

Editorial

Stress and Cardiac Arrhythmias

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Stress can exert adverse effect on cardiovascular health. Psychosocial stress adversely affects the autonomic homeostasis. This in turn can result in metabolic abnormalities, inflammation and dysfunction of endothelium [1]. Changes in the autonomic homeostasis can be a major trigger for ventricular tachyarrhythmias [2]. Increased sympathetic nervous activity can cause increased proarrhythmic repolarization instability leading to spontaneous ventricular arrhythmias. During stress-induced autonomic nervous system activity, the heart rate rises and the heart rate variability indices like *low frequency power* falls before the onset of ventricular tachycardia [3]. Psychological stress has been shown to induce T wave alternans, which in turn predicts future ventricular tachyarrhythmia events [4]. Fluctuations in T wave amplitude after psychological stress are predictive of subsequent arrhythmic events [5].

The mechanism of arrhythmia in children with structurally normal heart is the same as in an adult patient. Arrhythmias in children with heart disease can be the result of any underlying structural abnormality. It may also be due to surgical interventions [6]. Psychological stress stimulate sympathetic nervous system and this in turn can become proarrhythmic [7].

Catecholaminergic ventricular tachycardia is a rare primary ventricular tachyarrhythmia seen in children, which has a poor natural history. This potentially lethal tachyarrhythmia in children with structurally normal heart can be induced by stress or emotions [8].

Myocardial electrical instability can be triggered by psychological stress. Chronic stress can lead to reduced heart rate variability, increased QT dispersion and reduced baroreceptor sensitivity. Patients with greatest changes in the cardiac neural regulation associated with increased sympathetic activity due to stress have the greatest risk for developing fatal ventricular arrhythmias [9].

The influence of anxiety on cardiovascular disease is well known. Both chronic and acute psychosocial stressors leading to anxiety are associated with arrhythmic risk. Out of the 96 studies related to psychosocial aspects of arrhythmic risk conducted among different populations, 92% of the studies demonstrated positive correlation between psychosocial

stressors and arrhythmias [10]. Emotional stressors can lead to ventricular ectopic beats and ventricular tachycardia. Though disturbances of cardiac rhythm due to emotional stress are often transient, sometimes the consequences can be seriously damaging and even fatal [11].

The importance of psychological factors in the genesis of cardiac arrhythmias is well recognized. Among the emotional factors, anger is strongly associated with triggering of ventricular arrhythmias [12]. Negative emotions like anger and hostility increases the risk of atrial fibrillation [13]. Depressive symptoms can predict arrhythmic death [14]. Depression and anxiety act through common pathway leading to increased arrhythmic risk [15].

Sudden emotional arousal can even trigger malignant ventricular arrhythmias. It is estimated that about 20 - 40% of sudden cardiac deaths are precipitated by acute emotional stressors [16]. Cardiac autonomic dysfunction triggered by psychological distress can increase the risk of arrhythmias [12]. With the advent of functional neuro imaging, the anatomical substrate and the physiological mechanism by which emotional stress contributes to the arrhythmias and cardiovascular events are now recognized. During emotional stress there is lateralization of cerebral activity. This leads to asymmetrical stimulation of the heart, producing areas of inhomogeneous repolarization, creating electrical instability. This in turn facilitates the development of cardiac arrhythmias.

Non pharmacological approaches like relaxation therapy will be beneficial in the management of emotional stress [11]. As stress and negative emotions are important risk factors in arrhythmogenesis, to reduce the risk of arrhythmia in patients with psychological distress, stress management has a very important role.

References

1. Das S, O'Keefe J. Behavioral cardiology: recognizing and addressing the profound impact of psychosocial stress on cardiovascular health. *Curr Atheroscler Rep.* 2006;8:111-8.
2. Lampert R, Joska T, Burg MM, Batsford WP, McPherson CA, Jain D. Emotional and physical precipitants of ventricular arrhythmia. *Circulation.* 2002; 106:1800-5.
3. Shusterman V, Aysin B, Gottipaty V, Weiss R, Brode S, Schwartzman D, Anderson KP. Autonomic Nervous System Activity and the Spontaneous Initiation of Ventricular Tachycardia. ESVEM Investigators. Electrophysiologic Study Versus Electrocardiographic Monitoring Trial. *J Am Coll Cardiol.* 1998; 32:1891-9.
4. Lampert R, Shusterman V, Burg MM, McPherson CA, Goldberg A, Batsford W, Soufer R. Anger-Induced T-wave Alternans Predict Future Ventricular Arrhythmias in Patients with Implantable Cardioverter-Defibrillators. *J Am Coll Cardiol.* 2009; 53:774-8.
5. Abisse SS, Lampert R, Burg M, Soufer R, Shusterman V. Cardiac repolarization instability during psychological stress in patients with ventricular arrhythmias. *J Electrocardiol.* 2011;44:678-83.
6. Brugada J, Blom N, Sarquella-Brugada G, et al. Pharmacological and non-pharmacological therapy for arrhythmias in the pediatric population: EHRA and AEPC-Arrhythmia Working Group joint consensus statement. *Europace.* 2013;15:1337-82.
7. Brodsky MA, Sato DA, Iseri LT, Wolff LJ, Allen BJ. Ventricular Tachyarrhythmia Associated with Psychological Stress. *JAMA.* 1987; 257:2064-7.
8. Leenhardt A, Lucet V, Denjoy I, Grau F, Ngoc DD, Coumel P. Catecholaminergic

polymorphic ventricular tachycardia in children. A 7-year follow-up of 21 patients. *Circulation*. 1995;91:1512-9.

9. Brunckhorst CB, Holzmeister J, Scharf C, Binggeli C, Duru F. Stress, depression and cardiac arrhythmias. *Ther Umsch*. 2003;60:673-81.

10. Hemingway H, Malik M, Marmot M. Social and psychosocial influences on sudden cardiac death, ventricular arrhythmia and cardiac autonomic function. *Eur Heart J*. 2001;22:1082-101.

11. Ziegelstein RC. Acute emotional stress and cardiac arrhythmias. *JAMA*. 2007;298:324-9.

12. Peacock J, Whang W. Psychological Distress and Arrhythmia: Risk Prediction and Potential Modifiers. *Prog Cardiovasc Dis*. 2013 ; 55: 582-589.

13. Eaker ED, Sullivan LM, Kelly-Hayes M et al. Tension and anxiety and the prediction of the 10-year incidence of coronary heart disease, atrial fibrillation, and total mortality: the Framingham Offspring Study. *Psychosom Med*. 2005; 67:692-6.

14. Frasure-Smith N, Lesperance F, Habra M et al. Elevated depression symptoms predict long-term cardiovascular mortality in patients with atrial fibrillation and heart failure. *Circulation*. 2009; 120:134-40.

15. Watkins LL, Blumenthal JA, Davidson JR et al. Phobic anxiety, depression, and risk of ventricular arrhythmias in patients with coronary heart disease. *Psychosom Med*. 2006; 68:651-6.

16. Vlastelica M. Emotional stress as a trigger in sudden cardiac death. *Psychiatr Danub*. 2008;20:411-4.