

Ankle-Brachial Index and Ventricular Hypertrophy in Arterial Hypertension

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Abstract

The ankle-brachial index (ABI) is a marker of peripheral arterial disease. Very few reports have correlated this index with left ventricular hypertrophy (LVH), functional capacity (FC) and Framingham risk score (FRS).

The objective of this study was to verify the correlation between ABI, LVH, FC and FRS in men with arterial hypertension (AH).

Prospective and cross-sectional study of male patients ($n = 40$) with a mean age of 57.92 ± 7.61 years and no cardiovascular complications. This population was submitted to ABI measurements, echocardiography (ECHO), exercise test (ET) and laboratory tests. The ABI (right and left) was considered abnormal when the ratio between the highest mean systolic pressures of the ankles and arms was 0.9 or higher than 1.3 mmHg. LVH was identified by transthoracic ECHO and the FC by the ET. Peripheral blood samples were collected to calculate the FRS.

Normal ABI values were observed in 33 patients (82.5%), who were included in Group I; seven patients (17.5%) with abnormal ABI constituted Group II. Left ventricular mass index (LVMI) at the ECO were 111.18 ± 34.34 g/m² (Group I) and 150.29 ± 34.06 g/m² (Group II) ($p = 0.009$). The prevalence of LVH was 4% (Group I) and 35.3% (Group II) ($p = 0.01$), demonstrating a significant difference between the groups. As for the FC in ET, there was no difference between the groups. Regarding the FRS, the mean in Group I was below that in Group II: 13.18 ± 2.11 versus 15.28 ± 1.79 ($p = 0.019$).

In hypertensive patients, the presence of LVH defined by the LVMI was more frequent in cases with abnormal ABI, identifying a higher cardiovascular risk.

Keywords

Ankle brachial index, hypertrophy, left ventricular, hypertension, risk assessment, risk factors.

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Introduction

Cardiovascular disease (CVD) has an important impact on morbimortality. Therefore, prevention of events, including the accurate identification of risk factors, remains a challenge for public health¹. Thus, it is essential to identify these factors, selecting the population at risk, as well as to establish the diagnosis of left ventricular hypertrophy (LVH) and peripheral arterial disease (PAD), which can be assessed by ankle-brachial index (ABI)².

Objective

The objectives of this study were to evaluate ABI values in patients with arterial hypertension (AH) and to correlate these values with the presence of LVH detected by echocardiography (ECHO), with the assessment of functional capacity by exercise test (ET) and the cardiovascular risk estimated by the Framingham risk score (FRS).

Methods

The present is a prospective and cross-sectional study approved by the Ethics Committee in Human Research of Universidade Estadual de Alagoas, carried out between December 2007 and July 2008, which evaluated 40 asymptomatic men with a mean age of 57.95 ± 7.61 years, with AH and no history of cardiovascular or kidney disease and diabetes mellitus.

The patients were submitted to right and left ABI measurements, ECO, ET and peripheral blood collection. To obtain the ABI, the systolic pressures were measured in the brachial, pedal and posterior tibial arteries, considering, for the calculation, the mean of two pressure measurements taken in each artery. We used the auscultatory technique mediated by a Doppler Vascular ultrasound 4283 DV 2001 (MEDPEJ, Ribeirão Preto, Brazil), with a 5 to 10 MHz transducer. The ABI (right and left) was considered abnormal when the ratio between the highest mean of systolic pressures in the ankles and arms was ≤ 0.9 or > 1.3 mmHg.

LVH was defined by the left ventricular mass index (LVMI) > 115 g/m² at the transthoracic ECO, using an Esaote Caris 2D device with a 2.5 to 3.5 MHz transducer. FC was considered by the maximal exercise time achieved at the ET in minutes, using the Bruce protocol on the treadmill. For the calculation of FRS, peripheral blood samples were collected after ten to twelve hour-fasting, using an Olympus Kit - Olympus AV 400 device, using the direct method.

Statistical analysis

Means and standard deviations were used for numeric variables and percentages were used for categorical ones. Kruskal-Wallis H test (equivalent to Chi-square test) was used for the analysis of group means, whereas for the categorical variables, risk analysis (odds ratio - OR) or Fisher's exact test were used as appropriate. Statistical significance level was set at 0.05.

Results

Normal ABI values were observed in 33 patients (82.5%), which were included in Group I, while seven patients (17.5%) with abnormal ABI constituted Group II. The LVMI was 111.18 ± 34.34 g/m² in Group I and 150.29 ± 34.06 g/m²

in Group II ($p = 0.009$) (Chart 1). The prevalence of LVH was 4% (Group I) and 35.3% (Group II) ($p = 0.01$), with significant differences (Table 1). As for FC, there was no difference between the groups. Regarding FRS, the mean in Group I was below the mean in Group II: 13.18 ± 2.11 versus 15.28 ± 1.79 ($p = 0.019$).

Discussion

In this report, the occurrence of abnormal ABI was associated with LVH in hypertensive patients without cardiovascular complications. Reports in the literature have shown the influence of ABI values on left ventricular function and morphological alterations, constituting an independent predictor of echocardiographic abnormalities.

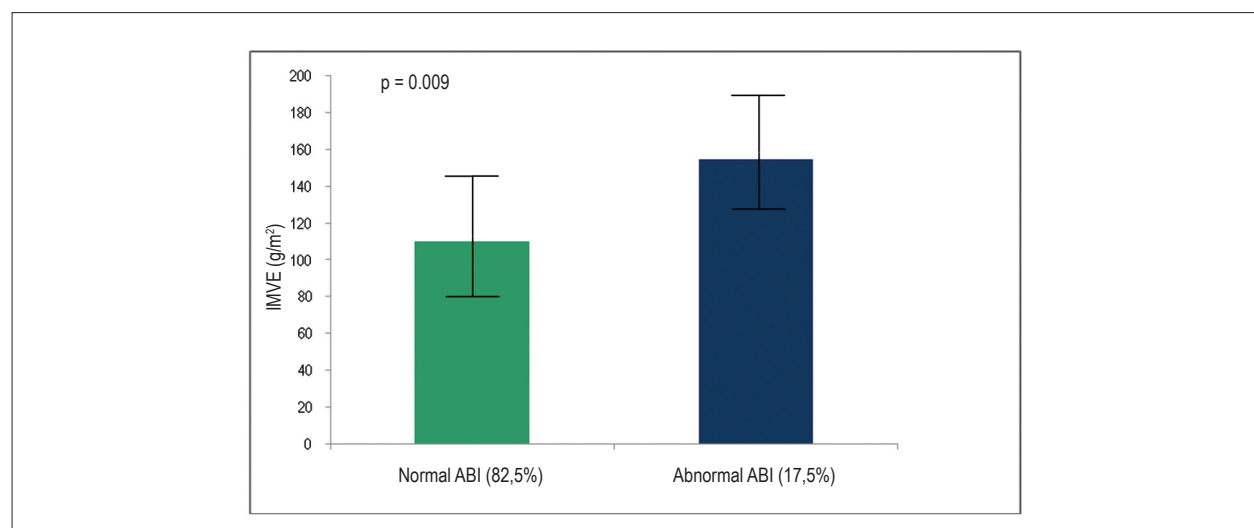


Chart 1 – Association between ABI and left ventricular hypertrophy, defined by the left ventricular mass index (LVMI) – (95%CI).

Table 1 - Echocardiographic variables in Groups I (normal ABI, n = 33) and II (Abnormal ABI, n = 7)

Variable*	Group I	Group II	p
LA (mm)	39.06 ± 2.95	41.28 ± 2.92	NS
LVDD (mm)	50.66 ± 3.29	53.85 ± 4.18	0.032
LVSD (mm)	31.37 ± 2.02	34.57 ± 2.87	0.051
IVS (mm)	10.75 ± 3.29	13.42 ± 2.69	0.0012
LVPW (mm)	10.10 ± 2.95	12.71 ± 1.79	0.03
LV Mass (g)	211.14 ± 70.79	297.60 ± 60.65	0.004
LVMI (g/m ²)	111.18 ± 34.34	150.29 ± 34.06	0.009
EF (%)	0.67 ± 0.05	0.65 ± 0.03	NS
LVFS (%)	38.48 ± 3.98%	36.14 ± 3.02	NS
LVH Prevalence (%)†	4.0	35.3	0.01

*NS - non-significant; LV – left ventricle; LA – left atrium; LVDD – left ventricular diastolic diameter; LVSD – left ventricular systolic diameter; IVS – diastolic thickness of interventricular septum; LVPW – diastolic thickness of left ventricular posterior wall; LVMI – left ventricular mass index; EF – ejection fraction; LVFS – left ventricular fractional shortening; LVH – left ventricular hypertrophy; † LVH Criterion - LVMI ≥ 116 g/m².¹⁵

Brief Comments

The presence of abnormal ABI shows a high prevalence of left ventricular (LV) dysfunction (ejection fraction < 45%) and is associated with high cardiovascular mortality³. Using stress echocardiography, it was reported that ABI was a strong predictor of mortality from all causes⁴. Other reports have shown an inverse correlation between LV mass and ABI, associating LV dysfunction to reduced ABI values⁵. In our study, the inverse correlation between ABI and LV mass was significant: the mean LVMI was 111.18 ± 34.34 g/m² for normal ABI, and 150.29 ± 34.06 g/m² for abnormal values. It is possible that the increased vascular stiffness promotes a compensatory LVH. In the present study, we also observed an association between low ABI values and higher values of FRS. This inverse proportion constitutes a risk combination for cardiovascular events⁶.

Study limitations

Although it demonstrated an association between ABI reductions and LVH prevalence in AH, this pilot study had a small sample size (n = 40), which was evaluated in a cross-sectional design. Future longitudinal studies with larger samples will be useful.

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Conclusion

In patients with arterial hypertension without clinical manifestations of PAD, ABI values below the reference limit were associated with the presence of LVH, identifying individuals at higher cardiovascular risk. Hypertensive patients with abnormal ABI should be submitted to LV structural assessment.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

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Study Association

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