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The Peguero-Lo Presti criterion is the most sensitive in left ventricular hypertrophy detection in ECG in patients with severe aortic stenosis

Short title: Left ventricular hypertrophy in ECG in patients with aortic stenosis

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INTRODUCTION

Left ventricular hypertrophy (LVH) in patients with aortic stenosis (AS) is associated with increased mortality and morbidity before and after aortic valve replacement [1–3]. There are several electrocardiographic criteria for the diagnosis of left ventricular hypertrophy (ECG-LVH**)** [4, 5]. The aim of the study was to analyze which of the ECG-LVH criteria in patients with severe AS had the highest sensitivity.

METHODS

In this prospective study we analyzed the presence of widely used ECG-LVH criteria in patients with AS. All patients had left ventricular mass index (LVMI) in echocardiographic study above gender limits. Patients with right bundle branch block, left bundle branch block, paced QRS were excluded from the analysis. The 12-leads ECG at rest were recorded. The study was approved by the ethics committee. Patients provided written informed consent to participate in the study.

The ECG-LVH criteria used in the study are listed below [4, 5]:

1. The amplitude of R wave in lead aVL >11 mm;

2. The amplitude of R wave in lead V5 or V6 >26 mm;

3. The Sokolow–Lyon index — >35 mm;

4. The Romhilt index — >45 mm;

5. The Cornell index — >20 mm in women and >28 mm in men;

6. The Cornell index product - > 1700mm*ms in women, >2400mm*ms in men;

7. The Lewis index – > 25mm;

8. The Peguero-Lo Presti voltage criterion — sum of S amplitude in lead V4 and maximal S wave in any other lead ≥23 mm for women and ≥28 mm for men;

9. T wave amplitude in V5, negative T wave as a strain presentation.

Statistical analysis

Continuous variables are presented as mean (standard deviation). We calculated the sensitivity of analyzed criteria. The differences between categorical variables were assessed with the chi-squared test. The strength of correlation between the number of ECG-LVH criteria and LVMI was tested with Spearman correlation coefficient. We used SPSS ver 6.2. P <0.05 was treated as statistically significant.

RESULTS AND DISCUSSION

Finally, the study group consisted of 739 consecutive patients with severe AS, qualified for aortic valve replacement (between 2004 and 2019): 297 women and 442 men, mean age 60 (11.1) years. At least one indicator of ECG-LVH was confirmed in 675 (91.4%) patients; 269 (90.6%) women and 406 (91.9%) men. We compared LVMI in subgroups with presence of 0–9 ECG-LVH criteria. Gradual increase of LVMI together with the raising number criteria was recorded (r^2 = 0.41; P <0.001; higher for women r^2 = 0.47 vs. men r^2 = 0.38). Sensitivity of ECG-LVH criteria in patients with severe AS was gender dependent (Table 1). The highest sensitivity was observed for the Pequero-Lo Presti criterion and the Cornell index. When we used the presence of at least one of them, the sensitivity of LVH detection increased to 84% in both genders.

Electrocardiography has historically been used as the standard method for detecting LVH in epidemiological studies. A lot of ECG criteria have been developed for the detecting LVH [4, 5]. The sensitivity and specificity of ECG-LVH criteria were compared with echocardiography or magnetic resonance, emphasized ECG imperfection in different diseases [6–10]. In AS electrocardiography plays important role; the presence of ECG-LVH together with the characteristic systolic murmur suggests the diagnosis and necessity of

echocardiographic examination and possible invasive treatment. One may expect almost 100% sensitivity on ECG-LVH diagnosis in severe symptomatic AS. It was not documented in previous reports [12–14] and also in our study. We could not find too many publications assessing relation between ECG and ECHO criteria of LVH in patients with AS. Most often, ECG-LVH was evaluated by single voltage criteria, sometimes in connection with strain [2, 3, 12–14]. The studies also included the patients without severe AS or asymptomatic. The Peguero and Lo-Presti voltage novel criterion proposed for LVH screening with a better accuracy than the Cornell and the Sokolow–Lyon indices, showed stronger association with an increased LVM [5]. One possible explanation for the improved performance was that the vector generated by the depolarization of the ventricular free wall and myocardium may be represented by the latter part of the QRS complex, the S wave representing depolarization of the Purkinje fibres. S-wave is deepest in the right precordial leads, usually in lead V2. Observation reported by Peguero [5] was confirmed by Noubiap and stressed that this criterion might be more useful in routine clinical practice as a screening tool for LVH [11]. In our study we confirmed this observation – this criterion had the highest sensitivity with elevated LVMI. Cornell index had also high sensitivity. Presence of at least one of them increased the sensitivity of LVH detection to 84% in both genders.

Study limitations

We analyzed selected group of patients with AS and documented LVH. We did not include asymptomatic patients. We did not have enough patients without LVH to assess specificity. However, the number of cases we analyzed seemed to be the largest in literature.

CONCLUSIONS

There are gender differences in ECG-LVH criteria. Peguero-Io Presti has the highest sensitivity in left ventricular hypertrophy detection in ECG in both sexes. Presence of at least one of 2 criteria — Cornell index and Peguero-Io Presti improves the sensitivity in LVH detection.

Article information

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Table 1. Sensitivity of ECG-LVH criteria

Criterion	All patients n = 739	Women n = 297	Men n = 442
RaVL	32%	35%	30%
Lewis index	28%	32%	25%[a]
RV5/V6	38%	26%	46%[b]
Sokolov–Lyon	63%	52%	69%[b]
Romhilt	42%	30%	55%[b]
Cornell index	52%	67%	41%[b]
Cornell product	64%	76%	57%[b]
Peguero-Lo Presti	71%	75%	68%
Strain	45%	42%	46%
Cornell index and/or Peguero-Lo Presti	84%	84%	84%

Women/men differences [a]*P* <0.01; [b]*P* <0.001