HEART RATE VARIABILITY AND ARRHYTHMIAS

WHAT IS HEART RATE VARIABILITY?

Heart rhythm, the pattern of cardiac contraction followed by relaxation, represents the myocardial response to electrical activation of specialized cells and fibers within the atria and ventricles. Heart rhythm should be regular, with a rate of between 60-99 beats per minute at rest, but under normal conditions even a healthy heart displays slight beat-to-beat variability, as reflected in the R-R interval. (Consider sinus arrhythmia, where the R-R interval shortens during inspiration and lengthens during exhalation.) Thus, a healthy heart rhythm is not strictly regular, but varies slightly as a result of numerous factors, especially vagus nerve activity. Measuring heart rate variability (HRV) may provide useful clinical information about autonomic tone and heart function. In addition, reductions in HRV have been associated with a wide range of disorders.

There has been growing interest in the potential role of the heart as a sensory organ, specifically as relates to emotions, and the interplay between brain and heart as collaborative interpreters of our environment. Some experts believe that people are most healthy when cardiac, respiratory and central nervous system activities align and function in synchrony. This is reflected as balanced autonomic tone and, in part, high HRV.

The most common clinically used parameter of HRV is the standard deviation of all normal R-R intervals (SDNN) calculated from electrocardiographic tracings over a period of hours. R-R interval variability reflects a confluence of the complex interplay between many factors. Especially important is the balance between the sympathetic and parasympathetic arms of the autonomic nervous system, itself impacted by physical, emotional, pharmacologic and pathophysiologic factors. HRV may be taken as an indicator of baroreflex activity and psychophysiologic resilience, where high HRV signifies healthy systemic adaptability, and low HRV points to susceptibility to the negative consequences of stress and disease.[1]

CLINICAL USES OF HRV

As an independent variable, HRV is believed to have significant prognostic importance. Low HRV is correlated with increased all-cause mortality and a range of non-cardiac disorders including diabetes mellitus (where autonomic nervous system dysfunction is common), fibromyalgia, and neurologic and psychiatric disorders such as epilepsy, Parkinson’s disease, anxiety, depression, and posttraumatic stress disorder (PTSD). Acute, intense stress of the kind frequently experienced by military personnel is related to parasympathetic withdrawal and high cortisol levels, the latter associated with reduced memory, impaired cognitive performance, and an increase in mental errors. HRV varies inversely with cortisol secretion during stressful tasks. Those with high resting HRV recover quickly and function at a higher level.[2] Reduced HRV has been tied to an increased risk of dysrhythmias and sudden cardiac death in the recent post-heart attack
period, as well as worsened prognosis in the setting of heart failure.

Abnormalities of heart rhythm may occur as a result of underlying coronary artery disease, reentry phenomena, cardiotoxin exposure, ectopic foci, medication side effects, and abnormal automaticity. Apart from lowered HRV, factors that may promote cardiac arrhythmias include stimulant or alcohol use, cigarette smoke,[3] sympathetic nervous system overdrive as a result of psychosocial stress, and the use of non-steroidal anti-inflammatory drugs (due to increased risk of atrial fibrillation).[4]

Prevention of heart rhythm disturbance assumes primary importance not only to prevent morbidity and mortality, but also because conventional medical treatment of cardiac arrhythmias is often fraught with complications and risk of significant side effects. Dietary and lifestyle factors may help lower the risk for arrhythmias, as may select complementary therapies, but supportive evidence is scant with respect to the latter.

SELF-CARE

FOOD AND DRINK

Following a Mediterranean pattern of eating, or the DASH diet, provides safe and adequate amounts of magnesium, potassium, and other nutrients that help support normal sinus rhythm. Alcohol has a role in the Mediterranean diet but moderation is important for many reasons, not the least of which is the association of binge drinking and subsequent development of arrhythmias, including atrial fibrillation.

Omega-3 fatty acids obtained by eating cold water, fatty fish, or perhaps through supplementation with high quality fish oil, may help protect against life-threatening arrhythmias following acute coronary events, such as myocardial ischemia and damage. However, there is little evidence supporting an overall antiarrhythmic effect of omega-3s, especially against ventricular ectopy.[5] There is some evidence of a protective effect of omega-3s against atrial fibrillation following cardiac surgery.

WORKING YOUR BODY

Regular physical activity enhances vagal tone, reduces release and sensitivity to catecholamines, and improves heart rate variability, all of which protect against cardiac rhythm disturbances. Exercise can occasionally induce arrhythmias, but for most patients the health benefits of maintaining and improving aerobic capacity outweigh potential risks.

COMPLEMENTARY APPROACHES

Results from a small number of studies suggest that acupuncture may be considered a useful adjunct in the management of atrial fibrillation.[6,7]
Caution is recommended with stimulant herbs, but botanicals such as **khella** (*Ammi visnaga*, from which amiodarone and nifedipine were developed), **rhodiola** (*Rhodiola rosea*, extracts of which show some anti-arrhythmic activity), **motherwort** (*Leonurus cardiaca*, associated with negative chronotropic effects), and **hawthorn** (*Crataegus sp.*, a traditional cardiac tonic with suggestion of anti-arrhythmic activity) show promise.[8,9] Concerns about overlapping mechanisms of action with conventional anti-arrhythmic agents, and thus increased potential for toxicity, as well as limited data on safety and effectiveness, serve to relegate herbal therapy against arrhythmias as no more than investigational. Some experts believe that coenzyme Q10 (CoQ10) may offer protection against rhythm disturbances, but this is speculative.

**Note:** Please refer to the *Passport to Whole Health*, Chapter 15 on Dietary Supplements for more information about how to determine whether or not a specific supplement is appropriate for a given individual. Supplements are not regulated with the same degree of oversight as medications, and it is important that clinicians keep this in mind. Products vary greatly in terms of accuracy of labeling, presence of adulterants, and the legitimacy of claims made by the manufacturer.

Regular practice of **mind-body therapies such as biofeedback, meditation and yoga** appear to enhance autonomic balance and improve heart rate variability, and so should function to help prevent arrhythmias, however, there is a paucity of research in this regard.[10,11]

Optimizing HRV may enhance an individual’s ability to respond well to stress, improve performance, and reduce morbidity and mortality, including that related to arrhythmias. A number of interventions appear to improve HRV, at least in the short-term (refer to the box below). Overlap with the general recommendations for prevention of arrhythmias, as noted above, is considerable and noteworthy.

**MEANS OF IMPROVING HEART RATE VARIABILITY**

- Aerobic exercise
- Biofeedback
- Breathing exercises
- Cognitive behavioral therapy (CBT)
- Meditation
- Omega-3 fatty acids (increased intake)
- Smoking cessation
- Tai Chi
- Yoga

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REFERENCES