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INFLUENCE OF ARTERIAL HYPERTENSION AND OBESITY ON LEFT ATRIAL SIZE

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It is known that left atrial size can increase in patients with arterial hypertension. The aim of the presented study was to determine the relative contribution of body weight to left atrial size in patients with established atrial hypertension.

Left atrial size was measured in 114 patients with moderate hypertension (mean blood pressure 168 ± 9 mmHg and 101 ± 7 mmHg). The patients were classified in three groups: normal weight patients (BMI $20 \pm 3,3$ kg/m²) preobese patients (BMI $27 \pm 2,1$ kg/m²) and obese patients ($32 \pm 4,2$ kg/m²). On basis of this classification the effects of body weight on left atrial size were examined. Left atrial size was significantly greater in obese ($4,5 \pm 0,6$ cm) than in preobese patients ($4,2 \pm 0,4$ cm) or normal weight ($3,7 \pm 0,4$ cm) patients ($p < 0,05$). Left atrial enlargement (> 4 cm) was presented in 65% obese patients compared with 49% of preobese and 19% normal weight patients. Left atrial dimension had weakly correlated ($r = 0,23$) with mean blood pressure.

Obesity is the strongest predictor of left atrial size in patients with hypertension

The cardiac effects of hypertension include increases of left ventricular mass and left atrial size. Whereas increases in left ventricular mass has been shown to be a predictor of cardiovascular events, left atrial size is associated with likelihood of developing atrial fibrillation and in addition, it is a predictor of stroke, once atrial fibrillation is manifest /1,2/.

Using by echocardiographic have suggested that age, sex, obesity, and race are other important cofactors in left atrial dilatation /3/.

The aim of the presented study was to determine the relative contribution of body weight to left atrial size in patients with established atrial hypertension.

Patients and method

The study included 114 consecutive hypertensive individuals (63 males and 51 females). We excluded subjects for any of the following conditions: history of clinically apparent coronary heart disease, congestive heart failure, valvular heart disease, or atrial fibrillation.

Body mass index (BMI) was selected as a measure of adiposity determined as weight (kg) divided by height squared (m²). “Normal” weight was defined by body mass index <24,9 kg/m² (29 patients); “overweight” or “preobese” as 25 to 29,9 kg/m² (40 patients); and “obesity” (45 patients) as BMI>30 kg/m².

At each examination, systolic and diastolic pressure were measured in the left arm with a mercury sphygmomanometer while the subject was seated. Systolic and diastolic pressures were determined by the first and fifth Korotkoff phases, respectively.

Subjects were studied with standard M-mode and twodimensional echocardiography. Left atrial size was determined in accordance with American Society of Echocardiography guidelines with the use of a leading edge–to–leading edge measurement of the maximal distance between the posterior aortic root wall and the posterior left atrial wall at end systole. Left atrial enlargement was defined as left atrial dimension greater than or equal to 4,0 cm. The modified cubed formula (with end-diastolic left ventricular [LV] measurements obtained in accordance with the Penn convention) was used to calculate LV mass : LV Mass (g)=1.04[(LV Internal Diameter+LV Septal Thickness+Posterior Wall Thickness)³ - (LV Internal Diameter)³]-13.6.

Results

Mean age of the patients was 54±7,2 years; the average blood pressure was 168±9/101±7mmHg. The average left ventricular mass was 217±23g. The prevalence of left ventricular hypertrophy was 24%. Baseline height, weight and echocardiographic characteristics shown in Table 1.

Height 169±14(cm)

Weight 75±12 (k g)

Body mass index (kg/m²) 29.0±4.6

LV diastolic dimension (cm) 5,1.±0,4

Septal thickness (cm) 1.09±0,7

Posterior wall thickness (mm) 1,04±0,83

LV mass (g) 217 ±23

Table 1. Value of height, weight, echocardiographic parameters

For all patients the average left atrial dimension was $4,2 \pm 0,53$ cm (range 2.5 to 5,4 cm). Left atrial enlargement was noted in 50 patients (57%). Of these, 43 patients (87%) had mild to moderate enlargement (average $4,39 \pm 1,9$, range 4,2 to 4,6 cm) and 7 (13%) had severe enlargement (average $5,0 \pm 0,3$ cm, range 4,7 to 5,2cm)

Left atrial size differed significantly ($p < 0.05$) across obesity categories. Obese patients had a greater left atrial size ($45 \pm 0,6$ cm) than overweight ($4,2 \pm 0,4$ cm) or normal weight patients ($3,7 \pm 0,4$ cm). Left atrial enlargement was present in 65% of obese 40% of overweight patients and 18% of normal weight patients ($p < 0.05$)

The strongest correlations of left atrial size were, in decreasing order, with body weight ($r=0,44$), body mass index ($r=0,41$), left ventricular mass ($r=0,35$). Correlations were not significant with mean arterial pressure ($r=0,23$).

Discussion

Left ventricular hypertrophy and left atrial enlargement are both manifestations of cardiac target organ damage in established hypertension.

More than 25 years ago Dunn et al found that hypertensive subjects with evidence of left atrial abnormality by electrocardiogram or left ventricular hypertrophy by either electrocardiogram or chest roentgenogram had significantly greater left atrial indexes (left atrial size/body surface area) than normotensive subjects /4/. In an early echocardiographic study, Savage et al. found left atrial enlargement in only 5% hypertensive patients /5/. Miller et al in an evaluation of 14 hypertensive and 10 normotensive subjects with normal coronary angiography, demonstrated significantly increased left atrial dimension and left atrial index among the hypertensive subjects/6/. A study by Pearson et al of 144 participants of the Systolic Hypertension in the Elderly Program (SHEP) trial and 55 age-matched normotensive control subjects found significantly increased left atrial index (left atrial size/body surface area) in the hypertensive group /7/.

What is the mechanism of association between arterial hypertension and left atrial enlargement?

Elevated systolic or pulse pressure may directly promote atrial dilatation. More reports demonstrated left atrial enlargement to be associated both with the duration of elevated blood pressure and with the level of systolic pressure in a general population /8-10/. The increase in left atrial size in the hypertensive patient may reflect other factors associated with increased systolic and pulse pressure. Left atrial enlargement in hypertensive patients can be secondary both to

changes in systolic and diastolic left ventricular function. The left atrial enlargement has been regarded as an early clinical sign of reduced diastolic left ventricular function in patients with normal systolic function /9/. In recent investigation O Sullivan et al demonstrate that association of blood pressure and left atrial enlargement are mediated through the more clearly defined association of hypertension with left ventricular hypertrophy /11,12/.

In presented study we evaluated subjects with moderate arterial hypertension. Level of arterial pressure evaluated patient is answer way we did not find association between arterial hypertension and left atrial enlargement.

Visari et al in the part of Framingham Study based on a large closely followed population demonstrate that blood pressure and left ventricular mass were both correlated with left atrial enlargement, although on multivariable analysis most of the variance in left atrial dimension was explained by left ventricular mass and body weight /8/.

Gerts et al found independent associations of obesity and left ventricular hypertrophy with left atrial enlargement /9/

Similar to arterial hypertension, isolated chronic obesity (without arterial hypertension) is associated with cardiac alterations. This association has been recognized since early in the last century and has been attributed to the chronic increase in both pressure and volume overload that reduce the contractile reserve of the left ventricle in obese patients /13/.

Morriconi et al. found that the obese patients had a significantly larger internal diastolic left ventricular diameter, a thicker end-diastolic septum and posterior wall, a greater indexed left ventricular mass, a higher atrial diastolic filling wave velocity, a lower ratio between early and atrial diastolic filling wave velocities and a prolonged isovolumic relaxation time. End-diastolic septum and posterior wall thickness and the left ventricular mass were significantly greater in patients with a. The morphological and functional echocardiographic alterations usually found in normotensive obese patients closely correlate with the amount of intra-abdominal fat deposition /14/.

The present study evaluated that obesity is the most important predictor of left atrial enlargement

Obesity has been shown to be both an independent direct risk factor for cardiovascular disease and an indirect risk factor because of its effects on hypertension, diabetes, and hyperlipidemia /15/.

Combination of factors including overactivity of the sympathetic nervous system, insulin resistance, and abnormalities in vascular structure and function may contribute to obesity-

related hypertension /16/. Together, arterial hypertension and obesity are strongest predictors of changes of cardiovascular structure.

The left atrial size was significantly associated with the risk for stroke /17/. The mechanisms of the increased risk of stroke and death in subjects with left atrial enlargement are incompletely understood. Left atrial dilation promotes stasis of blood, which in turn predisposes to thrombus formation and the potential for embolization. The thrombogenicity of left atrial dilation is supported by transesophageal echocardiography studies that found that left atrial dilation was associated with spontaneous echocardiographic contrast, left atrial thrombus, and embolic events /18/. New challenge is to know if reduction of left atrial size was associated with decrease in prevalence of stroke.

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