

# Echocardiographic Findings in an Elderly Population. Influence of Arterial Hypertension. The EPICARDIAN Study

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The aim of this study was to determine the prevalence of left ventricular hypertrophy (LVH), left ventricular diastolic dysfunction (LVDD), and left ventricular systolic dysfunction (LVSD) in a group of elderly Spanish individuals. Data were obtained on a subgroup of 371 individuals from the Lista district of Madrid, Spain who were taking part in the EPICARDIAN study. In hypertensive subjects, the prevalence of LVH was 51.8%–61.8%, that of LVDD was 86%, and that of LVSD was 6.2%. In normotensive subjects, the prevalences were 14%–30% for LVH, 86% for LVDD, and 6% for LVSD. The isovolumic relaxation time was 115(33) ms in the hypertensive group and 105(24) ms in the normotensive group. In this study, the only factor that differentiated between the diagnoses of LVDD due to age and LVDD due to hypertension was a longer isovolumic relaxation time.

**Key words:** Systemic arterial hypertension. Left ventricular hypertrophy. Left ventricular dysfunction. Elderly.

## Hallazgos ecocardiográficos en población anciana. Influencia de la hipertensión arterial. Estudio EPICARDIAN

El objetivo fue evaluar la prevalencia de hipertrofia ventricular izquierda (HVI), disfunción diastólica (DDVI) y disfunción sistólica (DSVI) del ventrículo izquierdo en una muestra de ancianos españoles. Los datos proceden de una submuestra del proyecto EPICARDIAN perteneciente al barrio de Lista (Madrid). Las prevalencias en pacientes hipertensos fueron: HVI, 51,8-61,8%; DDVI, 86%, y DSVI, 6%. En normotensos: HVI, 14-30%; DDVI, 81%, y DSVI, 6,2%. El tiempo de relajación isovolumétrica (TRI) fue 115 ± 33 ms en hipertensos y 105 ± 24 ms en normotensos. La mayor prolongación del TRI fue el único factor que estableció el diagnóstico diferencial entre la DDVI asociada a la edad y la asociada a hipertensión.

**Palabras clave:** Hipertensión arterial sistémica. Hipertrofia ventricular izquierda. Disfunción ventricular izquierda. Anciano.

## INTRODUCTION

The prevalence of arterial hypertension increases with age, and various studies estimate the prevalence in persons aged 65 years of age or older to be from 60% to 80%.<sup>1</sup> One of the complications of arterial hypertension in elderly persons is left ventricular (LV) involvement,<sup>2</sup>

which may present as left ventricular hypertrophy (LVH) or ventricular dysfunction.<sup>3</sup>

## METHODS

The data for this study come from a subgroup of patients of the EPICARDIAN study (EPIdemiología CARDiovascular en los ANcianos en España [Cardiovascular epidemiology in the elderly in Spain]). The methods of the EPICARDIAN study have been published in detail previously.<sup>4</sup>

The echocardiograms were carried out with a Toshiba 160 with a 2.5 MHz transthoracic transducer. The echocardiographers were blinded as to whether the patient was hypertensive or normotensive. The degree of agreement was studied in order to control inter-observer

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variability. The echocardiographic measurements were made according to the guidelines of the American Society of Echocardiography, published by Sahn et al<sup>5</sup> in 1978, and made in M mode and Doppler. The isovolumic relaxation time (IRT), used to measure the time between aortic valve closure and mitral valve opening, can be measured with Doppler in an intermediate position between the left ventricular outflow tract and the septal mitral valve. The sample was stratified according to whether the age of the patients was  $\geq 75$  years or  $< 75$  years, and left ventricular diastolic dysfunction (LVDD) was considered when the maximum velocity of the E wave was  $< 0.6$  m/s, the E wave/A wave ratio was  $< 1$ , the deceleration time was  $> 275$  ms and the IRT was  $> 100$  ms. Those patients who had atrial fibrillation (AF) were excluded from the evaluation of the diastolic function.

“Patients with a poor echocardiographic window” were considered to be those in whom no safe measurement was possible of any of the following factors in the parasternal long axis view: end-diastolic diameter, end-systolic diameter, septum or posterior wall.

## Statistical Analysis

The description of the variables was made with the distribution of frequencies for categorical variables and the mean and standard deviation for continuous variables. To test the possible association between the qualitative variables we used the  $\chi^2$  test or Fisher's exact test. The statistical adjustment methods used were the logistic regression and multiple linear regression models. Data processing and analysis were done with the help of the statistical program SPSS, version 10.

## RESULTS

Of the 371 patients selected, 291 (78.6%) were hypertensive and 80 (21.4%), normotensive. The mean age of the sample was 74 (6) years. Table 1 shows the characteristics of the 2 groups.

The prevalence of a “poor window” was 34.4% in the hypertensive patients and 36.7% in the normotensive patients ( $P=.7$ ).

The values of the M mode measurements showed an increased interventricular septal thickness (11.5 [2.8] vs 10 [2.4];  $P<.0005$ ), posterior wall thickness (10.7 [2] vs 9.4 [1.8];  $P<.0005$ ), left ventricular end-diastolic diameter (46.6 [7.4] vs 44.3 [6.4];  $P<.047$ ), and left atrial end-diastolic diameter (40.9 [6.4] vs 37.6 [5.6];  $P<.001$ ) in the hypertensive patients as compared with the normotensive patients, differences that were all significant.

Significant differences were also detected between the normotensive and the hypertensive patients in the mean left ventricular mass (LVM) (165.3 [72.7] vs 224.5 [86];  $P<.0005$ ), LVM index (LVM/body surface) (99.5 [36.8] vs 130.9 [47.4];  $P<.0005$ ) and the LVM index (LVM/height) (102 [40] vs 140 [51.8];  $P<.0005$ ).

**TABLE 1. Characteristics of the Study Population (n=371)<sup>a</sup>**

	Normotensive	Hypertensive	P
Men, n (%)	48 (25.8)	135 (74.2)	.039
Women, n (%)	32 (17)	156 (83)	.039
Sinus rhythm, %	91.7	94.6	.7
Atrial fibrillation, %	6.7	4	.7
Age, mean (SD), y	72 (6)	74 (6)	.052
Height, mean (SD), cm	161.5 (10.1)	159.6 (9.4)	.113
Weight, mean (SD), kg	65.7 (9.9)	67.8 (12.2)	.147
BMI, mean (SD)	25.1 (3)	26.6 (4.3)	.005

<sup>a</sup>BMI indicates body mass index; SD, standard deviation.

The prevalence of LVH was significantly greater in the hypertensive patients than the normotensive patients according to the Devereaux criteria (51.8% vs 14%;  $P<.005$ ), the Framingham criteria (57.6% vs 22.0%;  $P<.005$ ), and the Cornell-Penn criteria (61.8% vs 30%;  $P<.005$ ). In the normotensive patients, the prevalence of LVH ranged around 30% (Cornell-Penn criteria) and 14% (Devereaux criteria).

The left ventricular morphology was conserved in 22.3% of the hypertensive older patients; 26.1% of the patients had concentric hypertrophy (LVM index with criteria of hypertrophy and relative parietal wall thickness  $> 0.44$ ); and 25.5% had excentric hypertrophy (LVM index with criteria of hypertrophy and relative parietal wall thickness  $< 0.44$ ).

Doppler study of the left ventricular diastolic function (Table 2) was possible in 271 (73.3%) patients. In the normotensive patients, the prevalence of echocardiographic signs of LVDD was 81% and of left ventricular systolic dysfunction (LVSD), 6%. In the hypertensive patients, the prevalence of echocardiographic signs of LVDD was 86.1% ( $P=.41$  compared with the normotensive patients) and the prevalence of LVSD was 6.2%. The differences seen between the 2 groups were not significant. The measurements of the E wave velocity (0.7 [0.2] vs 0.7 [0.2];  $P<.75$ ), the A wave velocity (0.8 [0.2] vs 0.9 [0.2];  $P<.87$ ), the E wave/A wave ratio (0.8 [0.2] vs 0.8 [0.7];  $P<.95$ ) and the E wave deceleration time (223.6 [53.9] vs 222.2 [66];  $P<.88$ ) were similar in both groups, with no significant differences. An increase was detected in the IRT (105.4 [24.2] vs 115.4 [32.6];  $P=.02$ ) in both groups in comparison to non-elderly or normotensive persons.<sup>7</sup> In those aged  $< 75$  years, the prevalence of LVDD was 83% and in those aged  $\geq 75$  years it was 88% ( $P=.4$ ).

## DISCUSSION

The results of this study show a greater prevalence of LVH in both normotensive and hypertensive persons as compared with other studies.<sup>6</sup> This difference may be

**TABLE 2. Characteristics of the Population According to Subgroups<sup>a</sup>**

	LVH (+)	LVH (-)	LVDD (+)	LVDD (-)	LVSD (+)	LVSD (-)
Age						
<75 y	41.9	58.1	83.6	16.4	4.1	95.9
≥75 y	46.8	54.2	87.9	12.1	7.4	92.6
Sex						
Male	41.1	58.9	84.9	15.1	7.2	92.8
Female	46.6	54.2	85.1	14.9	5	95
Blood pressure						
Hypertensive	58.1	49.2	86.1	13.9	6.2	93.8
Normotensive	14	86	81	19	6	94

<sup>a</sup>LVDD indicates left ventricular diastolic dysfunction; LVH, left ventricular hypertrophy; LVSD, left ventricular systolic dysfunction; (+), present; (-), absent.

Statistical significance depending on:

Age:  $P=.45$  (LVH);  $P=.42$  (DD);  $P=.29$  (SD).

Sex:  $P=.39$  (LVH);  $P=.97$  (DD);  $P=.47$  (SD).

Blood pressure:  $P<.0005$  (LVH);  $P=.41$  (DD);  $P=.96$  (SD).

due to methodological aspects or, more likely, to the age of the study sample, since all the study subjects were older than 65 years of age.

The general prevalence of echocardiographic signs of LVDD was greater<sup>7</sup> than in earlier studies. No differences were found in our series between the normotensive and the hypertensive persons, probably due to the above-mentioned reasons, and only IRT was identified as a differentiating factor. The prevalence of LVSD, on the other hand, was similar to that of previous studies,<sup>7</sup> although our study did not include an analysis of a history of ischemic heart disease.

The sample was recruited from the general census population in an area of Madrid with a high social and economic level,<sup>4</sup> which could explain the low incidence of atrial fibrillation in comparison with other studies and it may also have led to a lower significance value and thus account for the lack of significant differences between the groups of hypertensive and normotensive persons.

### Limitations

The isovolumic relaxation time was the only difference found between the hypertensive and the normotensive persons, with a more prolonged IRT in the hypertensive persons. This finding may be explained either because it is a marker of LVDD, or because the rise in blood pressure in the hypertensive persons results in an early closure of the aortic valve. As the blood pressure was not recorded during the Doppler study, we are unable

to say which of the 2 mechanisms accounts for this finding.

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