Viewpoint: Role of Mind–body Therapies in the Management of Cardiovascular Disorders

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Abstract

Cardiovascular disorders (CVD) are the leading cause of death across the globe. The estimated cost to the National Health Service and UK economy is £30 billion. These costs continue to escalate despite major advances in pharmacotherapy and devices, which, in part, is due to improved survival, but also greater resource utilisation per patient. Hence, there is a need to develop cost-effective adjunctive therapies beyond conventional strategies. Mind-body therapies– including mindfulness and meditation, emotional regulation, practicing ‘heartfelt’ emotions including gratitude and compassion– may be novel low-cost approaches to reduce morbidity and mortality in CVD.

Keywords

Mental stress, mindfulness, cardiovascular disorders

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Role of Mental Stress in Cardiovascular Disease

The pathophysiology of how mental stress affects and modulates the cardiovascular system is incompletely understood. Chronic stress has long been suspected to be a risk factor for cardiovascular disorders (CVD), either through direct or indirect mechanisms.^{1,2} Stress is known to activate two biological systems: the hypothalamic-pituitary-adrenal axis as well as the sympathetic nervous system, leading to increases in noradrenaline, adrenaline, cortisol, blood pressure, inflammatory activity as well as altered glucose metabolism.^{3–7}

The association between acute mental stress as a trigger for an acute cardiac event (e.g. angina, myocardial infarction, arrhythmias) or rarely sudden cardiac death is established.^{8–11} Epidemiological studies have demonstrated that the incidence of acute coronary syndromes increases immediately following natural disasters such as hurricanes, earthquakes and tsunamis. Common emotional stressors leading to anger or conflict, and sometimes happy events, have also been implicated as potential triggers.¹² The relatively recent description of apical ballooning (Takotsubo) syndrome provides a very clear example of this relationship.^{13,14} Approximately one-third of patients presenting with this intriguing condition have an antecedent emotional stressor.¹⁵

Possible pathophysiological mechanisms for the impact of acute stress include sympathetic system mediated coronary artery vasoconstriction, tachycardia and hypertension leading to an acute mismatch of myocardial oxygen demand and supply. This is supported by evidence linking mental stress to endothelial dysfunction, exaggerated peripheral microvascular tone, including vasoconstriction of normal coronary artery segments.^{16,17} Mental stress may also promote cardiac electrical instability. Thus, the autonomic nervous system forms a key component of the mind–heart connection by linking our thoughts and emotions with the heart.

The mechanism by which chronic stress influences CVD is less clear. Animal models have suggested a myriad of potential mechanisms but their clinical significance remains to be determined.¹⁸ Potential mediators may include an altered diurnal pattern or blunting of stress hormones release, endothelial dysfunction, epigenetics and a pro-inflammatory response.^{18,19} Epidemiological studies have suggested that chronic mental stress, such as excessive work demands, may be harmful. In a recent meta-analysis, comprising data from 603,838 individuals who worked ‘long hours’ (≥55 h per week), there was an association with an increased risk of incident coronary heart disease (CHD).²⁰ Stress-related psychological dispositions such as anxiety, depression and anger/hostility have also been linked to CHD.^{12,21,22} The INTERHEART study demonstrated a doubling in the incidence of myocardial infarction in individuals with chronic stressors, even after adjustment for conventional cardiovascular risk factors.²³ Stress was defined as feeling irritable, filled with anxiety, or as having sleeping difficulties as a result of conditions at work or at home.

Stress is also associated with unhealthy lifestyle behaviours, such as smoking and alcohol consumption.²⁴ Thus, further investigation is required to determine whether chronic stress is a marker or mediator of adverse cardiovascular health outcomes.

Neuroscience of Stress

We recognise a close connection between mental stress and the brain; however, the exact mechanism by which stress affects the brain is incompletely understood. A possible pathophysiological mechanism by which the brain may respond to stress is outlined below. It is understood that the brain is both the mediator and target of the stress response with the deep limbic system and the prefrontal cortex modulating the stress response.³ Sensory inputs are processed via the thalamus into these two regions. The instinctive stress response

operates via fast subcortical signalling directly to the lateral amygdala from dorsal thalamic nucleus. The lateral amygdala projects to the hypothalamus and the brain stem. The primary effectors of the stress response are the paraventricular nucleus of the hypothalamus and the anterior pituitary. A rationalised response is mediated via a slower cortical route via somatosensory and prefrontal cortex.

Chronic stress may potentially impair brain circuitry through the effects of glucocorticoids.^{25,26} In animal studies, repeated stress causes shortening of dendrites in the prefrontal cortex and increases dendritic growth in the amygdala. Stress also increases spine synapses in the amygdala. These changes are accompanied by impairment in tests of cognitive flexibility and attention switching.

The default mode network (DMN) appears to be central to modulating the long-term effects of stress, potentially through active recollection of past experiences and anticipation of future events during the stress-free periods.^{27,28} In an experimental model of stress in 51 healthy young men, functional magnetic resonance imaging was performed prior to stress, immediately following, and 2 hours later. A stress-induced rise in amygdala–hippocampal connectivity, a marker of the DMN, was documented, which was sustained for as long as 2 hours. The sustained limbic system activity was inversely correlated with impaired stress-induced cortisol response. There is some evidence to suggest that cortisol may regulate the activity of the amygdala and other brain regions involved in the stress response via a feedback loop.

Mind-body Therapies as Adjunctive Therapies

Mind-body therapies (MBTs) might improve health via impacting some or all of these mechanisms.²⁹ Mind-body medicine is a branch of integrative medicine gaining growing attention in clinical practice and public health circles as a critical tool to promote chronic disease management and enhance wellbeing and resilience.³⁰

There have been few large-scale efforts to date to identify effective MBTs for stress management in patients with CVD. However, there is an emerging body of evidence to suggest that MBTs that reduce stress or enhance stress coping skills have beneficial effects in CVD

and promote patient wellbeing. MBTs include mindfulness-based stress reduction (MBSR), meditation, guided imagery, progressive muscle relaxation, deep breathing exercises, yoga, tai chi, qigong, biofeedback as well as hypnosis. Meditation has been shown to have a beneficial effect on CVD risk factors such as hypertension, insulin resistance and myocardial ischaemia. In patients with CHD, meditation has been shown to reduce clinical events in conjunction with anger scores, potentially with a dose–response effect.^{31,32} MBTs also improve components of the metabolic syndrome, an important risk factor for cardiovascular disease.^{33–35}

Prior studies have documented the efficacy of both mindfulness and concentrative meditation for decreasing symptoms of stress and anxiety.^{36–42} A recent review and meta-analysis showed a significant reduction in stress levels in addition to an improvement in spirituality levels in participants who attended the MBSR programmes compared with control subjects.^{43,44} As a result, MBT is gaining increasing attention from doctors and patients as a potential adjunct to promote chronic disease management (for example, see the US National Center for Complementary and Integrative Health's web page on mind and body practices [nccih.nih.gov/health/mindbody]).

The Mayo Clinic Stress Management and Resiliency Training (SMART) programme is another evidence-based intervention that uses attention training, mindfulness and paced breathing to facilitate recovery from stressful experiences and develop skills to deal with adversity.^{45,46}

Conclusion

There is a need for innovative strategies to assist patients with CVD in reducing the impact of mental stress. Such initiatives will not only be a step in the right direction for disease management, but will also promote insights into the pathophysiological role of stress in CVD.

Potential interventions for managing stress related to CVD should address biological, behavioural and psycho-spiritual factors. A deeper understanding of these determinants will not only improve prevention and intervention strategies, but have the potential to reduce healthcare costs and improve quality of life. ■

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