Brain-Heart (Cardiovascular) Interactions in Stress and Anxiety Related Disorders

Implications for Increased Cardiovascular Disease Risk

MENTAL STRESS INDUCED MYOCARDIAL ISCHEMIA

Acute psychological stress has been associated with an increase in myocardial ischemia,1-5 and has also been seen to induce myocardial ischemia.6-9 Although the mechanism is not fully understood, mental stress-induced myocardial ischemia (MSIMI) carries a worse prognosis with a nearly twofold increase in risk of cardiac events and mortality.10 Mental stress does lead to a different response from the cardiovascular system as compared to exercise. There is a modest increase in cardiac output, but during mental stress systemic vascular resistance increases, as compared to the decrease seen during exercise.11,12 Mental stress is shown to lead to changes consistent with endothelial dysfunction,13 however the mechanism does not appear to be through inflammatory markers and may instead by partially mediated by neuronal nitric oxide synthase.14,15 While coronary vasomotor function is affected by mental stress, there are also changes and increases in peripheral vasoconstriction, however they differ by sex.16

MSIMI is independently associated with anginal symptoms independent of the presence of obstructive coronary artery disease,17,18 and is associated with other psychological stressors such as anger and depression.19,20 These psychological factors suggest neurological structures may be indicated in the pathophysiology of MSIMI. We studied brain correlates in those that develop MSIMI, and we showed an increased activation to stress in the anterior cingulate, inferior frontal gyrus, and parietal cortex during public speaking, with additional activity in the left insula during arithmetic stress.21 We examined brain correlates in those that developed stress-induced peripheral vasoconstriction; we found increased activation in the insula and parietal cortex and decreased activation of the medial prefrontal cortex compared to control.22 Additionally, we showed that in several individuals mental stress induces a coronary microvascular vasodilator response measured as changes in coronary blood flow during angiography, and that this microvascular response is endothelium‐dependent and correlates with peripheral microvascular function during mental stress,23 suggesting ANS dysfunction as the likely basis for these findings.

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