OF THE STUDY

This study was designed to assess the prevalence and stratify the risk of different patterns of LV remodeling among patients with chronic systolic HF due to ischemic and nonischemic dilated cardiomyopathy.
METHODS

This study was performed in consecutive patients (n=536) with chronic HF secondary to ischemic and nonischemic dilated cardiomyopathy referred for transthoracic echocardiography.

The echocardiographic measure of LV wall thickness-to-cavity radius was determined as: sum of end-diastolic septum and posterior wall thickness divided by LV end-diastolic dimension. Increased LV mass was defined using the cut offs of 148 g/m2 in males and 122 g/m2 in females, as suggested by the recommendations of the European Association of Echocardiography for the chamber quantification by echocardiography. The end point was all-cause mortality. Follow-up duration was 29±18 months.
RESULTS 1

The study patients were divided into four groups according to LV wall thickness-to-cavity radius and the presence of a severely increased LV mass. A cut off value of wall thickness-to-cavity radius of 0.34 was used since it was the best at identifying an increased LV end-diastolic wall stress (≥30 kdyne/cm²). LV mass and LV wall thickness-to-cavity radius were normal in 14.5% (pattern A), 44% had increased LV mass and normal LV wall thickness-to-cavity radius (pattern B), whereas 12.5% had normal LV mass and decreased LV wall thickness-to-cavity radius (pattern C) and 29% had LV hypertrophy with decreased LV wall thickness-to-cavity radius (pattern D) (Figure 1).
Figure 1

Patterns:

- **Pattern A**: Reduced Wall Thickness-to-cavity radius, Normal LV mass
- **Pattern B**: Normal or Increased Wall Thickness-to-cavity radius, Increased LV mass
- **Pattern C**: Reduced Wall Thickness-to-cavity radius, Normal LV mass
- **Pattern D**: Normal or Increased Wall Thickness-to-cavity radius, Normal LV mass

Left Ventricular Mass (g/m²):
- Males: 148 g/m²
- Females: 122 g/m²

Wall Thickness-to-cavity Radius (WTCHR): 0.34
RESULTS 2

A total of 137 deaths occurred (127 cardiovascular deaths and 10 non-cardiovascular deaths). Mortality rates according to the patterns of LV remodeling and to quartiles of LV end-diastolic volume index are presented in Figure 2. Figure 3 displays Kaplan-Meier survival curves in patients divided according to the different patterns of LV remodeling and of patients grouped according to LV end-diastolic volume quartiles.
Patterns of LV remodeling vs. LV EDV index (ml/m²)

Figure 2

All-cause mortality

P-Trend < 0.0001

P-Trend = 0.0013
Figure 3

Survival (%) vs Time (months) for patterns A, B, C, and D. The log-rank test yields a statistic of 18.74 with a p-value of 0.0003.
CONCLUSION

This study demonstrates that patients with chronic HF characterized by increased LV end-diastolic volume and depressed EF may be stratified according to different patterns of LV geometry with the worst survival in those with ventricular hypertrophy and a disproportion between LV wall thickness and cavity radius.