Differences in Emotion Processing in Patients With Essential and Secondary Hypertension

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BACKGROUND
An impaired ability to experience and express emotions, known as alexithymia, has previously been associated with hypertension. Alexithymia and related emotion-processing variables, however, have never been examined as a function of the type of hypertension, essential (EH) or secondary (SH).

METHODS
Our working hypothesis was that if dysregulated emotional processes play a key neurobiological role in EH, they would be less present in hypertension due to specific medical causes or SH. A total of 98 consecutive hypertensive patients (73 EH, 25 SH) with similar blood pressure levels completed two complementary measures of emotion processing: the 20-item Toronto Alexithymia Scale (TAS-20) and the Levels of Emotional Awareness Scale (LEAS).

RESULTS
After controlling for confounding variables, LEAS score was lower in EH than SH (estimated means: 46.4 vs. 52.0; P = 0.028; effect size 0.52).

Hypertension has historically been considered a psychosomatic disease.1–3 Consequently, several studies have searched for differences in emotion processing between normotensives and hypertensives, as well as between normotensives with and without a family history of hypertension. Increased blood pressure reactivity to mental stressors as well as several emotion-processing abnormalities, such as suppressed anger, anxiety, depression, or job stress, have been associated with hypertension.4–14 A few studies focused on the presence of a global impairment in processing emotions in hypertensives. Such impairment, named alexithymia, was originally defined as a difficulty in identifying and describing feelings. The association of alexithymia with several classic psychosomatic diseases was described by Sifneos15 and Nemiah et al.16 in the 1970s. The construct of alexithymia was further developed by several authors.17–24

Using the 20-item Toronto Alexithymia Scale (TAS-20), the most widely used measure of alexithymia to date, Todarello et al.25 found hypertensive patients to be more frequently alexithymic: 55% of alexithymic individuals in a hypertension group, compared with a rate of 33% in a psychiatric control sample, and 16% in a normal control sample. Jula et al.26 also found higher TAS-26 scores in newly diagnosed, uncomplicated and as yet untreated hypertensive men and women, compared with normotensive controls (TAS-26 is an earlier version of the TAS-20, which correlates highly with it). Gage and Egan27 and Lyshova et al.28 observed more severe disease (i.e., presence of target organ damage) or longer duration of the disease in alexithymic vs. nonalexithymic hypertensive patients.

Psychometric data available in hypertensive patients are therefore compatible with impaired emotion-processing in hypertension. Nevertheless, studies published on this topic generally compared hypertensive patients with normotensive controls, and it cannot be excluded that the observed results may simply reflect the psychological impact of having a

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chronic somatic disease or the consequences of some subclinical brain damage due to a longstanding hypertensive disease.

This study was based on the hypothesis that if dysregulated emotional processes play a key neurobiological role in primary or essential hypertension (EH), they would be less present in hypertension due to specific medical causes or secondary hypertension (SH). In other words, we thought that even if EH and SH share common emotion-processing alterations as results of a similar clinical condition, a more pronounced impairment in emotion processing should be expected in EH. In fact, no study has ever compared emotion processing between the two forms of hypertension. This study was thus designed to compare emotion-processing scores in EH vs. SH, taking into account the presence of potential confounding variables. Two complementary tools were used for measuring emotion processing: the TAS-20, for measuring alexithymia, and the Levels of Emotional Awareness Scale (LEAS), for measuring “emotional awareness”, i.e., the capacity to represent, discriminate, and elaborate both one’s own and others’ emotional experience in a given context. Emotional awareness has never been studied in hypertensive patients. Higher levels of alexithymia and/or lower levels of emotional awareness were expected in EH compared with SH.

**METHODS**

**Subjects.** The study population consisted of consecutive hypertensive patients admitted to a hypertension clinic (Broussais Hospital, Paris, France), typically for pharmacological readjustment or extensive clinical work-up. Subjects completed a battery of questionnaires (see below). Sociodemographic and clinical data were obtained from medical records.

**Psychometric measures.** Alexithymia was measured by the French version of the TAS-20 (ref. 30). This is a self-report questionnaire that involves rating 20 statements on a 5-point Likert scale for a minimum score of 20 and a maximum score of 100. Although alexithymia is a dimensional construct, cut-off scores have been proposed (≥56 for the French population) for selecting alexithymic subjects when using a categorical approach. The three factorial components of the scale were also computed: difficulty identifying feelings (DIF) or Factor 1, difficulty describing feelings (DDF) or Factor 2, and externally oriented thinking (EOT) or Factor 3 (ref. 31).

Emotional awareness was measured by the French version of the Levels of Emotional Awareness Scale (LEAS). This is a written, projective instrument that asks the subject to describe his or her anticipated feelings and those of another person in each of 20 scenes described in two to four sentences and constructed to elicit four types of emotion (anger, fear, happiness, and sadness). Each scene is followed by two questions: “How would you feel?” and “How would the other person feel?” The construct of LEAS is based on a cognitive-developmental model of emotional experience related to Piaget’s model of intelligence. In this model, the experience of emotion is hypothesized to undergo structural transformation in a hierarchical developmental sequence of progressive differentiation and integration. Alexithymia is thought to be associated with lower level function on this continuum. Thus, each response to a scene receives a score of 0–5, according to five levels of increasing complexity, 0 corresponding to non-emotion responses, e.g., cognitive terms, 1 to an awareness of physiological cues, 2 to undifferentiated emotions or action tendencies, 3 to differentiated emotions or feelings, 4 to a blend of differentiated emotions, and 5 to differentiated emotions attributed to self and other that are nonidentical. The maximum possible score on the LEAS is 100. Self and other LEAS subscores are also generally computed. We will report only the results for total LEAS scores as this is the most reliable measure. A glossary of words and phrases at each level was created by Lane and Schwartz to guide scoring. Inter-rater reliability of LEAS total score is high with intraclass r = 0.84 for the English version and r = 0.96 for the French version.

In addition to these two main emotion-processing measures, subjects also completed the French version of the 27-item Ways of Coping Checklist, which provides three scores: problem-focused coping, emotion-focused coping, and seeking social support. Emotion-focused coping includes items addressing minimization (Wished that the situation would go away or somehow be over with), or self-blame (Criticized or lectured myself). No hypothesis was formulated regarding a difference in coping mechanisms between EH and SH, but coping measures were considered as potential covariates of the two emotion-processing measures. Actually, emotion-focused coping was found in several studies to be a good predictor of depression, negative affect, or emotional distress.

**Statistical analysis.** Student t-tests for unpaired groups, Mann-Whitney nonparametric tests, and χ²-tests were, respectively, used for comparing means or ranks of continuous or ordered variables (e.g., educational level, duration of the disease), or distributions of categorical variables. Associations between quantitative variables were tested calculating Pearson r product-moment or Spearman r rank correlation coefficients for ordered variables (e.g., correlation between psychometric measures and educational level). Effect sizes were computed for indicating the magnitude of differences in psychometric measures between EH and SH (Cohen’s d for continuous variables and the coefficients of contingency for categorical ones (categorical alexithymia)). Post hoc power estimates with α = 0.05 were also computed.

Multivariate analyses of continuous variables (i.e., the TAS-20 total score and subscores and the LEAS score) were performed for comparing EH and SH, using a general linear model, with all potential confounding variables (i.e., sociodemographic or clinical variables found to be associated with the type of hypertension in univariate analyses) as covariates.

Finally, a multivariate binary logistic regression was performed for predicting the type of hypertension (EH vs. SH) according to psychometric measures and controlling for sociodemographic or clinical variables found to be associated with the type of hypertension in univariate analyses. Only the variables with a statistical level of significance <0.10 were kept into the model.
Emotion Processing in Hypertension

Table 1 | Sociodemographic and clinical characteristics of the study population

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>EH</th>
<th>SH</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (%)</td>
<td>98</td>
<td>73</td>
<td>25</td>
<td>0.56</td>
</tr>
<tr>
<td>Male gender</td>
<td>98</td>
<td>45%</td>
<td>52%</td>
<td>0.56</td>
</tr>
<tr>
<td>Age (years)</td>
<td>98</td>
<td>53.4 ± 12.7</td>
<td>52.2 ± 15.7</td>
<td>0.86</td>
</tr>
<tr>
<td>Educational level (1–7)</td>
<td>98</td>
<td>4.9 ± 1.7</td>
<td>5.2 ± 1.5</td>
<td>0.51</td>
</tr>
<tr>
<td>SBP (mm Hg)</td>
<td>95</td>
<td>165.8 ± 23.8</td>
<td>169.2 ± 31.8</td>
<td>0.58</td>
</tr>
<tr>
<td>DBP (mm Hg)</td>
<td>95</td>
<td>96.4 ± 15.0</td>
<td>99.3 ± 15.4</td>
<td>0.42</td>
</tr>
<tr>
<td>ACE inhibitors</td>
<td>98</td>
<td>32%</td>
<td>12%</td>
<td>0.057</td>
</tr>
<tr>
<td>Angiotensin II receptor antagonists</td>
<td>98</td>
<td>29%</td>
<td>8%</td>
<td>0.034</td>
</tr>
<tr>
<td>Thiazide diuretics</td>
<td>98</td>
<td>36%</td>
<td>24%</td>
<td>0.29</td>
</tr>
<tr>
<td>Calcium channel blockers</td>
<td>98</td>
<td>45%</td>
<td>44%</td>
<td>0.92</td>
</tr>
<tr>
<td>β-Blockers</td>
<td>98</td>
<td>45%</td>
<td>36%</td>
<td>0.42</td>
</tr>
<tr>
<td>Number of antihypertensive drugs</td>
<td>98</td>
<td>2.45 ± 1.65</td>
<td>1.68 ± 1.35</td>
<td>0.045</td>
</tr>
<tr>
<td>Duration of HT (years)</td>
<td>98</td>
<td>10.5 ± 9.4</td>
<td>11.0 ± 9.0</td>
<td>0.69</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>97</td>
<td>27.6 ± 5.5</td>
<td>24.7 ± 3.0</td>
<td>0.002</td>
</tr>
<tr>
<td>BMI ≥30 kg/m²</td>
<td>97</td>
<td>27%</td>
<td>4%</td>
<td>0.017</td>
</tr>
<tr>
<td>Current smoking</td>
<td>98</td>
<td>19%</td>
<td>20%</td>
<td>0.93</td>
</tr>
<tr>
<td>Hypercholesterolemia</td>
<td>96</td>
<td>72%</td>
<td>48%</td>
<td>0.031</td>
</tr>
<tr>
<td>Diabetes</td>
<td>98</td>
<td>14%</td>
<td>8%</td>
<td>0.45</td>
</tr>
<tr>
<td>CV complications</td>
<td>98</td>
<td>12%</td>
<td>16%</td>
<td>0.64</td>
</tr>
</tbody>
</table>

Except for categorical variables, results correspond to means ± s.d. P is the comparison between EH and SH (Student t-test for continuous variables, Mann–Whitney test for ordered variables (educational level, duration of HT, number of antihypertensive drugs prescribed) and χ²-test for categorical variables). ACE, angiotensin-converting enzyme; BMI, body mass index; CV, cardiovascular; DBP, diastolic blood pressure; EH, essential hypertension; HT, hypertension; SBP, systolic blood pressure; SH, secondary hypertension.

RESULTS

Population characteristics

A total of 98 hypertensive patients were included in the study. Two subsets of hypertensives were defined based on medical diagnosis: 73 patients suffering from EH and 25 patients from SH; 13 of the latter were attributed to renal artery stenosis, 1 to primary nephropathy, 9 to primary aldosteronism, and 2 to pheochromocytoma.

The sociodemographic and clinical characteristics of the study population are described in Table 1. EH differed from SH patients in having a higher body mass index (BMI) and a higher percentage of patients suffering from obesity (BMI ≥30 kg/m²) or hypercholesterolemia. Given the non-normal distribution of the duration of the disease, this variable was log-transformed before entering into statistical analyses. In total, 13 patients (9 EH and 4 SH patients) presented with associated clinical cardiovascular (CV) complications. The latter consisted of coronary heart disease (n = 6), peripheral vascular disease (n = 5), stroke (n = 4), and heart failure (n = 1), some patients presenting with more than one CV complication.

Except for three EH patients, for whom the current blood pressure measures were not reported in medical records, data collected for the remaining 95 patients showed that systolic and diastolic blood pressures did not differ between EH and SH. The number of prescribed antihypertensive drugs was greater in EH; moreover, angiotensin II receptor antagonists and, marginally, angiotensin-converting enzyme (ACE) inhibitors were less prescribed in SH (Table 1).

Correlation analyses

Total TAS-20 score and LEAS score were slightly intercorrelated (r = −0.20, P = 0.047). LEAS was also correlated with DDF score (r = −0.27, P = 0.008).

Ways of Coping Checklist emotion-focused coping was positively correlated with TAS DIF subscore (r = 0.25; P = 0.013) and, marginally, with total TAS-20 score (r = 0.18; P = 0.082), but not with LEAS (r = 0.03).

TAS-20 was correlated with age (r = 0.20; P = 0.043) and educational level (ρ = −0.32, P = 0.001). No significant association was observed between LEAS scores and gender, age, or educational level. No significant association was observed between TAS-20 or LEAS scores and CV risk factors (smoking, hypercholesterolemia, BMI, diabetes), except a positive correlation between TAS-20 EOT subscore and BMI (r = 0.24; P = 0.017), the log-transformed duration of hypertension since diagnosis or the presence of CV complications. No association was found between psychometric measures and the number of prescribed antihypertensive drugs, but LEAS scores were lower in patients receiving ACE inhibitors (43.0 ± 10.5 vs. 49.6 ± 10.9; P = 0.009).

Univariate comparisons of psychometric measures between EH and SH

The mean TAS-20 total score and LEAS score for the entire sample of hypertensives were 51.4 ± 11.8 and 47.9 ± 11.2, respectively.

Univariate comparisons of psychometric measures between EH and SH are presented in Table 2. EH differed from SH in that it was associated with higher EOT scores (P = 0.033) and lower LEAS scores (P = 0.009). Although a higher percentage of alexithymia was found in EH (40%) in comparison to SH (28%), according to French-recommended cutoff point (≥56; ref. 30) the difference was not significant. The difference was even narrower when applying international cutoff point (≥61; ref. 20). Although TAS-20 total score, DIF, and DDF subscores were not significantly different between EH and SH, values were higher in EH, with effect sizes of 0.34, 0.27, and 0.07, respectively, and a post hoc power estimate of 0.30 for TAS-20 total score.

No difference between the two types of hypertension was found for Ways of Coping Checklist scores.

Multivariate analyses

Regarding the TAS-20 total and factorial subscores (DIF, DDF, and EOT scores), no effect of hypertension type (EH vs. SH) was observed after controlling for BMI and hypercholesterolemia and/or for emotion-focused coping.

Regarding the LEAS score, the difference observed in univariate analysis between EH and SH persisted after controlling
for BMI, hypercholesterolemia, CV complications, emotion-focused coping, and prescription of ACE inhibitors (P = 0.047). Retaining within the model only those subjects associated with LEAS score at P < 0.10, LEAS was predicted both by the type of hypertension (P = 0.028) and prescription of an ACE inhibitor (P = 0.027). Estimated LEAS means for EH and SH were 46.4 and 52.0, respectively (effect size = 0.52). LEAS scores were lower in hypertensive patients treated by ACE inhibitors.

We finally performed a descending hierarchical binary logistic regression analysis for predicting SH vs. EH, entering first into the model all the variables associated with the type of hypertension. Three independent variables remained within the model: the LEAS total score (P = 0.012), the BMI, and the prescription of an angiotensin II receptor antagonist. SH was thus predicted by higher LEAS scores, lower BMI, and no prescription of an angiotensin II receptor antagonist (Table 3).

**DISCUSSION**

To our knowledge, this is the first study that examined two complementary aspects of emotion processing, alexithymia, and emotional awareness, in ES vs. SH, using both TAS-20 and LEAS measures. Our results confirmed the presence of emotion-processing differences between EH and SH, even after controlling for potential confounding variables. In univariate as well as in multivariate analyses, emotional awareness, as measured by the LEAS, strongly differentiated EH from SH, according to our hypothesis, with significantly lower emotional awareness in EH vs. SH. Although TAS-20 scores and subscores did not significantly differentiate EH from SH in multivariate analyses, the differences found were in the expected direction, with higher alexithymia scores in EH vs. SH and a non-negligible effect size for TAS-20 total score.

**Table 2 | Psychometric measures of the study population**

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>EH Mean ± SD</th>
<th>SH Mean ± SD</th>
<th>t-test</th>
<th>P</th>
<th>95% CI</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEAS total score</td>
<td>98</td>
<td>46.2 ± 11.5</td>
<td>48.4 ± 12.1</td>
<td>0.15</td>
<td>0.34</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>Angiotensin II receptor antagonists</td>
<td>98</td>
<td>23.4 ± 4.8</td>
<td>23.9 ± 6.0</td>
<td>0.64</td>
<td>0.10</td>
<td>0.08</td>
<td></td>
</tr>
</tbody>
</table>

**Table 3 | Multivariate logistic regression analysis of the type of hypertension (secondary vs. essential)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>P</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEAS</td>
<td>0.012</td>
<td>1.07</td>
<td>1.02–1.13</td>
</tr>
<tr>
<td>BMI</td>
<td>0.026</td>
<td>0.88</td>
<td>0.78–0.99</td>
</tr>
<tr>
<td>Angiotensin II receptor antagonists</td>
<td>0.032</td>
<td>0.16</td>
<td>0.03–0.85</td>
</tr>
</tbody>
</table>

**Interpretation of findings**

Results are consistent with a higher emotion dysregulation in EH than in SH, potentially playing a key neurobiological role in the pathogenesis of EH, which corresponds to the classical “psychosomatic” model of the disease. They are also consistent with the existing literature suggesting that, in patients suffering from paroxysmal hypertension, greater emotional awareness may prevent emotional distress from contributing to blood pressure elevation.37

LEAS proved to be more effective in discriminating between EH and SH than did TAS-20. The latter measures the more classical aspect of a deficit in emotion processing, i.e., the presence of alexithymic characteristics. Only the EOT factor score was higher in EH vs. SH, but this finding in univariate analysis was not confirmed in multivariate analysis. Consistently, Jula et al.,26 showed a greater effect size between hypertensives and normotensives using the TAS-26 Factor 4, which is very similar to the TAS-20 EOT Factor score. Independent of hypertension type (EH or SH), quite high levels of alexithymia and a moderately high percentage of alexithymic individuals (40% in EH and 28% in SH, when using the French-recommended cutoff points, and, respectively, 25 and 20% with international cutoffs) were observed in our study, in comparison with data from the general populations (about 15% of alexithymics30,38).

Our results in EH, even with lower cutoffs, are nevertheless lower than those of Todarello et al.,25 and Jula et al.,26 who, respectively, found 55% of alexithymic subjects, and 57% of alexithymic males and 46% of alexithymic females in their samples, but we have to take into account that their samples did not mix EH and SH as did ours. As regards continuous TAS-20 scores, our results on EH subjects (52.4 ± 11.6) are lower than those published by Todarello et al.,25 (62.0 ± 13.0) but higher than US norms for nonclinical populations (45.6 ± 11.4; ref. 39) or French norms for nonclinical populations (46.2 ± 10.5; ref. 30). As regards our TAS-20 scores in SH patients (48.4 ± 12.1), our results are still higher than US or French norms. Our LEAS scores not only in EH subjects (46.2 ± 11.5) but also in SH subjects (52.8 ± 8.4) are lower than US norms (58.5 ± 11.0 for males and 64.3 ± 10.2 for females)38 or French norms (62.1 ± 8.5; ref. 32). These findings suggest...
that some impairment in emotion processing exist even in SH subjects and that emotion dysregulation observed in EH could result from the same medical conditions leading to SH, thus contributing to the null finding for the TAS-20 scores. It is now documented that early-stage hypertension is associated with cognitive deficits, altered cerebral blood flow support for cognitive processing, and decreased gray matter in specific cortical regions. Nevertheless, our findings do not support the hypothesis that the differences in emotion processing between the two types of hypertension could result from differences in blood pressure measures between EH and SH, given that no significant difference in blood pressure was found between the two groups of subjects. On the other hand, the specificity of the concept of alexithymia regarding somatic diseases has been put into question, given that high rates of alexithymia were also found in psychiatric patients, especially in post-traumatic stress disorder. These findings raised the possibility of a “secondary” alexithymia, reflecting an adaptive reaction to a life-threatening situation or severe medical condition, vs. or in addition to a “primary” alexithymia, constituting a sustained deficit in emotion processing and possibly contributing to the onset of various psychosomatic diseases.

Our study took advantage of two complementary measures of emotion processing: the TAS-20 and the LEAS. Several limitations in the measurement of alexithymia (the reliance on self-assessment, the association with depressive mood or anxiety, false-negative, and false-positive issues) high-lighted the value of the construct of Levels of Emotional Awareness by Lane and Schwartz, which constitutes a complementary approach to emotion processing and offers an alternative way of measuring an individual’s emotional abilities. Emotional awareness has been investigated in various normative and clinical populations and has found to be associated with actual emotion recognition ability and actual differences in brain function during emotional arousal. It nevertheless had never been studied in patients suffering from hypertension.

In our study, we observed that only the LEAS score, but not the more commonly used TAS-20 measure of alexithymic characteristics, differentiated between EH and SH. One way of understanding this is to consider that TAS-20 scores are based on self-reported assessments of the ability to identify and describe emotions, which are influenced by the respondent’s level of distress, whereas the LEAS is a performance measure of the ability to identify and describe emotions that does not involve self-assessment and is not influenced by self-reported distress. In previous studies, emotional awareness proved to be a more robust and relevant construct than alexithymia in patients presenting with somatoform disorder, eating disorders, or psoriasis. Nevertheless, LEAS and TAS-20 findings are not opposed to each other, as the direction of the nonsignificant difference of TAS scores between the two types of hypertension is congruent with the significant LEAS finding. Post hoc power estimates indicate that, due to sample size, negative findings with TAS could also result from a lack of power.

To better examine the possible impact of the severity of hypertension on emotion-processing variables (“secondary alexithymia”), we considered clinically significant CV diseases, in addition to hypertension (e.g., stroke or coronary heart disease), and not simple asymptomatic target organ damage due to hypertension, such as asymptomatic left ventricular hypertrophy. Because it is often impossible to state that hypertension is the only CV risk factor contributing to such organ damage, we named them “associated CV complications”. Neither TAS-20 total score nor LEAS score distinguished hypertension with or without CV complications. Moreover, no emotion-processing measure was related to the duration of the disease. This negative finding contrasts with the results previously published by Gage and Egan and Lyshova et al. who observed higher alexithymia scores in more severe hypertension or in disease of longer duration. A possible explanation may be related to the definition of the severity of hypertension, either including only clinically relevant CV diseases, as in this study, or including also asymptomatic target organ damage, as previously reported by others. A surprising finding regarding LEAS and antihypertensive treatment concerned the lower LEAS scores in hypertensives treated by ACE inhibitors. Given that in our sample the latter were more often prescribed in EH than in SH, we verified that EH subjects still presented with lower emotional awareness scores, even after controlling for the medication prescribed. Such a side finding could be explained by cerebral receptors and cognitive effects related to the renin–angiotensin system. Further observational or intervention longitudinal studies are warranted for exploring emotion-processing effects of antihypertensive drugs acting on the renin–angiotensin system.

Our findings could also provide a rationale for therapeutic nonpharmacological approaches in hypertension. Subic-Wrana et al., collecting emotion-processing data from in-patients of a psychosomatic ward at onset and at the end of multimodal psychodynamic treatment, observed that LEAS scores increased with treatment in the groups with somatoform disorders and psychological factors related to somatic disorders, and this change was independent of the negative affect. Thus, patients suffering from EH and presenting with low emotional awareness could represent a relevant indication for a specific combination of psychotherapeutic techniques.

Methodological issues
Our study presents several limitations. First, due to the random nature of the consecutive recruitment of subjects, the two types of hypertensives were not equal in number or balanced regarding clinical characteristics. We therefore performed multivariate analyses to control for these variables, as well as for presence or absence of CV complications and the antihypertensive drugs prescribed. Second, unlike TAS-20 scores, LEAS scores were independent of sociodemographic variables, a result that contrasts with other published data. The lack of associations between LEAS scores and sociodemographic variables in this study could be due to the more limited range...
of LEAS scores in our clinical population compared to healthy volunteers.

Third, due to its cross-sectional nature, no causal interpretation can be proposed for the associations observed between emotion-processing measures and the development of EH. Emotion processing and EH could be two manifestations of a unique underlying process. Indeed, lower emotional awareness and some forms of blood pressure dysregulation may share some neural bases, including aberrant activation of the anterior cingulate cortex. One also cannot exclude that an alteration in emotion processing could proceed from the burden of a disease diagnosed several years previously, or even from its pharmacological treatment and other nonpharmacological constraints. Nevertheless, if this was the case, a comparable impairment in emotion processing should have been found, within our population study, in SH as well. A prospective study should be undertaken with repeated measures of emotion processing to test this hypothesis in recently diagnosed and untreated hypertensives. Alexithymia scores and emotional distress would be compared in successfully treated hypertensives vs. untreated hypertensives.

Another question is whether group differences in emotional awareness could be explained by other emotional factors, such as negative emotionality, previously linked to hypertension. Actually, negative emotionality (e.g., anxiety or depressive mood) was not directly measured in the study, but a proxy of negative emotionality was available; thanks to the emotion-focused coping score derived from the Ways of Coping Checklist also completed by the participants to the study. No difference was observed between EH and SH subjects as regards emotion-focused coping. Moreover, as expected on the basis of already documented data on emotion-processing measures and negative affect, no association was observed between LEAS and emotion-focused coping, but a significant positive correlation with TAS DIF subscore (difficulty identifying feelings) and a trend with total TAS score. Adjusting for emotion-focused coping score did not change the association found between LEAS and the type of hypertension, but lead to a nonsignificant association between TAS EOT score and the type of hypertension, even before entering into the model the clinical confounding variables (BMI and cholesterol). Future studies should include a direct assessment of emotional distress, as it may have clinical implications regarding the management of hypertension.

Other limitations should be pointed out. Our study did not include any neuropsychological assessment or neuroimaging data. A contribution of a mild cognitive impairment in emotion processing due to brain damage caused by a sustained history of hypertension cannot be excluded. Nevertheless, neither the TAS-20 nor the LEAS scores were correlated with the duration of disease. In addition, even if the cause of SH can be identified and treated (e.g., surgical treatment of a renal artery stenosis), autonomic nervous system and endocrine deregulation may persist. Such observations blunt the theoretical difference between EH and SH. Finally, all hypertensive patients completed the questionnaires during their hospitalization, which itself can be stressful and could potentially blunt the differences between the two types of hypertension. Moreover, a selection bias of the type of hypertensive patients admitted in the hypertension clinic is likely, given the overrepresentation in our sample of patients suffering from SH relative to their rate in general population. The referral of a hypertensive patient to such a department is mainly due to the expertise of this department in the etiological work-up and follow-up of SH and the pharmacological management of resistant cases of hypertension; these particularities could also potentially blunt the differences between the two types of hypertension. The strong differences found for LEAS scores between EH and SH, in spite of these limitations, suggest that our findings are robust.

In conclusion, emotional awareness was lower in EH than SH, whereas alexithymia scores did not significantly differentiate EH from SH. Our results support a contribution of an emotional or “psychosomatic” component in EH. They also highlight the importance of using complementary measures of emotion processing in medically ill patients.

Perspectives

Our findings suggest the importance of carrying out further experimental studies to explore the relationships between alexithymia and/or low emotional awareness and blood pressure reactivity in response to stress, in hypertensives (both EH and SH) and normotensives. Further longitudinal, observational, as well as intervention studies are also needed to better understand the predictive role of alexithymia and/or low emotional awareness in relation to the onset of disease in people at risk for hypertension and the evolution of a sustained hypertension, or to examine whether treating impairments in emotional awareness among those with EH impacts blood pressure control (or vice versa). Finally, further studies addressing the neural bases of the association between emotional awareness and EH, via neuroimaging methods focused on anterior cingulate, amygdala and medial pre-frontal cortex, are also recommended.

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Emotion Processing in Hypertension