

## STRESS AND HEART

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**ARYA Journal, 2006, 2(2): 60-61**

*Background:* Human beings throughout the world are faced with high and ever increasing levels of acute or chronic stress. Acute stress is defined as “the normal short-term physiological response to the perception of major threat or demands”. Chronic stress is defined as “the abnormal ongoing physiological response to the continuing perception of irresolvable major threats or demands”.<sup>1</sup> In fact, all these modern definitions of stress date back to the time of Hans Selye, the first scientist who studied the effects of stress on health and physiological integrity of living organisms.<sup>2</sup> Accordingly, the term stress pertains to effects of all environmental and psychosocial factors on physical or mental well-being.<sup>1</sup>

The effect of stress on cardiovascular system has been discussed for many years,<sup>3</sup> although until recently, the evidence has been relatively weak due to the complexity of such a relationship.<sup>4</sup>

Among the many different types of stressors, mental and psychosocial stressors exert profound effects on the circulatory system. Primary studies on the relationship of stress with cardiovascular disease focused mainly on type A personality, then shifting to more specific components, i.e. hostility and anger, as stressful factors that provoke cardiovascular problems.<sup>5</sup>

Behavioral or psychosocial stress induces or influences the development and progression of atherosclerosis. Several mechanisms have been proposed for this effect. Psychosocial stress has been demonstrated to increase oxidative stress which disturbs endothelial integrity and induces endothelial injury and dysfunction.<sup>6</sup> These processes activate beta 1-adrenoceptors that cause sympathoadrenal activation, which in turn enhances atherosclerosis. Also, behavioral or psychosocial stressors decrease estrogen, which may be of importance for the development of premenopausal atherosclerosis.<sup>7</sup>

Stress is strongly associated with CAD. Clinically, mental stress is a cause of angina and may specifically worsen CAD. By provoking a dynamic decrease in coronary supply, mental stress may activate the

ischemic response and induce substantial myocardial ischemia, and in the long term adversely affect prognosis in CAD patients.<sup>8,9</sup> Hostility and anger have also been shown to negatively influence ejection fraction and myocardial blood circulation, pointing out the importance of these phenomena as the etiology of CAD.<sup>5</sup> However, other forms of stress also have an impact. Behavioral/ psychosocial stress may participate in the development of CAD, via neuroendocrine mediation through sympathoadrenal activation (chronic sympathetic hyperarousal), seen clinically in angina/chest pain associated with normal coronary angiograms.<sup>10</sup>

Stress clearly has the potential to actively trigger threatening cardiac events that lead to myocardial infarction. Mental stress increases the myocardial oxygen demand via sympathoadrenal activation and also involves a reduction in the myocardial oxygen supply, an eventually fatal consequence.<sup>11</sup> Mental stress obviously has a profound impact on long-term cardiac events and outcome. In particular, mental stress may cause paradoxical constrictions in patients with CAD/atherosclerosis, especially at points of stenosis - a response that correlates with the extent of atherosclerosis (plaque) and with the endothelium-dependent response to an infusion of acetylcholine (verification of endothelial dysfunction).<sup>12</sup>

*Discussion:* Stress contributes to the onset, development, progression, and treatment delay of a variety of cardiovascular diseases. The prevalence of stress is high in both developing and developed countries,<sup>13</sup> an example of which is a large multicomponent interventional project on lifestyle habits performed in Iran, named Isfahan Healthy Heart Program, the results of which show high stress levels in 40% of men and 45% of women.<sup>14</sup> Thus, ‘lifestyle’ needs to be a central focus of prevention,<sup>13</sup> as this ‘epidemic of stress’<sup>1</sup> may turn into a critical medical issue. Stress management interventions such as cognitive behavioral strategies to improve adaptive methods, and the use of relaxation response techniques are of growing importance in the future.<sup>14</sup>

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