Plasma noradrenaline, age and blood pressure: a population study

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Summary

1. Mean supine plasma noradrenaline was lower in 12 male laboratory staff (0.24 ± 0.02 μg/l) than similarly normotensive out-patients (0.44 ± 0.07 μg/l).

2. In 164 non-medical hospital staff, plasma noradrenaline increased with age in white males only.

3. Plasma noradrenaline was significantly higher in women than men.

4. There was no relationship between supine blood pressure and plasma noradrenaline in normotensive or hypertensive subjects.

Key words: age, blood pressure, essential hypertension, plasma noradrenaline.

Introduction

Plasma noradrenaline has been measured extensively as an index of sympathetic nervous activity. Although some early studies noted increased plasma noradrenaline in up to 50% of essential hypertensive subjects (Engelman, Portnoy & Sjoerdsma, 1970; de Quattro & Chan, 1972) and even reported a linear relationship with blood pressure (Louis, Doyle & Anavekar, 1973), others did not find any difference between hypertensive and normotensive subjects (Pedersen & Christensen, 1975).

More recently an age-related increase in plasma noradrenaline has been described (Lake, Ziegler, Coleman & Kopin, 1977) and confirmed (Sever, Birch, Osikowska & Tunbridge, 1977; Franco-Morselli, Elghozi, Joly, di Guilio & Meyer, 1977).

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There was, however, a non-uniform age distribution in many of these studies and in addition many studies used young medical and laboratory workers as controls. We have investigated the relationship between blood pressure, age and plasma noradrenaline in a group of normotensive and hypertensive hospital out-patients and in a population taking part in an employee health screen.

Materials and methods

Plasma noradrenaline concentration was measured by the radioenzymatic method of Henry, Starman, Johnson & Williams (1975) in normotensive and hypertensive out-patients, in healthy laboratory personnel, and in a large population of non-medical hospital personnel. All blood samples were drawn after a 10 min period resting supine. A small pilot study in 15 patients had initially shown that plasma noradrenaline concentrations immediately after venipuncture (0.51 ± 0.09 μg/l) were not significantly (P > 0.05) different from those (0.51 ± 0.08 μg/l) obtained after the needle was left in situ for 10 min. Supine blood pressure was measured in duplicate with an ultrasonic sphygmomanometer (Arteriosonde 1217).

Results

In 16 normotensive patients (mean age 41 ± 3 years) plasma noradrenaline was 0.44 ± 0.07 μg/l. This was significantly (0.025 < P < 0.05) higher than the mean value of 0.24 ± 0.02 μg/l obtained from 12 healthy male laboratory staff (mean age 33 ± 1 year) studied under identical conditions. The age of the groups was not significantly different.
Supine plasma noradrenaline was measured in 164 non-medical hospital staff whose blood pressure was recorded as part of a health screen. The mean value was $0.47 \pm 0.03$ pg/l (mean age 42 \pm 1 year) and was similar to that of the normotensive patients. These mean values were also similar to the plasma noradrenaline concentration of $0.41 \pm 0.04$ pg/l in 31 untreated hypertensive subjects (mean age 47 \pm 2 year).

Mean blood pressure in the health screen was $132 \pm 6/80 \pm 1$ mmHg with a pulse rate of $78 \pm 1$ beats/min. Both systolic and diastolic pressures increased significantly ($P < 0.01$) with age ($r = 0.33$ and 0.46 respectively). There was no correlation between systolic or diastolic blood pressure and plasma noradrenaline in this study or in the other groups of normotensive or hypertensive subjects examined. Analysis of the data according to race and sex showed that the plasma noradrenaline of $0.39 \pm 0.04$ pg/l in 60 white males (mean age 41.3 \pm 1.7 year) was significantly ($P < 0.05$) lower than the mean value of $0.53 \pm 0.05$ pg/l in 67 white females (mean age 41.0 \pm 1.5) (Table 1). With smaller numbers of blacks, the mean values of $0.24 \pm 0.07$ and $0.67 \pm 0.11$ pg/l respectively were significantly ($P < 0.05$) different.

No statistical difference ($P > 0.05$) was found between the plasma noradrenaline of blacks and whites or between black and white females respectively. The plasma noradrenaline concentration of black males ($0.25 \pm 0.07$) was significantly ($P < 0.05$) lower than that of white males ($0.39 \pm 0.04$).

A significant ($P < 0.01$) correlation between plasma noradrenaline and age ($r = 0.41$) was found in white males only. Analysis of variance (including analysis for interaction) of the data on the white population showed no age difference, and even though the mean values for plasma noradrenaline were significantly different, each group showed a highly significant ($P < 0.01$) interaction.

**Discussion**

In this study there was no difference in the mean plasma noradrenaline concentrations of hypertensive and normotensive subjects. The concentration was not correlated with blood pressure and the only relationship between noradrenaline and age in the present study was seen in white males. Generally females have higher amounts of noradrenaline than males and black males may have lower amounts than white males.

Medical or laboratory personnel appear to have lower plasma noradrenaline than similarly aged individuals unconnected with hospital work, presumably as a result of the greater familiarity of the former group with blood pressure measurement and venepuncture. It is tempting to use accessible laboratory employees as controls for younger groups but clearly this may be misleading. Several recent studies have noted that whereas plasma noradrenaline is not increased in all hypertensive subjects, in younger patients concentrations are higher than controls (Sever et al., 1977; Franco-Morselli et al., 1977). These results await confirmation in studies with appropriate controls.

Unfortunately we did not have many young hypertensive subjects in our studies.

Although we do not find a significant increase in plasma noradrenaline in hypertensive patients this does not mean that the sympathetic nervous system does not play an important role in blood pressure control. However, with existing methods of assessment, we find no evidence of quantitative increases in sympathetic tone in essential hypertension.

### Table 1. Mean plasma noradrenaline according to sex and race

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$n$</td>
<td></td>
<td>$n$</td>
</tr>
<tr>
<td>White</td>
<td>60</td>
<td>67</td>
<td>127</td>
</tr>
<tr>
<td>Age (years)</td>
<td>41.3 \pm 1.7</td>
<td>41.0 \pm 1.5</td>
<td>41.2 \pm 1.1</td>
</tr>
<tr>
<td>Plasma NA</td>
<td>0.39 \pm 0.04</td>
<td>0.53 \pm 0.05</td>
<td>0.45 \pm 0.03</td>
</tr>
<tr>
<td>$P$</td>
<td>$&lt;0.05$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>8</td>
<td>22</td>
<td>30</td>
</tr>
<tr>
<td>Age (years)</td>
<td>41.4 \pm 1.7</td>
<td>46.7 \pm 2.5</td>
<td>46.3 \pm 1.9</td>
</tr>
<tr>
<td>Plasma NA</td>
<td>0.24 \pm 0.07</td>
<td>0.67 \pm 0.11</td>
<td>0.56 \pm 0.09</td>
</tr>
<tr>
<td>$P$: white vs black</td>
<td>$&lt;0.05$</td>
<td>N.S.</td>
<td>N.S.</td>
</tr>
</tbody>
</table>

Mean plasma noradrenaline (NA) is expressed as $\mu g/l \pm$ SEM. N.S., Not significant.
Acknowledgments

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References


