SYMPATHETIC ACTIVITY IN ALEXITHYMICS WITH MOTHER’S LOW CARE

ISAO FUKUNISHI,* HIROYOSHI SEI,‡ YUSUKE MORITA,‡ and RICHARD H. RAHE‡

Abstract—This study examines the relationships between alexithymic characteristics and their psychological factors (i.e., maternal closeness) and the sympathetic system in a sample of male college students. At the resting period, low frequency (LF)/high frequency (HF) ratio, as an index of sympathetic activity, was significantly higher for students with high scores on global alexithymia or its alexithymia factor (difficulty describing feelings) than those with low scores, suggesting that alexithymic students tend to indicate high sympathetic activity during the resting period. During stress, the increase of LF/HF ratio was higher for students with low scores on alexithymia than those with high scores. Although no significant differences were noted, one may speculate that the differences in stress-related activation of LF/HF are due to higher levels of LH/HF in high alexithymics prior to stress. Our findings indicate that significant association between alexithymia and sympathetic activity during the resting period was controlled for the level of mother’s care, suggesting that maternal attachment in infancy and/or childhood may play an important role in the development of alexithymic characteristics and/or sympathetic activity during the resting period. © 1999 Elsevier Science Inc.

Keywords: Alexithymia; Sympathetic system; Parental bonding; Maternal closeness; Maternal attachment.

INTRODUCTION

Alexithymia refers to a marked difficulty in describing and expressing feelings, a striking absence of fantasies, and a thought content consistent with pensee opérateire [1]. The concept of alexithymia was derived from observations of patients with classical psychosomatic diseases [1]. Many studies, however, have indicated relatively high prevalence rates of alexithymia among psychiatric patients with substance use disorder [2], eating disorder [3], posttraumatic stress disorder [4], and panic disorder [5]. Thus, a relatively wide range of psychiatric patients tends to exhibit alexithymic features [2–5].

Of the large number of studies on alexithymia, many have examined the etiology of alexithymic characteristics. Several studies have indicated that multiple factors (i.e., early developmental deficiencies [6, 7], sociocultural influences, and neurobiological deficits [8]) play a role in the etiology and/or development of alexithymia. Psychoanalytic speculations are supported by observational studies of infants and children in interaction with their primary caregivers [6, 7]. The development of af-

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fects and affect-regulating capacities is facilitated early in life by the experience of affect sharing and “mirroring” of affective expressions with the primary caregiver [6, 7, 9]. Validation studies have been conducted in only two prior investigations [10, 11]. It was reported that, in a study of college students with mother’s low care, participants expressed alexithymic characteristics, in particular an alexithymic construct—difficulty describing feelings [11].

Several studies have suggested the possibility of sympathetic overactivity in alexithymic individuals [12–14]. Martin and Pihl proposed the stress–alexithymia hypothesis, although it involved only theoretical and empirical considerations [12]. Only a few studies have provided evidence of sympathetic overactivity in alexithymics. Thus, lack of evidence of an association between alexithymia and sympathetic activity is surprising.

The role of the early mother–infant relationships in affect development and in acquisition of affect-regulating capacities has been emphasized [6, 7, 9]. Interestingly, Schore [15] elaborated that the degree to which the mother stimulates and modulates the infant’s affect–arousal states, and maintains them within a moderate range, may influence the balance between sympathetic and parasympathetic components of the autonomic nervous system. Whereas secure infants are protected from extreme high and low arousal states, and develop an optimal balance between these two autonomic systems, insecure–avoidant infants develop an ongoing parasympathetic bias, and insecure–ambivalent infants develop a bias toward predominance of the sympathetic system over the parasympathetic system.

We propose the hypothesis that alexithymic characteristics associated with poor maternal care may be related to overactivity of the sympathetic system, and thus may be a factor in the development of stress-related disorders. The purpose of this study was to examine whether alexithymia and its related psychological factors (i.e., maternal closeness) are associated with high activity of the sympathetic system.

### METHOD

This study is comprised of two experiments. In experiment 1, the relationship between alexithymic characteristics and parental bonding was examined in a sample of 201 college students. In experiment 2, the relationship of alexithymia and its related psychological factors (i.e., maternal closeness, coping with stress, personality traits, and mood states) to the sympathetic system was examined.

**Experiment 1**

Subjects included 201 college students (111 men and 90 women) living in Tokyo. Mean age was 20.2 years (sd = 1.2). After informed consent, the Japanese versions [16, 17] of the 20-item Toronto Alexithymia Scale (TAS) [18, 19] and Parental Bonding Inventory (PBI) [20] were administered to all subjects.

The PBI is a self-report questionnaire of 25 items rated on a four-point Likert-type scale (0–3 points). It is used to assess two major dimensions of parental bonding: (1) “parental care,” (total score 0–39 points), for example, “My parents did not help me as much I needed”; and (2) “parental overprotection” (total score 0–36 points), for example, “My parents did not want me to grow up.” In this study, parental bonding was measured for mothers and fathers separately. The 20-item TAS is a self-report questionnaire to assess alexithymia [18, 19]. This inventory has three factors: difficulty identifying feelings (factor 1); difficulty describing feelings (factor 2); and externally oriented thinking (factor 3). The Japanese versions of these two inventories have high construct validity and reliability [16, 17].

To examine the relationship between scores on the TAS and PBI, the data obtained were analyzed using Pearson product-moment correlation. STATISTICA software (Japanese version) for the Macintosh was used for conduct statistical analysis.
Experiment 2

The subjects included 26 male college students living in Tokyo. Mean age was 20.4 years (sd=2.1). The study was undertaken after informed consent was provided. Subjects abstained from smoking and drinking any caffeinated beverages on the mornings of the experimental days and from eating foods 2 hours before the beginning of the experimental session.

Procedure

Physiological measurements. At the session, the subjects participated individually. After the electrodes of an electrocardiogram (Nihon Kohden, Cardiofax-GEM, ECG-6201) were attached, the subjects sat in a comfortable chair in a sound-proof and electrically shielded room. The ECG data were recorded during a 30-minute resting period spent sitting quietly and relaxed without falling asleep. The last 6-minute resting period (Rest) data were used as the resting values for analysis.

The task was explained with the instructions emphasizing that the subject continue at his own pace during the entire task period. After one more 30-minute rest, the subject performed a mental arithmetic task for 4 minutes. The last 6-minute resting period (Pre) and the whole 4-minute task period (T1) data were used as the pretask and task values for analysis.

Measurements of heart rate (HR) and blood pressure (BP) were used to evaluate cardiovascular reactivity. HR was determined from the R-wave of the ECG. Systolic and diastolic blood pressures (mmHg) measured the Rest, Pre, and T1 values by automatic digital blood pressure monitor (Omron, HEM-709) from a cuff placed on the upper part of the left arm.

ECG data capture and off-line analyses were performed using a personal computer (NEC). The ECG signal was digitized at a sampling rate of 250 Hz through a 14-bit analog/digital converter (Canopus, ADN1400) and stored on a hard disk for further analysis. We analyzed the three ECG data recorded during the Rest, Pre, and T1. A trendgram of 100 successive R–R intervals (RR), which did not include artifacts due to body movements, cough, swallowing, etc., was obtained from each of the three periods for power spectral analysis. Using the modeling and decomposing algorithm [21] of an autoregressive (AR) process, we calculated component power spectral density functions of the RR trendgrams. This method of AR modeling analysis gives us a more consistent and smoother spectrum, a spectral resolution independent of the number of samples, and the possibility of avoiding windowing procedures, as opposed to the classical Fourier analysis. Furthermore, a center frequency and an absolute power value of the individual component activity can be given directly by means of decomposing the AR autocorrelation function. In this study, the order of the AR modeling function was fixed at 11. We determined the normalized power of the individual component, which was expressed as a percentage of the total power. The AR activity in RR trendgram contained two major frequency components: a low frequency component (LF, 0.15–0.40 Hz) and a high frequency component (HF, 0.05–0.15 Hz). The HF is known as the reflection of respiratory arrhythmia and is related to the level of parasympathetic activity. The LF is related to Mayer waves in blood pressure and is jointly mediated by the sympathetic and parasympathetic activities. We calculated the LF/HF ratio as an index of sympathetic activity [19].

Psychological assessments. The Japanese versions [16, 17, 22–25] of five psychological tests were administered to all subjects. These included the TAS-20, PBI, Profile of Mood States (POMS) [24], Stress and Coping Inventory (SCI) [26, 27], and the Minnesota Multiphasic Personality Inventory-2 (MMPI-2) [28]. The MMPI-2 [28] is a widely known questionnaire that assesses psychiatric symptoms and personality traits. These are the most useful for measuring hypochondriasis, schizophrenia, psychopathic deviancy, etc.

The POMS is a 65-item self-rating questionnaire that assesses current mood states [23]. This inventory has six subscales: anxiety; anger; depression; confusion; fatigue; and vigor. The six subscales are summed to generate a total mood disturbance score (TMD).

The SCI is a self-report questionnaire battery compiled and edited by Rahe [26, 27]. This inventory represents a collection of newly developed and previously standardized scales to provide four stress indicators and four measures of coping with stress. Four coping subscale measures were used in the present study: health habits; social support; responses to stress (negative responses to stress and positive responses); and life satisfaction. The health habits measure consists of a collection of healthful attitudes and behaviors, including diet, exercise, restriction of tobacco and alcohol use, pace, and optimism. Social support questions measure the existence of an individual’s social network, the utilization of this network, and a person’s perception of the readiness of their network to come to their aid. The Japanese versions of these three inventories have high construct validity and reliability [22–26].

The subjects were divided into two groups, high and low, based on median score on total and three factors of the TAS, respectively. The unpaired Student’s t-test (two-tailed) was used to check for significant differences of mean scores between two groups on the psychological tests. The Pearson product-moment correlation was used to assess relationships among the psychological tests and those between psychological assessments and physiological measurements. Analysis of covariance (ANCOVA) was
RESULTS

Experiment 1

Mean score and SD of the TAS were 47.1 and 7.5. Table I shows correlations between the TAS and PBI. The correlational analysis revealed that total scores on the TAS were significantly and negatively correlated with those of mother’s care factor, but were not significantly correlated with those of mother’s overprotection factor and father’s care and overprotection factors. As for the three factors of the TAS, scores on factor 2 (difficulty describing feelings) were significantly and negatively correlated with those of mother’s care factor, but were not significantly correlated with those of mother’s overprotection factor and father’s care and overprotection factors. As for factors 1 (difficulty identifying feelings) and 3 (externally oriented thinking), no significant correlations were noted.

Experiment 2

Mean score and SD of the TAS were 46.8 and 8.0, respectively. Based on the median scores on total and three factors of the TAS, the subjects were divided into two groups, high- and low-score groups, respectively.

Relationships between psychological assessments. We examined the relationships of the TAS to PBI, POMS, SCI, and MMPI-2. As shown in Table II, the same results as those obtained in experiment 1 were found in regard to correlations between the TAS, although the number of subjects was small compared with the experiment 1. Total scores on the TAS were significantly and negatively correlated with those of mother’s care factor, but were not significantly correlated with those of mother’s overprotection and father’s care and overprotection factors. Scores on factor 2 were significantly and negatively correlated with those of mother’s care, but were not significantly correlated with those of mother’s overprotection factor and father’s care and overprotection factors. No significant correlations were noted in factors 1 and 3.

As for correlations between the TAS and POMS, total scores on the TAS were
Table II.—Correlations between TAS and PBI

<table>
<thead>
<tr>
<th>TAS</th>
<th>PBI</th>
<th>Total</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Care factor</td>
<td>Mother</td>
<td>-0.510</td>
<td>-0.201</td>
<td>-0.593</td>
<td>-0.147</td>
</tr>
<tr>
<td></td>
<td>Father</td>
<td>-0.064</td>
<td>-0.052</td>
<td>-0.102</td>
<td>0.038</td>
</tr>
<tr>
<td>Overprotection</td>
<td>Mother</td>
<td>0.167</td>
<td>0.157</td>
<td>0.215</td>
<td>0.042</td>
</tr>
<tr>
<td></td>
<td>Father</td>
<td>0.134</td>
<td>0.088</td>
<td>0.123</td>
<td>0.059</td>
</tr>
</tbody>
</table>

Results are shown as Pearson product-moment correlation coefficients.

*p < 0.05 (adjusted by Bonferroni correction, p = 0.003).

not significantly correlated with those on the POMS. However, scores on factor 1 of the TAS were significantly correlated with those on vigor of the POMS ($r_{24} = -0.528$, $p < 0.05$). Scores on factor 2 were significantly and positively correlated with those on anxiety ($r_{24} = 0.523$, $p < 0.05$). In scores on factor 3, no significant correlations were found.

As for correlations between the TAS and SCI, no significant correlations were found. As for correlations between the TAS and MMPI-2, TAS scores were significantly correlated with those on hypochondriasis (total: $r_{24} = 0.508$, $p < 0.05$; factor 1: $r_{24} = 0.601$, $p < 0.05$; factor 2: $r_{24} = 0.523$, $p < 0.05$), ego strength (total: $r_{24} = -0.595$, $p < 0.05$; factor 1: $r_{24} = -0.606$, $p < 0.05$), and somatic complaints (factor 1: $r_{24} = 0.601$, $p < 0.05$; factor 2: $r_{24} = 0.584$, $p < 0.05$) of the MMPI-2.

Relationships of AR analysis to psychological assessments. As shown in Figure 1, the high-score group on total and factor 2 of the TAS indicated a significantly higher LF/HF ratio than the low-score group at the Rest and Pre (total: $t_{1,24} = 2.91$, $p = 0.008$ [Rest], $t_{1,24} = 3.48$, $p = 0.002$ [Pre]; factor 2, $t_{1,24} = 3.04$, $p = 0.006$ [Rest], $t_{1,24} = 3.15$, $p = 0.004$ [Pre]). No significant differences between LF/HF ratio of the high- and low-score groups on factors 1 and 3 of the TAS were noted at both Rest and Pre. As for the HF component, no significant difference between the high- and low-score groups on the total and other three factors was noted at Rest and Pre. At T1, no significant differences were noted in the HF component and LF/HF ratio.

When LF/HF ratio at the Pre was baseline, changes of the LF/HF ratio between Pre and T1 were calculated. The increases in LF/HF ratio between Pre and T1 were significantly lower for the high-score group on total and factor 2 of the TAS than for the low-score group, although the level of significance was marginal (total: $t_{1,24} = 2.09$, $p = 0.047$; factor 2: $t_{1,24} = 2.44$, $p = 0.022$). There were no significant differences between increase of LF/HF ratio of high- and low-score groups on factors 1 and 3 of the TAS. There were no significant differences between increase of HF component of high- and low-score groups on the total and the other three factors.

Table III shows the relationship between physiological measurements and psychological tests. Among a large number of correlations, six significant correlations were noted: at Rest and Pre, LF/HF ratios were significantly and negatively correlated with scores on mother’s care factor of the PBI and scores on total and factor 2 of the TAS. As for increase in LF/HF ratio between Pre and T1, no significant diff-
Fig. 1. Relationships between AR analysis and TAS scores
ferences were found. Although not shown in Table III, the increases of LF/HF ratio were not significantly correlated with scores on the POMS, SCI, and MMPI-2. No significant differences were found in regard to increases of HF component between Pre and T1.

In the Rest and Pre, that the high-score group on factor 2 of the TAS indicated significantly higher LF/HF ratio than the low-score group may have been due to its significant relationship with LF/HF ratios and scores on mother’s care factor of the PBI. To examine for this possible effect, the relationship between LF/HF ratio and factor 2 of the TAS were re-examined using the ANCOVA. The ANCOVA testing resulted in the elimination of the significant differences obtained by the ANOVA (covariate, mother’s care factor, $p = 0.11$ [Rest], $p = 0.15$ [Pre]). Also, that the high-score group on total score of the TAS indicated significantly higher LF/HF ratio may have been due to its significant relationship with LF/HF ratio and scores on mother’s care factor. ANCOVA testing resulted in the elimination of the significant differences obtained by the ANOVA (covariate, mother’s care factor, $p = 0.11$ [Rest], $p = 0.19$ [Pre]).

Similarly, that the high-score group on total scores and scores on factor 2 indicated a significantly lower increase of LF/HF ratio between Pre and T1 than the low-score group may have been due to its significant negative correlations with increase of LF/HF ratio and scores on mother’s care factor of the PBI. ANCOVA testing resulted in the elimination of the significant differences (covariate, mother’s care factor: $p = 0.07$ [total]; $p = 0.12$ [factor 2]).

As for the significant increases of LF/HF ratio between Pre and T1, the significance levels were weak (total: $p = 0.047$; factor 2: $p = 0.022$). To clarify this finding (whether these two significance levels were true or not), we re-examined the data and compared the peak scores covarying for the baselines, because this procedure (ANCOVA) eliminated the baseline differences. As a result, no significant differences were found (TAS total: $p = 0.09$; factor 2: $p = 0.08$).

Relationships of heart rate and blood pressure to psychological assessments. Although not shown in the tables, no significant relationships between HR and psychological assessments were noted. Also, no significant relationships between BP and psychological assessments were found.

The results just discussed were not influenced significantly by sociodemographic data (age, gender, and years of education).

**DISCUSSION**

Potentially, the most important finding of this study is that poor parental bonding is related to the perceived difficulty in articulating feelings. In addition, regarding psychological assessments, our results suggest that male college students with alexithymia are prone to: (1) having experienced mother’s low care (parental bonding); (2) weakness of ego strength (personality traits); and (3) anxiety, hypochondriasis, and somatic complaints (psychiatric symptoms). These findings are in accordance with previous studies on alexithymia [11, 29, 30].

Based on observational studies of infants and children in interactions with their primary caregivers such as the mother [6, 7, 11], several psychoanalytic hypotheses on the etiology and/or development of alexithymia have been reported. Most of
Table III.—Correlations of physiological measurements to TAS and PBI

<table>
<thead>
<tr>
<th></th>
<th>Rest</th>
<th>Pre</th>
<th>T₁</th>
<th>Increase of LF/HF ratio between Pre and T₁</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HF component</td>
<td>LF/HF ratio</td>
<td>HF component</td>
<td>LF/HF ratio</td>
</tr>
<tr>
<td>TAS Total</td>
<td>-0.024</td>
<td>0.602³</td>
<td>0.191</td>
<td>0.562³</td>
</tr>
<tr>
<td>Factor 1</td>
<td>-0.123</td>
<td>0.100</td>
<td>0.133</td>
<td>0.032</td>
</tr>
<tr>
<td>Factor 2</td>
<td>-0.093</td>
<td>0.698³</td>
<td>-0.189</td>
<td>0.681³</td>
</tr>
<tr>
<td>Factor 3</td>
<td>0.077</td>
<td>-0.024</td>
<td>-0.155</td>
<td>-0.090</td>
</tr>
<tr>
<td>PBI Care factor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother</td>
<td>0.242</td>
<td>-0.602³</td>
<td>0.191</td>
<td>-0.662³</td>
</tr>
<tr>
<td>Father</td>
<td>0.176</td>
<td>-0.100</td>
<td>0.133</td>
<td>-0.032</td>
</tr>
<tr>
<td>Overprotection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother</td>
<td>-0.201</td>
<td>0.321</td>
<td>-0.189</td>
<td>0.281</td>
</tr>
<tr>
<td>Father</td>
<td>-0.197</td>
<td>0.024</td>
<td>-0.155</td>
<td>0.090</td>
</tr>
</tbody>
</table>

Results are shown as Pearson product-moment correlation coefficients.³p < 0.05 (adjusted by Bonferroni correction, p = 0.0008).
these hypotheses were drawn from observational studies. Very few validation studies have been reported [31]. Of the findings obtained in this study, one particular finding—that alexithymia was closely related to mother’s low care during childhood—may be of value, because it provides possible evidence of the etiology and/or development of alexithymia. However, there are several problematic points to overcome. Indeed, the results of this study were replicated in two experiments, but the subsequent findings may be an artifact of retrospective reporting bias. Furthermore, because our results were obtained from simple correlational analysis, no suggestions or conclusions could be drawn, except for an association between alexithymia and mother’s low care. Further examinations across different samples and different measurement instruments will be required.

As for the association between physiological measurements and psychological assessments, the LF/HF ratio during the resting period was significantly higher for students with high scores on global alexithymia or its alexithymia factor (difficulty describing feelings) than those with low scores, suggesting that alexithymic students tend to indicate high sympathetic activity in spite of the resting period.

In addition to the stress–alexithymia hypothesis, based on theoretical and empirical considerations [12], only two studies on high sympathetic activity with alexithymia have been found in the literature [13, 14]. One study used frontalis EMG data and indicated high tonic levels of sympathetic activity in highly alexithymic subjects [13]. The other study demonstrated that, based on the data of electrodermal activity, highly alexithymic neurotic subjects showed high levels of electrodermal arousal and slow recovery time in novel situations as compared with those with low alexithymia [14].

During the resting period, the activity of the sympathetic system in alexithymic male students was relatively high. Moreover, our findings indicate that the significant associations between alexithymia and sympathetic activity were controlled for the level of mother’s care, suggesting that maternal attachment in infants and/or children may play an important role in the development of alexithymia and/or sympathetic activity. One study indicated that the level of maternal attachment influences the balance between sympathetic and parasympathetic activity, in particular a predominance of the sympathetic system over the parasympathetic system [15]. Before the development of alexithymic characteristics, infants and/or children who have grown up under poor maternal attachment may acquire a predominance of high sympathetic activity.

During stress, in contrast to previous studies [13, 14], the increase in LF/HF ratio during stress was significantly higher for students with low alexithymia scores than those with high scores. However, because the levels of significance were weak, we re-examined the peak scores, covarying for baselines. The results showed no significant association between alexithymia scores and the increased LF/HF ratio. In this study, therefore, we could not draw a clear conclusion on high sympathetic activity in low alexithymic male students during stress. Although no significant differences were found, the association between alexithymia and the increase in LF/HF ratio during stress may exist. One may speculate that the differences in stress-related activation of LF/HF are due to lower levels of LH/HF in low alexithymics prior to stress.

In conclusion, although further examinations on the potential contribution of
poor maternal attachment to the development of alexithymic characteristics and/or sympathetic activity are needed, our findings support the hypothesis that alexithymia with poor maternal care is related to high sympathetic activity during the resting period.

REFERENCES