Atrio-Ventricular Plane Displacement in Ischemic Heart Disease

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Abstract

Background- Whether atrio-ventricular plane displacement (AVPD) in echocardiography findings may help to diagnose ischemic heart disease (IHD) in the presence of normal systolic function is not clear. This study aimed to assess the relationship between AVPD and ischemic heart disease (IHD) in a group of IHD patients.

Method- One hundred two outpatients (65 male and 37 female) aged 58.9±11.4 were examined for IHD by echocardiography, stress test and angiography, and 61 patients were found to have IHD. Echocardiographic findings, including AVPD, LVEF and RWMA, were compared in normal and IHD patients.

Results- Comparison of echocardiography findings in the ischemic patients to the normal subjects showed that the subjects with IHD had significantly lower AVPD, LVEF and higher RWMA. Results of a logistic regression analysis indicated that AVPD was an independent predictor of IHD (OR=0.61, 95%CI= 0.46-0.79).

Conclusion- These data suggested that low AVPD was associated with increased risk of IHD. AVPD may help diagnose IHD when more sophisticated techniques are not available and/or applicable ***(Iranian Heart Journal 2005; 6 (1,2): 48-51).***

Key words: AVPD ■ echocardiography ■ IHD

There are many stress tests: stress imaging tests (radionuclide and stress echo study) and new imaging modalities (eg. CT-angio, MR) for the determination of the prognosis of ischemic heart disease (IHD).

While these diagnostic tests are improving rapidly, many people in low-income countries do not have access to these expensive tests.

Echocardiography is one of the basic heart evaluations. Whether simple and reliable techniques such as atrioventricular plane displacement (AVPD) in echocardiography findings may help diagnose IHD is not clear.

AVPD is an indicator of longitudinal fiber function, and is used in assessing systolic left ventricular (LV) function.[1-3]

The long axis shortening of the LV is related to LV function and can be measured by AVPD. Determination of left AVPD is a reliable, reproducible, readily mastered, quickly performed and, thus inexpensive method that can be used in almost all patients for evaluation of LV function, as well as for prognostic implications in heart failure (HF). Left AVPD reflects both systolic and diastolic LV functions.

Simplified echocardiography is useful for screening of asymptomatic patients at risk of developing HF, and for routine diagnostic

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purposes in patients with symptoms suggestive of HF.[4] AVPD was independently correlated with both left ventricular systolic function and diastolic filling in patients with CAD. Thus, given the same degree of ejection fraction, it was found that the greater the impairment in diastolic filling, the lower the AVPD.[5] Echocardiographically-determined AVPD is a clinically useful, independent prognostic tool in patients with stable CAD.[6] It is not currently a diagnostic tool for the diagnosis of IHD.[7] Considering that the subendocardium is more vulnerable to ischemic damage than mid-myocardium and subepicardium,[8] we hypothesized that AVPD might help detect IHD in patients with normal systolic function. This study aimed to assess the association of AVPD with the risk of IHD in a cross-sectional design.

Methods

The subjects were 102 outpatients (65 male and 37 female) aged 58.9± 11.4 admitted in Heshmat Heart Clinic in Rasht, Iran. The subjects were examined for IHD. Data on age, history of previous myocardial infarction and coronary revascularization (PCI and CABG) were collected using questionnaires. Four subjects were found to have atrial fibrillation and were excluded from the study. None of the patients had mitral valve replacement, repair, mitral annulus calcification or any localized aneurysm in the basal portion of the LV. The subjects gave written consent for participation in this study.

The equipment for echocardiography was a Vingmed 750-echocardiography system and a 2.5 MHz transducer.

A complete echocardiography study including parasternal long and short axis, apical four, five and two- chamber views was carried out. Sixteen segment wall motion abnormality and modified Simpson's LVEF were measured. AVPD measurement was done using the method described by Alam, et al. [1]

AVPD was measured in the long axis apical two-chamber view for anterior and posterior walls and in the long axis apical four-chamber view for lateral and septal walls. The distance between AV plane and apex was measured in millimeters in systole and diastole, and the difference between these two measurements was assigned as AVPD. The M-mode cursor was placed at the anterior, posterior, lateral and septal orientation at the AV plane and is connected to the fix point of the apical portion of the LV (fix portion is that part of the LV apex that has the lowest displacement relative to the chest wall, Fig. 1).

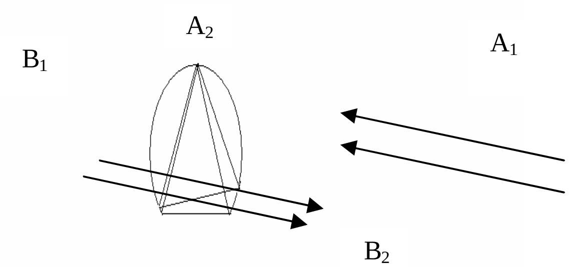

Fig. 1. schematic AVPD measurement in apical two-chamber view in systole and diastole

AVPD (ant) $=A_1- A_2$, AVPD (post) $=B_1- B_2$

The distance in each plane was measured twice, and the mean was calculated. Mean AVPD was calculated by adding four planes measurements divided by four.

CAD was defined by definite ECG findings, history of revascularization or positive diagnostic tests (stress test and coronary angiography). According to the history of revascularization and electrocardiography data (Q-waves indicating myocardial infarctions), 28 patients had documented CAD. The investigation was continued on 70 patients by either exercise stress test (n=28), stress imaging tests (n=38) or coronary angiography (n=4). Finally, 61 patients had proved IHD, and 37 subjects were normal.

Statistical analysis

Mean AVPD, LVEF, RWMA and age between the two groups were compared by Student's t test. The Pearson correlation of coefficients between the measured variables was calculated. A backward stepwise logistic regression analysis was also performed to model the predictors of IHD. Values are given as the mean ± standard deviation. P-value less than 0.05 were considered as the level of significance. Analyses were performed using the statistical package SPSS software, version 10.01 for windows (SPSS Inc®, Chicago, USA).

Results

Echocardiography data and age of the subjects in the two groups are given in Table I. Subjects with IHD had significantly lower AVPD, LVEF and higher RWMA than subjects without IHD. These data showed that AVPD was positively correlated to LVEF (r=0.635 p=0.0001) and negatively correlated to age (r=-0. 241 p=0.005) and RWMA (r=-0.44 p=0.0050).

Table I. Comparison of echocardiography data and age in the study population

	IHD (n=61)	normal (n=37)	P-Value
AVPD (mm)	8.9± 2.6	12.1 ±2.1	P<0.0001
LVEF (%)	51.3 ± 10.0	59.9 ± 7.3	P = 0.006
RWMA (n)	1.8 ± 0.3	1.3 ± 0.4	P<0.0001
Age (y)	60.0 ± 11.6	56.7 ± 11.2	P = 0.17

Results of a backward stepwise logistic regression analysis showed that AVPD is an independent predictor of IHD in this study (Table II).

Table II. The final result of a backward stepwise logistic multiple regression analysis with LVEF, AVPD, RWMA, age and sex as independent variables and IHD as the dependent variable.

Variables in the equation	B ± SD	OR	CI	P-Value
AVPD (mm)	- 0.48 ± 0.13	0.61	0.46 - 0.79	0.003
RWMA	1.46 ± 0.06	4.32	1.33 - 14.0	0.01
SEX (Male)	1.67 ± 0.61	5.3	1.5 - 17.6	0.006
LVEF (%)	- 0.27 ± 0.45	0.97	0.88 - 1.06	0.544
Age (y)	- 0.007 ± 0.027	0.99	0.94 - 1.04	0.799

Discussion

It is well known that under resting conditions patients with coronary artery disease may have normal left ventricular function. If no permanent myocardial damage occurs and the ventricle is not ischemic at the time of examination, routine echocardiography study does not reveal the underlying coronary artery disease.[9] Our findings showed that AVPD might serve as a predictor of IHD in the study population. Rydberg et al. have previously indicated that low AVPD is in high agreement with the results of angiography in assessing IHD.[10] The present data indicated that the association between low AVPD and the risk of IHD is independent of LVEF and RWMA. It has been recently suggested that decreased AVPD despite normal LVRWM may be a true sign of myocardial dysfunction, predominantly indicating subendocardial dysfunction.[11] High sensitivity of longitudinal muscle (subendocardial and papillary muscle fibers) to ischemia explains the association between AVPD and IHD.

Measurement of AVPD in four planes in apical two and four-chamber views using 2 D-guided M-mode echocardiography is a simple technique and can be performed by a simple echocardiography system. Such a technique does not take a long time to perform, and it is highly reproducible.[12] More studies are needed to elucidate the role of AVPD in diagnosing IHD.

In conclusion, our data suggested that abnormal AVPD was associated with IHD and that it might have a role in predicting IHD. This finding might have important diagnostic implications in developing countries, where more sophisticated diagnostic techniques are not available everywhere in the country.

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