A diagnosis of left ventricular hypertrophy on ECG is associated with a high cardiovascular risk: findings from a 40- to 69-year-old cohort in general practice

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Objective. Left ventricular hypertrophy (LVH) is an independent cardiovascular (CV) risk factor in both sexes. We studied if a diagnosis of LVH on electrocardiogram (ECG) was associated with a ‘high CV risk condition’ among 40- to 69-year-old individuals cared for by GPs.

Methods. We studied 4250 individuals, 5.4\% of whom had LVH. Cross-sectional frequencies, and age- and gender-adjusted statistical differences have been calculated.

Results. All the study variables were significantly worse for ‘LVH’ than ‘non-LVH’ individuals (except smoking). The ‘LVH’ had both a mean ‘5-year CV risk’ significantly greater than ‘non-LVH’ individuals (27.0\% versus 8.6\%), and a significantly higher prevalence of a ‘5-year CV risk >15\%’ (89\% versus 15\%).

Conclusions. A diagnosis of LVH on ECG among the adult individuals of an opportunistic cohort from general practice was associated with a 6-fold greater prevalence of a ‘high CV risk condition’.

Keywords. Cardiovascular disease, family practice, left ventricular hypertrophy, opportunistic cohort, risk factors.

Introduction

A documented left ventricular hypertrophy (LVH) is an independent cardiovascular (CV) risk factor in both sexes.\textsuperscript{1, 2} Hypertension is one of the main risk factors for cardiovascular disease (CVD). Other modifiable CV risk factors exist, such as smoking, diabetes, dyslipidaemia, obesity and a sedentary lifestyle.

In Italy, the prevalence of hypertension is 33\% for men and 30\% for women.\textsuperscript{3}

The aim of the present work was to determine whether a diagnosis of LVH on ECG was associated with a ‘high CV risk condition’ among 40- to 69-year-old individuals from an opportunistic cohort cared for by GPs.

Methods

We performed a cross-sectional study among the 40- to 69-year-old individuals in the care of 23 GPs (out of 76) in our health district, who went for a consultation over a 12-month period. In Italy, each citizen is in the care of a GP. All the individuals who were asked to take part agreed to participate in the study and signed a written informed consent. The cross-sectional data collected were analysed according to either the presence or not of LVH.

The diagnosis of LVH was made by a single cardiologist on the basis of an electrocardiogram (ECG) according to Cornell’s criteria.\textsuperscript{4, 5}
A ‘high CV risk condition’ was defined as a ‘5-year CV risk >15%’ applying New Zealand’s risk function. Our GPs chose this because it was judged more suitable for CV primary prevention because it considers a 5-year prospective period. The GPs collected data on risk factors included in the risk function, i.e. age, gender, cigarette smoking, diabetes, systolic blood pressure, total and high-density lipoprotein (HDL) cholesterol. Non-HDL cholesterol and the ratio of total to HDL cholesterol were calculated. The function did not include LVH as a variable for CV risk calculation. Diabetes was defined as a fasting blood glucose concentration >7.0 mmol/l or as the consumption of insulin or oral hypoglycaemic drugs. Smoking was defined as regular daily cigarette smoking or having stopped in the previous 12 months. Blood pressure was taken by the GP as the mean of two readings on a sitting patient resting for 5 min. All the blood sampling and standardized measurements were performed by trained personnel at the district laboratory.

We computed age- and gender-adjusted cross-sectional descriptive frequencies, and the difference between ‘LVH’ and ‘non-LVH’ individuals using the Student’s t-test for unpaired data. All the results are expressed as mean ± SD for continuous and as numbers and/or percentages for categorical variables. We used the STATA™ statistical package for Windows release 8.0.

Results

The mean age of 4250 participants was 56.3 ± 8.0 years; 47% were male. Of all participants, 5.4% individuals had a documented LVH. The characteristics of the 230 ‘LVH’ and 4020 ‘non-LVH’ individuals are described in Table 1.

All the study variables were significantly worse for ‘LVH’ individuals when compared with ‘non-LVH’ ones (except smoking). The ‘LVH’ had both a significantly greater mean ‘5-year CV risk’, and ‘5-year CV risk >15%’ than ‘non-LVH’ individuals (Table 1).

Discussion

According to the British Hypertension Society Guidelines on Hypertension, the absolute risk of CVD dictates the absolute benefit from antihypertensive treatment. However, in certain patients, formal risk assessment is unnecessary because certain risk factors, such as LVH, always place patients at high risk. Data from the Framingham Study demonstrated that the presence of LVH on ECG increases the age-adjusted coronary risk >3-fold, the age-adjusted risk of all CV events 4- to 7-fold, and the risk of sudden death 3- to 5-fold. Although echocardiography has become the gold standard to detect LVH in clinic practice, ECG is still considered the standard method for detection in epidemiological studies, and remains widely used because of its availability and low cost.

Our results were consistent with these previous findings. We found that the presence of LVH on ECG per se was associated with a higher CV risk (Table 1). The ‘5-year CV risk’ was nearly three times as high among persons with ‘LVH’ than among those without. The number of people with a ‘high CV risk condition’, i.e. with a 5-year CV risk >15%, was ~6-fold higher among ‘LVH’ than ‘non-LVH’ individuals (Table 1).

We are aware that our findings might be affected by a selection bias since, by indication, we did not use a random sample but an opportunistic cohort of individuals receiving care from their GPs. Nevertheless, our findings

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**Table 1** Participants’ characteristics, cardiovascular (CV) risk factors and ‘5-year CV risk’ by left ventricular hypertrophy (LVH) (mean ± SD)

<table>
<thead>
<tr>
<th>Variable</th>
<th>LVH individuals (n = 230)</th>
<th>Non-LVH individuals (n = 4020)</th>
<th>‘LVH’ – ‘non LVH’ absolute difference (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>60.5 ± 6.9</td>
<td>56.0 ± 8.0</td>
<td>+4.5 (+3.5 to +5.6)</td>
</tr>
<tr>
<td>Male gender (%)</td>
<td>58.3</td>
<td>45.9</td>
<td>+12.3 (+5.7 to +18.9)</td>
</tr>
<tr>
<td>Cigarette smoking (%)</td>
<td>15.6</td>
<td>22.3</td>
<td>−6.7 (−12.2 to −1.2)</td>
</tr>
<tr>
<td>Systolic blood pressure (mmHg)</td>
<td>145.3 ± 17.7</td>
<td>136.6 ± 12.7</td>
<td>+8.7 (+7.0 to +10.4)</td>
</tr>
<tr>
<td>Blood total cholesterol (mmol/l)</td>
<td>5.93 ± 0.92</td>
<td>5.80 ± 0.96</td>
<td>+0.13 (+0.01 to +0.26)</td>
</tr>
<tr>
<td>Blood HDL cholesterol (mmol/l)</td>
<td>1.33 ± 0.31</td>
<td>1.45 ± 0.40</td>
<td>−0.12 (−0.18 to −0.07)</td>
</tr>
<tr>
<td>Blood non-HDL cholesterol (mmol/l)</td>
<td>4.60 ± 0.92</td>
<td>4.35 ± 0.98</td>
<td>+0.25 (+0.12 to +0.38)</td>
</tr>
<tr>
<td>Ratio of total to HDL cholesterol</td>
<td>4.7 ± 1.2</td>
<td>4.3 ± 1.3</td>
<td>+0.4 (+0.2 to +0.6)</td>
</tr>
<tr>
<td>Prevalence of diabetes mellitus (%)</td>
<td>23.9</td>
<td>9.1</td>
<td>+14.8 (+10.9 to +18.8)</td>
</tr>
<tr>
<td>5-year CV risk (%)</td>
<td>27.0 ± 11.2</td>
<td>8.6 ± 8.2</td>
<td>+19.2 (+18.1 to +20.3)</td>
</tr>
<tr>
<td>Prevalence of 5-year CV risk &gt;15% cut off (%)</td>
<td>88.7</td>
<td>15.2</td>
<td>+73.4 (+68.7 to +78.2)</td>
</tr>
</tbody>
</table>

*a Age and gender adjusted.*
LH and CV risk in a GP-based population

might be of some interest because they were from a GP-based large population. Additionally, our findings might contribute to provide more evidence on the value of non-HDL cholesterol as a CV risk index. Cross-sectional and prospective studies have demonstrated that in the search for the optimum index of CV risk across different populations, including Europeans, besides the ratio of total to HDL cholesterol, the value of non-HDL cholesterol should also be taken into account.\textsuperscript{9,10} In our study, both the ratio of total to HDL cholesterol and the non-HDL cholesterol were significantly higher in ‘L VH’ individuals than in the ‘non-L VH’ cases.

In everyday practice, each time that several treatment options with different effects are available, there is strong case for effective choice. Therefore, in the attempt to translate our findings into practice: (i) when a patient with mild hypertension has already developed a LVH, thus being at high CV risk \textit{per se}, he possibly will benefit greatly from intensive antihypertensive treatment with drugs also effective for LVH; and (ii) when a patient has not developed LVH, the focus should be on the prevention and/or management of diabetes or dyslipidaemia and on stopping smoking.

The last comment is consistent with the emphasis that the British Hypertension Society Guidelines have placed on the issue as they recommend that mild hypertension (i.e. 140–159/90–99 mmHg) should be treated if LVH is present whatever the risk of CVD.\textsuperscript{7}

In conclusion, a diagnosis of LVH on ECG among the adult individuals of an opportunistic cohort from general practice was associated with a 6-fold greater prevalence of a ‘high CV risk condition’.

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