Do Anger and Aggression Affect Carotid Atherosclerosis?

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Background and Purpose: Although a number of metabolic and psychosocial factors have been identified as coronary risk factors, no studies have evaluated the relation between personality and cerebrovascular disease. The purpose of the present study was to elucidate the relation between the characteristics of anger or aggression and the severity of carotid atherosclerosis on the basis of the findings of B-mode ultrasonography.

Methods: The Cornell Medical Index was used to measure anger in 34 patients with signs of atherosclerosis or at least one of four recognized risk factors for atherosclerosis (hypertension, hypercholesterolemia, diabetes mellitus, and cigarette smoking). The Rosenzweig Picture Frustration Study and Yatabe-Guilford Personality Test were used to evaluate aggression. High-resolution B-mode ultrasonography was performed, and the severity of carotid atherosclerosis was determined by plaque score. The occurrence of risk factors for carotid atherosclerosis was compared among the patients.

Results: The correlation of plaque score with one item that endorses anger was r=.65 (P<.01) and with "extrapersistive" in aggression was r=.50 (P<.01). Multivariate analysis identified significant correlations between plaque score and age, hypercholesterolemia, and anger.

Conclusions: Our results suggest that anger and, perhaps, aggression may be risk factors for cerebrovascular disease. (Stroke 1993;24:983-986)

KEY WORDS • atherosclerosis • carotid artery diseases • risk factors • ultrasonics

Psychological factors are known to play an important role in the occurrence of various cardiovascular diseases.1,2 Epidemiological research in the United States and Europe suggests that psychological stress and undesirable social circumstances are major risk factors for coronary heart disease (CHD).3 The coronary-prone behavior pattern that was originally described by Friedman and Rosenman in the late 1950s has been demonstrated to be a coronary risk factor. This pattern is called type A behavior pattern (TABP).4 TABP is a clinically derived behavioral syndrome characterized by competitive drive, time urgency, hostility, and strong job involvement.4,5

Many studies have been performed concerning the relation between TABP and CHD.4,6,7 It is said that future research probably will focus on hostility and anger as major precursors of CHD and that a less central role will be allocated to other behaviors such as time urgency and competitiveness.8 However, no study has considered the relation between personality and cerebrovascular disease (CVD).

The purpose of the present study was to elucidate the relation between anger or aggression and CVD objectively and with an emphasis on etiology. Extracranial carotid atherosclerosis is one of the major causes of CVD.9 We evaluated the relation between atherosclerotic risk factors, including anger and aggression, and the severity of carotid atherosclerosis on the basis of the findings of B-mode ultrasonography.

Subjects and Methods

The study surveys, which were ultrasonographic assessments of the carotid arteries and evaluations of anger and aggression of 34 Japanese patients (22 men and 12 women), were carried out from August 1991 to January 1992 at Hyogo College of Medicine Hospital. None of the patients had dementia. Of these 34 patients, 5 had chronic-stage ischemic CVD (more than 6 months after the onset), and 3 had transient ischemic attack. The remaining 26 patients without CVD had at least one of four recognized risk factors for atherosclerosis (hypertension, hypercholesterolemia, diabetes mellitus, and cigarette smoking). Patients were considered hypertensive if they were taking antihypertensive agents or if blood pressure measured in the hospital was more than 160 mm Hg systolic or more than 95 mm Hg diastolic (21 patients). Patients were considered diabetic if they were being treated for diabetes with oral hypoglycemic agents or insulin or the glycosylated hemoglobin (HbA1c) level in the hospital was more than 7.0% (4 patients). Patients were considered hypercholesterolemic if they were taking antihypercholesterolemic agents or the serum cholesterol level was more than 220 mg/dL (21 patients). Patients were considered
smokers if the Brinkman Index was more than 50 (15 patients).

The Q-section of the Cornell Medical Index–Health Questionnaire (CMI) (Japanese translation),10 consisting of a self-report and multiple-choice questionnaire, was used to evaluate the anger of the 34 patients. The Q-section contains nine items, each of which requires a “yes” or “no” response. One item (Are you easily upset or irritated?) in the Q-section is considered the characteristic item of anger.10 The anger score was determined by the number of “yes” answers given in the Q-section on the CMI as shown in Table 1.

The Japanese translation of the Rosenzweig Picture-Frustration (P-F) Study,11–13 consisting of a self-report and writing, were performed to evaluate aggression. After the subjects’ answers to all 24 items were rated, scores on these 11 kinds of responses are combined to form six categories of aggression and three types of aggression. Aggression may be directed toward the environment (extragression), toward oneself (intragression), or evaded (imaggression). The types of aggression include attending to the frustrating barrier (obstacle-dominance), defending the organization of personality (ego-defense), or finding solutions (need-persistence).12

The aggression section on the Yatabe-Guilford (Y-G) Test,14,15 consisting of a self-report and multiple-choice questionnaire, was used to evaluate the aggression of these 34 patients. The aggression score was estimated using the scale of the P-F study and the Y-G test.

In all subjects, carotid B-mode imaging was performed with a 7.5-MHz transducer with an axial resolution of less than 0.4 mm (SSD-650, Aloka, Tokyo, Japan). The subject was seated comfortably, and scanning of the extracranial carotid arteries in the neck was performed bilaterally in three different longitudinal projections and in the transverse projection. Severity of carotid atherosclerosis was evaluated by plaque score. The plaque score, using the scoring system method presented by Handa and colleagues,9 was computed by summing the maximum thickness of the intima-media complex (plaque thickness) measured in millimeters of both sides of the carotid arteries. The subjects were divided into two groups: group A (16 patients), or patients who had severe plaque (plaque score of 5.0 or higher), and group B (18 patients), or patients who had mild or no plaque (plaque score of less than 5.0). Anger, aggression, age, sex, and the four other risk factors for atherosclerosis combined were evaluated in all 34 survey patients.

The relation between the plaque score and anger or aggression was evaluated by linear regression analysis. The $\chi^2$ test was used to evaluate the difference in the prevalence of carotid lesions and anger. Multivariate linear regression analysis was used to assess the correlation between carotid lesions and risk factors and was carried out using the HALBAU statistical package designed for personal computers (PC-9801 NEC, Tokyo, Japan).9,16 $P<.05$ was considered significant.

**Results**

There was a significant positive linear correlation between the plaque score and anger (Fig 1). Of group A patients, 56.3% (nine patients) answered “yes” for the characteristic anger item in the Q-section of the CMI. This was significantly higher than the 16.7% (three patients) answering “yes” in group B ($P<.05$).

There was a significant positive linear correlation between the plaque score and extrapersistive aggression,13 one of the extragression characteristics from the P-F study (Fig 2). The other extragression scores, extrapreditive13 and extrapunitive,13 on the P-F study and the aggression score on the Y-G test had no significant correlation with the plaque score (Table 2). The intragression and imaggression scores had no significant correlation with the plaque score.

We also examined the association between these social factors and other risk factors for carotid atherosclerosis. Multivariate analysis indicated significant correlations of plaque score with age, hypercholesterolemia, and anger (Table 3). Hypertension, being male, cigarette smoking, diabetes mellitus, and aggression were not significantly associated with carotid atherosclerosis. There was a positive correlation between the score
TABLE 2. Correlation Between Personality and Plaque Score

<table>
<thead>
<tr>
<th>Personality</th>
<th>R</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMI item Q (anger)</td>
<td>.65</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>P-F study (extraggression, total)</td>
<td>.21</td>
<td>NS</td>
</tr>
<tr>
<td>Extrapductive (E')</td>
<td>.04</td>
<td>NS</td>
</tr>
<tr>
<td>Extrapunitive (E)</td>
<td>.06</td>
<td>NS</td>
</tr>
<tr>
<td>Extrapersistive (e)</td>
<td>.50</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Y-G personality test (aggression)</td>
<td>.12</td>
<td>NS</td>
</tr>
</tbody>
</table>

CMI, Cornell Medical Index-Health Questionnaire; P-F study, Rosenzweig Picture Frustration Study; Y-G personality test, Yatabe-Guilford Personality Test.

of extrapersistive aggression and the plaque score in a univariate analysis, but this relation disappeared in stepwise multiple linear regression analysis.

**Discussion**

In US studies, the increased risk of developing heart disease appears to be of the same order of pathogenetic magnitude for TABP as for other commonly accepted risk factors such as hypercholesterolemia and smoking. However, anger and aggression have not been recognized as risk factors for CVD. Regarding the relation between anger or aggression and carotid atherosclerosis, our study showed for the first time that anger and extrapersistive aggression were associated with the ultrasonographically documented severity of carotid atherosclerosis. The results of multivariate analysis show that the prevalence of carotid atherosclerosis and the plaque score strongly correlated with age, hypercholesterolemia, and anger. The results indicate that anger might act as an independent risk factor through the promotion of carotid atherosclerosis. Anger management training was performed. However, anger might be related to another characteristic that is more central, or there might be other aspects of emotional mental state that could correlate with severity of carotid atherosclerosis.

Except for extrapersistive aggression, the other aggression scores did not correlate significantly with plaque score. It is thought that some aspect of extrapersisive aggression may be similar to hostility. The aggression that was measured by the Y-G test included all types of aggression assessed in the P-F study. Therefore, it might be considered that the aggression in the Y-G test did not show a significant correlation with plaque score. It is possible that other aspects of emotional state, such as anxiety, phobias, panic, fear, or other emotions, might correlate significantly with plaque score. Assessment of personality requires evidence of longitudinal characteristic patterns of reaction and are not state-dependent phenomena that may vary over time. Further investigations might be required to solve these problems.

If anger is an independent cause of carotid atherosclerosis, the mechanism necessarily comes into question. Our study has not examined this; furthermore, the mechanisms of other risk factors such as smoking and hypertension have not been clarified.

Oliva reported that psychological stress promotes the aggregation of platelets in coronary arteries. Psychological stress also may lead to coronary spasms by direct α-adrenergic action or by the release of thromboxane A₂ from platelets due to the increase in plasma catecholamines through the adrenomedullary system. Catecholamines are thought to play important roles in these processes. Garruthers reported that the plasma level of norepinephrine was significantly higher in type A patients than in control patients.

Anger is construed as being determined by external events, internal events, internal processes, and behavioral reactions. To put it simply, anger can be examined in terms of aversive events, how these events are appraised or interpreted, and the behaviors that are enacted in response to these events. Raymond suggests that these three sets of determinants have mutually influenced relations. He shows that anger might induce behavioral reaction, including aggression and hostility.

Several conclusions can be drawn from our study. First, anger and aggression may constitute an important psychosocial factor associated with CVD. Second, anger and, perhaps, aggression may be risk factors for CVD.

**References**


**Table 3. Relation Between Risk Factors and Plaque Score by Multivariate Analysis**

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Standard partial regression coefficient</th>
<th>Partial correlation coefficient</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>.33</td>
<td>.582</td>
<td>.43</td>
</tr>
<tr>
<td>Male sex</td>
<td>.14</td>
<td>1.09</td>
<td>.20</td>
</tr>
<tr>
<td>Hypertension</td>
<td>-.15</td>
<td>1.62</td>
<td>-.25</td>
</tr>
<tr>
<td>Hypercholesterolemia</td>
<td>1.29</td>
<td>4.71</td>
<td>.40</td>
</tr>
<tr>
<td>Cigarette smoking</td>
<td>.20</td>
<td>1.39</td>
<td>.23</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>-.05</td>
<td>.18</td>
<td>-.08</td>
</tr>
<tr>
<td>Anger</td>
<td>.37</td>
<td>4.59</td>
<td>.39</td>
</tr>
<tr>
<td>Aggression</td>
<td>.11</td>
<td>.74</td>
<td>.17</td>
</tr>
</tbody>
</table>

Multiple correlation coefficient: .85
Multiple correlation coefficient adjusted for the degree of freedom: .80
Multiple correlation coefficient readjusted for the degree of freedom: .74

F=8.18 (P<.001)

e, extrapersistive.
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