A Psychobehavioral Factor, Alexithymia, is Related to Coronary Spasm

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The aim of this study was to assess whether the psychobehavioral pattern alexithymia is related to coronary artery spasm. Alexithymia, deficient psychological awareness, was examined using the Minnesota Multiphasic Personality Inventory Alexithymia Scale in 100 patients with angina pectoris in whom coronary spasm, defined as ≥99% coronary narrowing, was documented upon ergonovine provocation, and in 109 patients with chest pain syndrome who were shown to have almost normal coronaries without inducible coronary spasm on coronary angiogram (control group). Alexithymia was approximately twice as prevalent in the coronary spasm group (31%) as in the control group (14%) (p<0.01). Among various conventional risk factors including hyperlipidemia, obesity, diabetes mellitus, hypertension, hyperuricemia, or family history of ischemic heart disease, only male sex and smoking were more prevalent in the coronary spasm group than in the control group (p<0.001). The odds ratios of coronary spasm adjusted for all the other risk parameters including sex and age were 4.14 [95% confidence interval (CI) 1.81–9.47] for alexithymia and 2.38 (95% CI 1.18–4.82) for smoking. A psychobehavioral pattern, alexithymia, relates to coronary spasm. This relationship is independent of the conventional coronary risk factors. (Jpn Circ J 1998; 62: 409–413)

Key Words: Coronary spasm; Alexithymia; Coronary risk factors

Risk factors for coronary spasm, a functional narrowing of the coronary artery, appear to be distinct from those for atherosclerotic coronary artery disease. Conventional clinical risk factors such as hypertension and hyperlipidemia, but smoking, have been reported to be no more related to this functional abnormality.

On the other hand, type A behavior has been recognized as a risk factor for ischemic heart disease. Several prospective and case-control studies have demonstrated a relationship between ischemic heart disease and depression and neuroticism. The role of psychological or behavioral characteristics associated with increased risk of coronary artery spasm, however, has not yet been clarified.

In our clinical practice we have noted that patients with typical vasospastic angina often show certain psychological or behavioral characteristics. Many of them seem to communicate their histories correctly without emotional expression; they seldom manifest nervousness or stress; when they show type A behavior it is expressed as time urgency rather than as aggression. These characteristics seem to be compatible with "alexithymia," a term coined by Sifneos in 1973. Alexithymia is a psychological trait characterized by the tendency to focus one's attention on external stimuli such as the environment rather than on internal experience such as feelings and motivations. This personality trait has been reported to interact with stressors in association with increased general susceptibil-

ity to somatic illness or disease, so-called psychosomatic disease. In general, alexithymic people cannot avoid or leave stressful situations because they have difficulty in realizing their state of distress owing to a lack of emotional awareness; as a result, they are driven to extreme levels of stress. We hypothesized that stress would affect the coronary arteries via the neurohormonal system and so played a role in provoking coronary spasm. We therefore examined the link between alexithymia and spasm. This clinical image of patients with vasospastic angina is not inconsistent with the profile that emerged in our previous study, in which we undertook a pilot study using 4 questionnaires to investigate the psychological characteristics of patients with vasospastic angina and patients with normal coronary arteries: the Minnesota Multiphasic Personality Inventory Index (MMPI) Alexithymia Scale; the Yatabe-Ogilford character test; the Self Rating Scale for Depression; and the Cornell Medical Index. It was found that only the alexithymic trait had a significantly higher incidence in patients with vasospastic angina than in those with normal coronary arteries. In our next pilot study, we found that the alexithymic trait was significantly more common in patients with coronary spasm and without significant coronary stenosis than in those with significant stenosis. There was also a higher incidence of type A behavior in patients with significant stenosis than in those with coronary spasm. We hypothesized that patients with coronary spasm would exhibit a disproportionately high incidence of alexithymia.

Methods

Patients

We prospectively selected 221 patients who fulfilled our study selection criteria from among 2,056 consecutive patients who underwent diagnostic coronary arteriography.
between July, 1990, and March, 1994. The vasospastic angina group consisted of 107 patients with coronary spasm and no coronary artery luminal narrowing $\geq 50\%$. Most of them had morning or nocturnal chest pain. Many of them did not show significant ST-T changes on treadmill exercise stress tests. The control group consisted of 114 patients with chest pain syndrome with normal coronary arteries and without coronary spasm. The results of exercise stress tests were variable. None of the patients in the present study had any history of myocardial infarction.

Among the other 1,835 patients, 460 patients were excluded because of the presence of fixed stenosis with $\geq 75\%$ diameter reduction and 445 patients were also excluded because of a history of myocardial infarction or emergency admission. Another 354 patients were excluded because an ergonovine provocation test could not be performed for one of the following reasons: a diagnosis of valvular heart disease; cardiomyopathy or congenital heart disease; possible risk of side-effects with renal failure; or difficulty in positioning a catheter in a coronary artery. The other 576 patients were excluded because they had either intermediate spasm or moderate coronary stenosis ($\geq 50\%$ diameter reduction).

Regarding administration of psychotropic drugs, such as sedatives and antidepressants, patients were still included if the drugs seemed to be successfully managed clinically. Although there were no drug abusers among our patients, 7 patients with coronary spasm and 9 patients with normal coronary arteries were administered hypnotics (usually for hypsomnolence), 6 patients with coronary spasm and 5 patients with normal coronary arteries were provided with minor tranquilizers (generally for tension headaches, climacteric disorder or similar conditions). One patient with coronary spasm was usually administered a tricyclic antidepressant to relieve headaches, and in general no patients were given major tranquilizers.

Twelve subjects were excluded for the following reasons: 3 patients showed organic brain disturbance such as dementia, and 9 patients left unanswered more than 1 item on the examination. Informed consent was obtained from all patients.

Coronary Angiography and Ergonovine Provocation Test

All drugs except sublingual nitroglycerin were discontinued at least 24 h before the study. Analgesics or sedatives were not administered before coronary angiography. Coronary angiographic examination was performed using the Sones technique in a fasting state. After control coronary angiograms were obtained, the catheter was placed in the right coronary ostium and ergonovine maleate was continuously injected at a rate of $8 \mu g/min$ into the right coronary artery for up to 4 min. When ischemic electrocardiographic changes and chest discomfort occurred, right coronary arteriography was performed immediately. If coronary spasm was induced, 2–25 mg of isosorbide dinitrate was administered into the coronary artery for relief of coronary spasm. The ergonovine provocation test was not performed in the left coronary artery after the administration of isosorbide dinitrate. If there was no electrocardiographic change, right coronary arteriography was performed 1 min after completion of ergonovine administration. If coronary spasm was not induced in the right coronary artery, the catheter was placed in the left coronary ostium, and ergonovine maleate was injected continuously at the same rate into the left coronary artery for up to 4 min. Finally, 1–5 mg of isosorbide dinitrate was injected into each coronary artery. Coronary arteriograms were obtained in multiple projections to assess the severity of fixed stenosis. The left coronary artery was visualized in 4 angulations: a right anterior oblique 35º view, a right anterior oblique 35º and caudal 25º view, a left anterior oblique 55º and cranial 25º view, and a left anterior oblique 55º view. The right coronary artery was visualized in a left anterior oblique 55º view and in a right anterior oblique 35º view. When a stenotic region was observed, an additional projection was used to obtain optimal visualization. During the study, arterial blood pressure and electrocardiography (ECG) were monitored continuously on the oscilloscope of a model EP 1100 polygraph (NEC, Tokyo) and recorded using a model 8M15 Omnicorder (NEC, Tokyo). The chest leads were used radiolucent carbon electrodes. The conditions of the coronary arteries were described according to criteria of the American Heart Association Committee Report.

Definitions of Vasospastic Angina

Coronary spasm was defined as 99% luminal narrowing or coronary occlusion occurring during ergonovine maleate provocation tests. Patients with spontaneous coronary spasm of any form were excluded because we could not discriminate between true spontaneous coronary spasm and spasm induced by catheter injury to the coronary artery. Absence of coronary spasm was defined as coronary luminal diameter narrowing of $<50\%$ during ergonovine maleate provocation tests. Intermediate spasm was assessed as equivocal and excluded. The diagnosis of vasospastic angina was made when the patient indicated that he or she felt the chest pain experienced before or during occurrence of coronary spasm.

Questionnaire

As an index of alexithymic personality traits, the Minnesota Multiphasic Personality Inventory (MMPI) Alexithymia Scale was administered before angiography to each patient during the hospital visit for diagnostic coronary angiography. This scale is the most commonly used brief self-report measure. The possible scores on the MMPI Alexithymia Scale range from 0 to 22, with higher scores indicating a greater degree of alexithymia. Established classification scores have been identified by Kleiger and Kinsman in Japan. Shibayama confirmed the validity of the MMPI Alexithymia Scale, and alexithymia is assumed to be present when the total score exceeds 17 out of a possible total of 22.

Conventional Risk Factors

The smoking index was defined as the daily average number of cigarettes smoked multiplied by the total number of years for which the subject had smoked. Hypercholesterolemia was defined as a serum cholesterol level of $>250 \text{ mg/dl}$, high serum low-density lipoprotein (LDL)-cholesterol level was defined as a serum LDL level of $>160 \text{ mg/dl}$, reduced serum high-density lipoprotein (HDL)-cholesterol level was defined as a serum HDL level of $<40 \text{ mg/dl}$, and high serum triglyceride (TG) level was defined as a serum TG level of $>170 \text{ mg/dl}$. Hyperlipidemia was diagnosed when one or more of these
lipid abnormalities were identified. The body mass index (BMI) was defined as the weight/height² ratio in kg/m². Diabetes mellitus was diagnosed using the glucose tolerance test result interpreted according to the World Health Organization criteria or when the patient was already receiving treatment for diabetes mellitus. Systemic hypertension was diagnosed when the blood pressure regularly exceeded 160/90 mmHg or when the patient was already receiving treatment for hypertension. Hyperuricemia was defined as a serum uric acid level > 6.9 mg/dl in a male patient or > 4.9 mg/dl in a female patient according to upper normal limits in our hospital laboratory.

Statistical Analysis

Comparisons between the 2 groups of the prevalence of various potential risk factors and alexithymia were conducted using the chi-square test and the unpaired t test, and then comparisons between the 2 groups of the values of coronary risk factors and MMPI Alexithymia Scale scores were conducted after adjusting for age and sex using analysis of covariance (ANCOVA) by the PROC REG program of the SAS Institute.

Crude odds ratios and 95% confidence intervals adjusted for age and sex were calculated on the basis of unconditional logistic regression models. Independent factors were smoking, hypercholesterolemia, high LDL-cholesterol level, low HDL-cholesterol level, high TG level, obesity, diabetes mellitus, hypertension, hyperuricemia, family history, family history of ischemic heart disease, and alexithymia. In this analysis, age was included as a continuous variable and the other factors were included as categorical variables. Finally, adjusted odds ratios with 95% confidence intervals were calculated on the basis of unconditional logistic regression models. In this analysis, age, total cholesterol, LDL, HDL, TG, BMI, and uric acid were included as continuous variables. Sex, smoking, hypertension, family history, and alexithymia were included as categorical variables. The program used was PROC LOGISTIC of the SAS Institute. A p value < 0.05 was considered significant for all the analysis.

Table 1 Prevalence of Various Potential Risk Factors and Alexithymia

<table>
<thead>
<tr>
<th></th>
<th>Patients with coronary spasm</th>
<th>Control subjects</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>100</td>
<td>109</td>
<td></td>
</tr>
<tr>
<td>Sex (M/F)</td>
<td>78/22</td>
<td>51/58</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mean (SD) age (years)</td>
<td>62 (9)</td>
<td>61 (10)</td>
<td>NS</td>
</tr>
<tr>
<td>Smoker</td>
<td>62 (62)</td>
<td>36 (33)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total chol &gt; 250 mg/dl</td>
<td>15 (15)</td>
<td>14 (13)</td>
<td>NS</td>
</tr>
<tr>
<td>LDL-chol &gt; 160 mg/dl</td>
<td>19 (19)</td>
<td>23 (21)</td>
<td>NS</td>
</tr>
<tr>
<td>HDL-chol &lt; 40 mg/dl</td>
<td>24 (24)</td>
<td>23 (21)</td>
<td>NS</td>
</tr>
<tr>
<td>TG &gt; 170 mg/dl</td>
<td>29 (29)</td>
<td>23 (21)</td>
<td>NS</td>
</tr>
<tr>
<td>BMI &gt; 29</td>
<td>14 (14)</td>
<td>22 (20)</td>
<td>NS</td>
</tr>
<tr>
<td>DM</td>
<td>8 (8)</td>
<td>12 (11)</td>
<td>NS</td>
</tr>
<tr>
<td>Hypertension</td>
<td>43 (43)</td>
<td>64 (59)</td>
<td>NS</td>
</tr>
<tr>
<td>Hyperuricemia</td>
<td>23 (23)</td>
<td>21 (19)</td>
<td>NS</td>
</tr>
<tr>
<td>Family history</td>
<td>16 (16)</td>
<td>20 (18)</td>
<td>NS</td>
</tr>
<tr>
<td>MMPI Alex. Scale ≥ 17</td>
<td>31 (31)</td>
<td>15 (14)</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

Values in parentheses are in percent. Statistical analysis, chi-square test and unpaired t test. BMI, body mass index; Chol, cholesterol; DM, diabetes mellitus; Family history, family history of ischemic heart disease; HDL, high-density lipoprotein; LDL, low-density lipoprotein; MMPI Alex. Scale, Minnesota Multiphasic Personality Inventory Alexithymia Scale; TG, triglycerides.

Table 2 Values of Potential Risk Factors and MMPI Alexithymia Scale

<table>
<thead>
<tr>
<th></th>
<th>Patients with coronary spasm</th>
<th>Control subjects</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>109</td>
<td>109</td>
<td></td>
</tr>
<tr>
<td>Smoking index</td>
<td>541 (31)</td>
<td>256 (39)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Total chol (mg/dl)</td>
<td>210 (3.7)</td>
<td>212 (3.3)</td>
<td>NS</td>
</tr>
<tr>
<td>LDL (mg/dl)</td>
<td>132 (3.7)</td>
<td>134 (3.2)</td>
<td>NS</td>
</tr>
<tr>
<td>HDL (mg/dl)</td>
<td>48 (1.2)</td>
<td>53 (1.6)</td>
<td>NS</td>
</tr>
<tr>
<td>TG (mg/dl)</td>
<td>152 (8.7)</td>
<td>131 (5.8)</td>
<td>NS</td>
</tr>
<tr>
<td>Total chol/HDL</td>
<td>4.6 (0.12)</td>
<td>4.3 (0.13)</td>
<td>NS</td>
</tr>
<tr>
<td>Uric acid (mg/dl)</td>
<td>5.8 (0.16)</td>
<td>5.3 (0.16)</td>
<td>NS</td>
</tr>
<tr>
<td>MMPI Alex. Scale</td>
<td>14.9 (0.22)</td>
<td>13.6 (0.25)</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

Values are means (SE). Chol, cholesterol; HDL, high-density lipoprotein; LDL, low-density lipoprotein; MMPI Alex. Scale, Minnesota Multiphasic Personality Inventory Alexithymia Scale; TG, triglycerides. The statistical analysis used was ANCOVA.

Results

After exclusion of the 12 patients, there were 100 patients with coronary spasm, and 109 patients in the control group. As for psychiatric drug use, the incidence of drug users with coronary spasm was not significantly different from that of drug users with normal coronary arteries. The prevalence of risk factors and alexithymia in each group is shown in Table 1. The male/female ratio was significantly higher in the coronary spasm group than in the control group. The 2 groups had equal prevalences of other risk parameters except smoking, which was twice as prevalent in the coronary spasm group as in the control group. The prevalence of patients categorized as showing alexithymia in the vasospastic angina group was also twice that in the control group. The mean values for each risk factor and MMPI Alexithymia Scale scores adjusted for age and sex are shown in Table 2. Among various parameters, only the smoking index and the MMPI Alexithymia Scale scores were significantly higher in the coronary spasm group than in the control group. To eliminate a possible relationship between alexithymia and fixed coronary stenosis, we confirmed the MMPI Alexithymia Scale score and incidence of alexithymia in the patients with significant coronary stenosis, who performed the examination completely. The MMPI Alexithymia Scale score in 398 patients with fixed stenosis with > 75% diameter reduction was 13.5 ± 0.24 (mean ± SE) and alexithymic patients was 52/398 (13%). Both the MMPI Alexithymia Scale score and the incidence of alexithymia were significantly lower than in the coronary spasm group.

The MMPI Alexithymia Scale score was not correlated with age and there was no significant difference between the MMPI Alexithymia Scale score in men (14.1 ± 0.21) and women (14.3 ± 0.31). The MMPI Alexithymia Scale score in men with coronary spasm was 14.9 ± 0.24 and that of male control subjects was 13.0 ± 0.31. The incidence of alexithymia in men with coronary spasm and male control subjects was 24/78 (31%) and 2/25 (4%), respectively. The MMPI Alexithymia Scale score and the incidence of alexithymia in the male patients with coronary spasm were significantly higher than in male control subjects (p = 0.0001 and p = 0.0002). The MMPI Alexithymia Scale score of women with coronary spasm was 14.8 ± 0.58

Table 3 Comparison of Risk Factors and Alexithymia Between Patients With Coronary Spasm and Control Subjects, Crude Odds Ratios

<table>
<thead>
<tr>
<th></th>
<th>Odds ratio (95% CI)</th>
</tr>
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<tbody>
<tr>
<td>Smoking</td>
<td>2.13 (1.13 - 4.03)</td>
</tr>
<tr>
<td>Total chol &gt; 250 mg/dl</td>
<td>1.38 (0.60 - 3.19)</td>
</tr>
<tr>
<td>LDL-chol &gt; 160 mg/dl</td>
<td>1.03 (0.50 - 2.11)</td>
</tr>
<tr>
<td>HDL-chol &lt; 40 mg/dl</td>
<td>0.99 (0.50 - 1.97)</td>
</tr>
<tr>
<td>TG &gt; 170 mg/dl</td>
<td>1.39 (0.71 - 2.70)</td>
</tr>
<tr>
<td>BMI &gt; 26</td>
<td>0.51 (0.23 - 1.11)</td>
</tr>
<tr>
<td>DM</td>
<td>0.67 (0.24 - 1.82)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>0.64 (0.36 - 1.15)</td>
</tr>
<tr>
<td>Hypersuricemia</td>
<td>1.01 (0.50 - 2.04)</td>
</tr>
<tr>
<td>Family history</td>
<td>0.85 (0.39 - 1.82)</td>
</tr>
<tr>
<td>MMPI Alex. Scale ≥ 17</td>
<td>3.71 (1.73 - 7.93)</td>
</tr>
</tbody>
</table>

BMI, body mass index; Chol, cholesterol; DM, diabetes mellitus; Family history, family history of ischemic heart disease; LDL, low-density lipoprotein; HDL, high-density lipoprotein; MMPI Alex. Scale, Minnesota Multiphasic Personality Inventory Alexithymia Scale; TG, triglycerides.

Table 4 Adjusted Odds Ratios Calculated on the Basis of Unconditional Logistic Regression Models for Patients With Coronary Spasm Versus Control Subjects, Adjusted for Age, Sex, all Risk Factors and Alexithymia

<table>
<thead>
<tr>
<th></th>
<th>Odds ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>2.38 (1.18 - 4.82)</td>
</tr>
<tr>
<td>MMPI Alex. Scale ≥ 17</td>
<td>4.14 (1.81 - 9.47)</td>
</tr>
</tbody>
</table>

MMPI Alex. Scale, Minnesota Multiphasic Personality Inventory Alexithymia Scale.

and that of female control subjects was 14.2 ± 0.37. The incidence of alexithymia in women with coronary spasm and female control subjects was 7/22 (32%) and 13/58 (22%), respectively. Although the MMPI Alexithymia Scale score and the incidence of alexithymia were higher in women with coronary spasm than in female control subjects, these differences were not statistically significant.

Table 3 shows crude odds ratios with 95% confidence intervals for each variable after adjusting for age and sex. Smoking and alexithymia, but not any of the other variables, were associated with increased risk of coronary spasm.

The odds ratios for smoking and alexithymia became even greater after adjusting for all the other factors, as shown in Table 4, suggesting that both smoking and alexithymia were independently associated with coronary spasm. The odds ratio for alexithymia was even greater than that for smoking.

**Discussion**

Our results are quite similar to those previously reported by Sugiishi et al., indicating that coronary spasm is associated with smoking but not with hyperlipidemia, diabetes mellitus, hypertension, or obesity. In contrast to many previous studies, we conducted on the basis of clinical diagnosis rather than angiographic examination, in our study all participants underwent coronary angiography with ergonovine provocation and fulfilled stringent criteria. Whereas Sugiishi et al. without exception excluded patients with coronary atherosclerosis among those with coronary spasm, some of our participants had mild coronary atherosclerosis (<25% decrease in luminal diameter). Despite these differences in selection criteria, the results of the 2 studies accord well, suggesting that, in the present study, patients with “predominantly vasoconstrictive angina” were successfully identified.

This study demonstrates that a psychobehavioral factor, alexithymia, but none of the conventional risk factors except male sex and smoking, is associated with coronary spasm, and that the relation between alexithymia and coronary spasm is prominent in male patients. A relationship between alexithymia and vasoconstrictive angina has not previously been reported. In the field of cardiovascular disease, alexithymia has been related to unrecognized myocardial infarction or delayed recognition of myocardial infarction. Subjects with alexithymic traits have reduced psychologic awareness, so that they may have diminished perception or concern over cardiac symptoms. On the other hand, it has been shown that alexithymic characteristics are prevalent among so-called psychosomatic patients. Although alexithymia is thought to link pathogenic psychologic problems to abnormal physiologic function and/or tissue change, including peptic ulcer and ulcerative colitis, such relations are not fully elucidated.

Because individuals who are alexithymic tend to have lower emotional awareness and consequently may not notice their stress or fatigue, it is not easy for them to avoid stress-provoking situations. Recent studies of the stress response patterns of normal individuals with high or low alexithymia have provided some evidence that persons with high alexithymic levels manifest a dissociation of the physiologic and subjective response to stress, as well as high tonic levels of sympathetic activity. Coronary spasm has been shown to be provoked by stress in both experimental and clinical situations. Hence, although the mechanism by which coronary spasm occurs in alexithymic individuals is not known exactly, high tonic levels of sympathetic activity in these patients may account for this association.

**Study Limitations**

We did not measure directly any stressors in the present study. A quantitative assessment of the stressors to which patients are exposed would be very difficult. Thus, we do not know if a greater stressor is associated with coronary spasm as compared with the control group. Instead, we clarified that some psychologic or behavioral characteristic that may affect the pattern of response to stress was related to coronary spasm. Furthermore, the exact temporal causal relationships are not yet known.

Although alexithymia is generally considered a stable personality trait, a similar reduction of emotional expression and imaginative activity, which is known as secondary alexithymia, has been reported in some individuals following massive psychic trauma including the stress of being severely ill. In this study, all the participants were administered the MMPI Alexithymia Scale under the same conditions, e.g., during hospitalization for and/or diagnosis of suspected angina pectoris. This would probably not have been intense enough to evoke secondary alexithymia, because our data disclosed that the MMPI Alexithymia Scale score of patients with significant stenosis, which is a more severe disease state in many cases than that of coronary spasm, is significantly lower than that of the coronary spasm group. Although Schmidt et
revealed that the Alexithymia Scale score does not change after drug therapy in bulimia nervosa patients, the influence of psychotic drugs on alexithymia is not fully elucidated. In our study, the incidence of users of various psychotic drug was not different in the coronary spasm group and the control group.

The influence of behavior specific to alexithymia cannot be eliminated completely in our study. In the field of psychosomatic medicine, Kauhanen et al. reported a new finding that alexithymic men might be diagnosed with coronary heart disease earlier because of their increased symptom reporting rather than pathophysiologic changes in coronary heart disease. Although their findings seem to bear on the interpretation of our results, we think that the effect would have been slight, as all of our control subjects who had the chest symptoms of angina pectoris without coronary stenosis and spasm tend to report symptoms frequently and also because the correlation that we found between alexithymia and coronary spasm was quite strong.

Conclusions

In conclusion, this psychobehavioral pattern, alexithymia, seems to be related to coronary spasm. This relationship is independent of other coronary risk factors including sex and smoking.

Acknowledgment

We thank Dr Yoshikazu Nakamura (Department of Public Health, Jichi Medical School, Tochigi, Japan) for his assistance with data analysis.

References

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