AMBULATORY BLOOD PRESSURE VARIABILITY IN NORMOTENSION AND IN WHITE COAT, MASKED AND SUSTAINED HYPERTENSION. DATA FROM THE SPANISH AMBULATORY BLOOD PRESSURE REGISTRY

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Background

- Based on office and ambulatory blood pressure (BP), subjects can be classified as having normotension, white coat hypertension (WCHT), masked hypertension or sustained hypertension. (Figure 1)
- Some studies reported an association of increased short-term BP variability (BPV) with cardiovascular events and target organ damage.
- WCHT might reflect an increased cardiovascular reactivity and thus be associated with an increased BPV in daily life; this might partly explain the adverse prognostic meaning of WCHT reported in some studies.
- In previous studies either no association Ref 1,2 or a weak association Ref 3 between WCHT and BP was reported. However, these studies were small and evaluated BPV with conventional methods only.

Aim

- The aim of this study was to assess whether WCHT is associated with higher BP reactivity to daily life stimuli, using both conventional and more recently developed methods for BPV estimation in a large group of subjects from the Spanish Ambulatory Blood Pressure Monitoring Registry.

Methods

• This study is an analysis of the Spanish Society of Hypertension (ABPM) Registry Ref 1 based on a nationwide network of over 1000 primary-care physicians who consecutively recruited hypertensive patients aged ≥18 years who had clinical indications for ABPM.
- The present analysis included 18395 subjects not on antihypertensive medication for at least 2 weeks before BP data collection Ref 1.

Assessments

• Clinic BP measurement and 24 h ABPM (SpaceLabs 90207)
• Covariates included age, sex, BMI, smoking status, dyslipidemia, diabetes mellitus, renal disease, previous cardiovascular disease (stroke and/or myocardial infarction).

Classification of subjects - See Figure 1

Subjects

Blood pressure and rate pulse variability

• Conventional estimates: Standard deviation (SD) of blood pressure and pulse rate over 24h, Daytime and Night-time periods
• Weighted SD (wSD) 2 according to the formula (see Figure 2):

\[ wSD = \left( \frac{\text{daytime SD} \times 14}{20} + \frac{\text{night-time SD} \times 6}{20} \right) \]

• Average real variability (ARV) 2 according to the formula:

\[ \text{ARV} = \frac{1}{N-1} \sum_{i=1}^{N} (BP_{i} - \text{EP})^{2} \]

Results

Conclusions

- Compared to NT, after adjusting for mean BP, in WCHT we found an increase of BP variability (either assessed as daytime SD, conventional and weighted 24h SD and ARV) similar to that observed in SHT, with smaller differences in MHT.
- Conversely, night-time BPV was increased in MHT and in SHT but not in WCHT.
- Our data suggest that an increased office BP is associated with higher BP reactivity to daily life stimuli, irrespective of differences in average out-of-office BP.
- These findings may be relevant when considering the higher cardiovascular risk reported by some studies in WCHT.

Table 1. Blood pressure and pulse variability in each group

<table>
<thead>
<tr>
<th>Group</th>
<th>Average real variability (ARV)</th>
<th>Average real variability (ARV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NT</td>
<td>0.52</td>
<td>0.20</td>
</tr>
<tr>
<td>MHT</td>
<td>0.60</td>
<td>0.23</td>
</tr>
<tr>
<td>WCHT</td>
<td>0.78</td>
<td>0.27</td>
</tr>
<tr>
<td>SHT</td>
<td>0.83</td>
<td>0.29</td>
</tr>
</tbody>
</table>

Table 2. Patient characteristics in each group

<table>
<thead>
<tr>
<th>Category</th>
<th>Mean BP (mmHg)</th>
<th>Heart rate (bpm)</th>
<th>Mean 24h daytime SD</th>
<th>Mean 24h night-time SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>NT</td>
<td>127.5  (\pm) 12.5</td>
<td>70  (\pm) 10</td>
<td>14.3</td>
<td>6.5</td>
</tr>
<tr>
<td>MHT</td>
<td>137.0  (\pm) 13.1</td>
<td>70  (\pm) 10</td>
<td>13.6</td>
<td>5.7</td>
</tr>
<tr>
<td>WCHT</td>
<td>145.0  (\pm) 14.0</td>
<td>75  (\pm) 10</td>
<td>15.0</td>
<td>6.3</td>
</tr>
<tr>
<td>SHT</td>
<td>151.0  (\pm) 15.1</td>
<td>75  (\pm) 10</td>
<td>15.5</td>
<td>6.5</td>
</tr>
</tbody>
</table>

**P<0.05, ***P<0.001 in ANCOVA model adjusted for age, body mass index, gender, smoking, diabetes mellitus, dyslipidemia, previous cardiovascular disease, renal failure and mean BP.**

Figure 1. Categories of subjects according to their office and ambulatory BP normally.

Figure 2. Weighted SD. Hypertensive (H) vs. normotensive (NT) subjects. The SD of BP in NT is higher than the corresponding daytime or night-time SD, which indicates that the variability of BP is higher in patients with sustained hypertension (SHT) than in those with white coat hypertension (WCHT).

Figure 3. Standard deviation of daytime SBP for four groups.

Figure 4. Standard deviation of nighttime SBP for four groups.