Alexithymia
A Facet of Essential Hypertension

Antti Jula, Jouko K. Salminen, Simo Saarijärvi

Abstract—Two hundred thirty-seven newly diagnosed yet untreated hypertensive men and women, 35 to 54 years of age, were compared with an age- and gender-stratified random population sample of 146 normotensive men and women to find out whether psychological distress symptoms, anger expression, and alexithymia are associated with elevated blood pressure and whether the possible associations are independent of sodium and alcohol intake, body mass index, and physical fitness. The independent attributes of mean arterial pressure were studied by multivariate regression analyses after combining the subjects in the hypertensive and control groups. Three questionnaires were used: the Brief Symptom Inventory (BSI-37), a 31-item version of the Spielberger State-Trait Anger Expression Inventory (STAXI), and the Toronto Alexithymia Scale (TAS-26). Total scores of the TAS-26 were higher (P<0.001) in hypertensive men and women than in their normotensive control subjects (75.6±7.8 vs 64.1±9.8 in men and 72.9±7.1 vs 57.5±11.5 in women). There were no differences between the study and control groups in psychological distress symptoms, including anxiety, depression, and hostility, or in anger expression. In multivariate regression analyses, higher age, male gender, higher sodium intake, lower physical fitness, and alexithymia were independently and highly significantly (P<0.01 for male gender, P<0.0001 for other variables) associated with increased blood pressure, explaining altogether 39.5% of the cross-sectional variation in mean arterial pressure. We conclude that alexithymia, that is, poor ability to experience and express emotions, is associated with elevated blood pressure independent of sodium and alcohol intake, body mass index, and physical fitness. (Hypertension. 1999;33:1057-1061.)

Key Words: hypertension, essential ■ alexithymia ■ sodium ■ alcohol ■ body mass index ■ physical fitness ■ stress, psychological

Psychological factors can raise blood pressure acutely, but whether they lead to development of essential hypertension, as stated by Alexander1 in his early psychosomatic hypothesis, is not known. The hypothesis has been addressed in many cross-sectional studies and in a small number of prospective studies. Suppressed feelings, anger and hostility,2–5 alexithymia,6 anxiety,4–5,7–9 depression,9 job strain,10 stressful work conditions,11 and psychosocial stress12,13 are the most common factors associated with elevated blood pressure. Some studies on suppressed hostility3,5 and increased anxiety14 as possible psychosomatic mechanisms in hypertension suggest that they may have a role in the development of mild high-renin essential hypertension. Prospective studies support the view that they may have feelings2 and especially suppressed anger5 are of importance in predicting blood pressure rise with age, whereas others do not find any association between anger behavior and change in blood pressured,4,7,8,15 Several studies suggest that high anxiety levels predict later incidence of hypertension, at least in subgroups of subjects,5,7–9 whereas negative findings have also been reported.4 A 30-year follow-up study suggests that lack of psychosocial stress may prevent blood pressure rise with age.13 Environmental factors play a significant role in the development of essential hypertension. High sodium and alcohol intakes and obesity are associated with blood pressure rise with age.16–18 Physically fit persons have lower incidence of hypertension when compared with less fit persons.19,20 Low level of education is related to higher blood pressure.21 The relation is largely explained by lifestyle factors.21 However, surprisingly little is known about the possible interactions between psychological factors, lifestyle factors, and blood pressure.

We compared newly diagnosed yet untreated, moderately to severely hypertensive subjects with a population sample of men and women of matching age to find out if anger expression, anxiety, hostility, depression, or alexithymia, that is, poor ability to experience and express emotions, are associated with hypertension. Moreover, we wanted to study if the possible associations are independent or partly mediated by lifestyle factors.

Methods

Subjects
Newly diagnosed yet untreated, moderately to severely hypertensive men and women, 35 to 54 years of age, residing in the city of Turku and 3 neighboring municipalities (a population of ~200,000 inhabitants) in southwestern Finland, were recruited into the study. The inclusion criteria were a systolic or a diastolic blood pressure consistently in the range of 180 to 220 mm Hg or 100 to 120 mm Hg,
respectively, as measured within the primary health care. Patients with coronary artery disease, cerebrovascular disease, insulin-treated diabetes mellitus, or hemodynamically significant valvular disease were excluded from the study. Two hundred thirty-seven out of 252 subjects met the inclusion criteria. For a control group, a random sample of men and women residing in the same area was drawn from the national population register. For stratification, 45 subjects of each gender and each 10-year age group (35 to 44 and 45 to 54) were chosen. Subjects with antihypertensive medication or a systolic or a diastolic blood pressure of ≥140 mm Hg or ≥90 mm Hg, respectively, were excluded from the control group. Sixty-eight out of 83 men and 78 out of 91 women met the inclusion criteria. The study was conducted following the Second Declaration of Helsinki and was approved by the ethical committee of the Social Insurance Institution of Finland. All subjects gave their informed consent.

Examinations and Measurements
Blood pressure was measured by a trained nurse. It was recorded in seated posture with a mercury sphygmomanometer, always between 8 and 10 AM, according to the guidelines of the American Society of Hypertension. A cuff with a bladder width of 15 cm was used. Subjects were requested to refrain from heavy exercise in the morning and to avoid cola drinks, coffee, tea, and smoking for at least 1 hour before the measurement. Blood pressure was averaged over duplicate measures obtained in 4 separate sessions within 3 weeks. Body weight was measured in light clothing without shoes with an accuracy of 0.1 kg and height with an accuracy of 1 cm. Twenty-four-hour urine samples were collected to determine sodium and creatinine excretions. Sodium was analyzed by emission flame photometry and creatinine by the Jaffé method. A 24-hour urine collection was accepted as complete if its creatinine content was >7.8 mmol for men and >6.9 mmol for women. These were the 2.5 percentile values of the 24-hour urinary creatinine of the 100 men and 100 women who had participated in the Intersalt study in Turku. Altogether 97.1% of urine collections in men and 90.4% of urine collections in women were complete according to these criteria. Seven-day alcohol intake was assessed by means of a questionnaire. The alcoholic drinks were converted to grams of alcohol with an accuracy of 0.1 kg and height with an accuracy of 1 cm. Twenty-four-hour urine samples were collected to determine sodium and creatinine excretions. Sodium was analyzed by emission flame photometry and creatinine by the Jaffé method. A 24-hour urine collection was accepted as complete if its creatinine content was >7.8 mmol for men and >6.9 mmol for women. These were the 2.5 percentile values of the 24-hour urinary creatinine of the 100 men and 100 women who had participated in the Intersalt study in Turku. Altogether 97.1% of urine collections in men and 90.4% of urine collections in women were complete according to these criteria. Seven-day alcohol intake was assessed by means of a questionnaire. The alcoholic drinks were converted to grams of alcohol with an accuracy of 0.1 kg and height with an accuracy of 1 cm.

The 31-item version of the Spielberger State-Trait Anger Expression Inventory (STAXI), and the Toronto Alexithymia Scale (TAS-26) was chosen. Subjects with antihypertensive medication or a systolic or a diastolic blood pressure of ≥140 mm Hg or ≥90 mm Hg, respectively, were excluded from the control group. Sixty-eight out of 83 men and 78 out of 91 women met the inclusion criteria. The study was conducted following the Second Declaration of Helsinki and was approved by the ethical committee of the Social Insurance Institution of Finland. All subjects gave their informed consent.

Psychological Characteristics and Symptoms
Hypertensive and normotensive subjects did not differ in their socioeconomic status (Table 1). As compared with their normotensive control subjects, hypertensive men and women were slightly older, had higher relative body weights and 24-hour urinary sodium excretions, and slightly lower maximal oxygen uptakes (Table 1). There were fewer smokers among hypertensive than among normotensive men and women (Table 1). Hypertensive and normotensive subjects consumed alcohol in equal amounts (Table 1).

Statistics
The values are given as mean±SD. Statistical analysis of the data were performed with SAS computer programs (SAS Institute). Group mean values were compared by a 2-way ANOVA grouped on gender and disease status. If significant, Tukey’s studentized range test was used for within-gender comparisons of normotensives and hypertensives. The test gives significances only on the level of <0.05. Correlation and regression analyses were performed after combining the subjects in the hypertensive and control groups. Associations between the studied variables were tested by calculating bivariate Pearson’s product moment coefficients and gender-, age-, and gender/age-adjusted partial correlation coefficients. To find out independent correlates of blood pressure and predictors of alexithymia, multiple linear regression analyses were made by use of the statistically significant (P<0.05) correlates. Before the analyses, a variable with skewed distribution (alcohol intake) was moved closer to normality by use of its natural logarithm.

Results
Demographic and Lifestyle Characteristics
Hypertensive and normotensive control subjects, hypertensive men and women were slightly older, had higher relative body weights and 24-hour urinary sodium excretions, and slightly lower maximal oxygen uptakes (Table 1). There were fewer smokers among hypertensive than among normotensive men and women (Table 1). Hypertensive and normotensive subjects consumed alcohol in equal amounts (Table 1).

Multivariate Analyses
We used the total score of the TAS-26 (range 26 to 130) as an indicator of alexithymia. To assess the prevalence of alexithymia, the proportion of subjects with TAS-26 total scores was categorized according to the clinically evaluated cutoff points suggested by the Toronto group: total score of ≥74 points indicates alexithymia and ≤64 points indicates that no alexithymia is present.26

Correlates of Blood Pressure in Multivariate Analyses
In multivariate analyses with statistically significant gender-adjusted correlates of mean arterial pressure, 39.5% of the
variation in mean arterial pressure was explained by age, gender (female 0, male 1), 24-hour urine sodium, maximal oxygen uptake, and total score of the TAS-26 (Table 4). In a model in which total score of the TAS-26 was not included, 25.2% of the variation in mean arterial pressure was explained by age ($P<0.0001$), gender ($P<0.05$), body mass index ($P<0.0001$), and 24-hour urine sodium ($P<0.0001$).

### Demographic and Lifestyle Correlates of Alexithymia in Univariate and Multivariate Analyses

Total score of the TAS-26 correlated positively with age ($R=0.12$, $P<0.05$), body mass index ($R=0.25$, $P<0.001$), alcohol intake ($R=0.13$, $P<0.01$), and 24-hour urine sodium level ($R=0.20$, $P<0.001$). The inverse association of total score of the TAS-26 with maximal oxygen uptake became significant ($R=-0.16$, $P<0.01$), and the association with alcohol intake disappeared after adjustment for gender. In multivariate analyses with gender, age, and lifestyle factors, 11.4% of the variation in the total score of alexithymia was explained by gender ($P<0.0001$) and body mass index ($P<0.0001$).

### Discussion

Our study showed that alexithymia, that is, poor ability to experience and express emotions and proneness to externally oriented thinking, differentiates men and women with untreated hypertension from their normotensive control subjects, whereas anger expression (including suppressed anger) or psychological distress symptoms (including anxiety, depression, and hostility) do not. Hypertensive women had more somatization (bodily sensations) than did normotensive women. In accordance with earlier studies, higher age, male gender, and lower physical fitness were associated with elevated blood pressure. Al-

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### TABLE 1. Characteristics of Subjects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Men HT (n=138)</th>
<th>Men NT (n=68)</th>
<th>Women HT (n=99)</th>
<th>Women NT (n=78)</th>
<th>$P^*$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>45.7±5.1</td>
<td>44.0±5.3</td>
<td>46.4±4.7†</td>
<td>44.2±5.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Body weight, kg</td>
<td>88.7±14.7†</td>
<td>80.4±14.5</td>
<td>74.1±13.5†</td>
<td>66.3±11.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Height, m</td>
<td>1.78±0.07</td>
<td>1.76±0.07</td>
<td>1.64±0.05</td>
<td>1.64±0.06</td>
<td>0.218</td>
</tr>
<tr>
<td>Body mass index, kg/m²</td>
<td>28.0±4.1†</td>
<td>25.8±4.0</td>
<td>27.6±4.9†</td>
<td>24.7±3.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Urinary sodium, mmol/d</td>
<td>198±82†</td>
<td>151±57</td>
<td>143±57</td>
<td>125±43</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Alcohol intake, g/wk</td>
<td>154±147</td>
<td>149±159</td>
<td>39±43</td>
<td>48±55</td>
<td>0.348</td>
</tr>
<tr>
<td>Maximal oxygen uptake, L·kg⁻¹·min⁻¹</td>
<td>35.1±6.4</td>
<td>36.8±7.9</td>
<td>26.4±5.0†</td>
<td>29.6±5.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Systolic blood pressure, mm Hg</td>
<td>146.2±13.1†</td>
<td>118.5±9.5</td>
<td>142.1±11.3†</td>
<td>113.3±8.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Diastolic blood pressure, mm Hg</td>
<td>96.5±7.9†</td>
<td>74.5±7.5</td>
<td>91.8±5.6†</td>
<td>72.5±6.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mean arterial pressure, mm Hg</td>
<td>110.9±11.0†</td>
<td>89.2±7.6</td>
<td>107.4±8.4†</td>
<td>86.1±6.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Smokers, %</td>
<td>21</td>
<td>40</td>
<td>13</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Socioeconomic class, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manual workers</td>
<td>51</td>
<td>48</td>
<td>27</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Lower level employees</td>
<td>28</td>
<td>34</td>
<td>62</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Upper level employees</td>
<td>14</td>
<td>10</td>
<td>7</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>7</td>
<td>7</td>
<td>4</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

HT indicates hypertensive; NT, normotensive. Values are mean±SD.†Significance level of hypertension in a main-effect model of 2-way ANOVA.

### TABLE 2. TAS-26 Scores in Hypertensive and Normotensive Men and Women

<table>
<thead>
<tr>
<th>Variable</th>
<th>Men HT (n=138)</th>
<th>Men NT (n=68)</th>
<th>Women HT (n=99)</th>
<th>Women NT (n=78)</th>
<th>$P^*$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total TAS-26</td>
<td>75.6±7.8†</td>
<td>64.1±9.8</td>
<td>72.9±7.1†</td>
<td>57.5±11.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Factor 1</td>
<td>28.0±5.4†</td>
<td>24.6±5.8</td>
<td>26.5±5.3†</td>
<td>20.8±7.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Factor 2</td>
<td>20.9±2.8†</td>
<td>18.0±3.8</td>
<td>19.9±2.7†</td>
<td>15.2±5.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Factor 3</td>
<td>15.1±2.1</td>
<td>14.4±4.1</td>
<td>14.9±2.0</td>
<td>14.0±4.5</td>
<td>0.016</td>
</tr>
<tr>
<td>Factor 4</td>
<td>20.0±2.5†</td>
<td>15.4±3.1</td>
<td>20.0±2.5†</td>
<td>13.9±3.9</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

HT indicates hypertensive; NT, normotensive; TAS, Toronto Alexithymia Scale; Factor 1, difficulty in identifying feelings; Factor 2, difficulty in describing feelings; Factor 3, reduced daydreaming; and Factor 4, externally oriented thinking. Values are mean±SD.†Significance level of hypertension in a main-effect model of 2-way ANOVA.

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most 40% of the cross-sectional variation in mean arterial pressure was attributed to age, gender, sodium intake, physical fitness, and alexithymia. Age, gender, and lifestyle factors alone explained \( \approx 25\% \) of the variation in mean arterial pressure. A relatively small portion of the association between blood pressure and alexithymia was mediated by lifestyle factors, mainly by higher relative body weight.

Psychological distress symptoms may fluctuate with time. On the contrary, alexithymia is generally considered as a stable personality trait. A recent population study showed that alexithymia is associated with male gender, low educational level, low socioeconomic status, and weakly associated with alexithymia twice as often as normotensive women, but the difference in psychological distress symptoms, which suggests that alexithymia hardly is a reaction to the awareness of having elevated blood pressure.

Theories of the causes of alexithymia range from neurobiological to sociocultural ones. Neurobiological theories suggest that alexithymia may be related to an interruption of the limbic-neocortical communication, or may be a result of a dysfunction in the right cerebral hemisphere. Psychological theories suggest that growing up in an emotionally poor and unstimulating environment or that a massive psychological trauma later in life could result in alexithymia. Recently, it has been suggested that alexithymia, regardless of its cause, reflects a deficit in cognitive processing and regulation of emotions. Poor ability to be aware of and to cope with emotions may make an alexithymic individual vulnerable to continuous stress.

Our study group consisted of untreated hypertensive patients and the control group of a random population sample of healthy men and women, all 35 to 54 years of age. To ensure that the sample of hypertensive patients would represent normal clinical settings, all local primary care physicians were requested to send patients with uncomplicated yet untreated sustained hypertension to the study. The ratio of hypertensive men to hypertensive women was 1.4, corresponding to the national ratio of hypertensive men and women of the same age. The random sample can be considered representative of the target population because the participation rate was >80%. Blood pressure was measured carefully by a trained nurse and averaged over 4 duplicate measures. We have earlier shown that this technique is as

**TABLE 4. Independent Correlates of Blood Pressure Based on Multiple Regression Analyses**

<table>
<thead>
<tr>
<th>Variable</th>
<th>( \beta )</th>
<th>SE</th>
<th>( t )</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.39</td>
<td>0.12</td>
<td>6.78</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Gender</td>
<td>-4.14</td>
<td>1.50</td>
<td>-2.76</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Urinary sodium, mmol/d</td>
<td>0.04</td>
<td>0.01</td>
<td>5.20</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Maximal oxygen uptake, L ( \cdot ) kg(^{-1})( \cdot ) min(^{-1})</td>
<td>-0.37</td>
<td>0.10</td>
<td>-3.95</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Total TAS-26</td>
<td>0.50</td>
<td>0.05</td>
<td>9.36</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Intercept</td>
<td>61.10</td>
<td>9.01</td>
<td>6.78</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

\( \beta \) indicates multiple linear regression coefficient; SE, standard error of the coefficient; \( t \), \( t \) value of the coefficient; \( P \), statistical significance of the coefficient; and \( R^2 \), squared multiple correlation coefficient.
reliable as ambulatory blood pressure monitoring in assessment of an individual’s blood pressure status. It also gives considerably lower blood pressure values compared with the usual measurements made by nurses or physicians within the primary health care. According to the carefully controlled repeated blood pressure measurements, only 20% of our hypertensives had a moderate and 5% a severe hypertension. A single, carefully conducted 24-hour urine collection was used for estimation of sodium intake. More than 90% of the urine collections were determined to be complete. Our study may still underestimate the association of dietary sodium with blood pressure, mostly because of the known large intra-individual variability in daily sodium intake, compared with smaller inter-individual differences.

In summary, alexithymia, that is, poor ability to experience and express emotions, is associated with elevated blood pressure independent of sodium and alcohol intake, body mass index, and physical fitness. Prospective studies measuring alexithymic personality features before elevated blood pressure as well as studies dealing with the neurogenic mechanisms of alexithymia are needed to elucidate its role in the pathogenesis of essential hypertension.

References


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