

When You Are Serious with Mike Nichols, MD

Heart Rate Variability

Bear with me; this one is a little tough. However, I am fortunate enough to have very, very intelligent patients. The import of the topic warrants the effort to have you help me make this topic make sense. If I have failed here to do so please ask questions.

I've had two patients bring up the topic of Heart Rate Variability (HRV). This is a very important topic directly related to Sudden Cardiac Death (SCD). I am glad for a surge in interest, if two patients broaching the topic is evidence of such, but I note a common error in their understanding of this issue.

For the last 10-15 years the medical literature has been refining, actually 'mining' would be a better term, the information to be found in commonly done medical procedures that look at heart function. Three such have been the basic EKG, the EKG stress test and the Holter monitor. The first is the record we have all seen of the squiggly lines reflecting the beating of the heart. The second is the same image of voltage variation of the heart, signifying its beating, recorded during physiological stress such as running or pharmacological stress of medications that make the heart rate race. The last is a continuous recording of the heart for a prolonged period of time from a few hours to several days. We have millions of miles of such paper and electronic recordings and some clever soul decided to go back and look at these records to see if retrodictively they had more information than first noted. Sure enough previously unnoticed or unappreciated variances in the 'squiggles' turned out to have important predictive value for SCD or other heart problems. Even previously thought to be minor changes like early repolarization turned out to increase the risk of SCD.

Well to get to the point, the variation in the beating of the heart, the time variance in microseconds, turns out to be linked to SCD; low and behold other non-heart disease states as well.

The heart at rest rumbling along, speeding up and slowing down turns out to be much healthier than steady-state, metronomic, synchronized perfection. For you old hot-rodders, knowledgeable about cars before variable timing came along, you will remember that the cam shaft tuned for power made the car idle very roughly; almost to the point of stumbling and stalling until up to speed and then the timing smoothed out and the car ran much faster. Something like this is going on in increased HRV. Fine, so far so good: increased HRV is a sign of health. Not just health of the heart but of the whole system. This is where many people's understanding of HRV runs aground.

The tone of the sympathetic and parasympathetic systems regulate this variability at rest; well mostly so. The sympathetic tone is mediated through nerve signaling and hormonal signaling to 'speed up' the system; both locally and systemically. Hormones course through the whole body to turn up the gas and nerves signal locally to increase muscle tone and heart rate firing; parasympathetic tone is just the opposite; it slows things down, turns down the furnace. All well and good; the missing piece is at the cellular, read that as mitochondrial, level. Back to the hotrods.

Intake system of carburetor/fuel injector, motor, and exhaust system/manifold. That is the mitochondria, the biological equivalent of the above; intake/engine/exhaust. Now, again, bear with me.

Meditate, breathe, and increase the parasympathetic tone, and the heart rate will slow down; but it will not automatically increase HRV. You need to decrease sympathetic tone as well. In fact you need to make them both subtly, supplely, intertwined: relaxed but taut as well. Ah, the wonderful paradox of biological systems.

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Now back to the mitochondria. If their intake system, oxidation/reduction chains, and exhaust system are not in great working order then the HRV cannot properly map or match the metabolic demand environment and thus the HRV of rest is not pointing to the desired risk reduction associated, at the statistical level, with increased HRV; you have a simulacrum and not the real thing of a supple heart rate mapping directly on metabolic need and demand.

Great, you are a Swami who can get your resting heart rate down to 15 but you can still be the guy that dies prematurely from lack of HRV, or seemingly so, because most mapping models, and almost everyone's idea of HRV is linked to resting HRV rather than to the important tight mapping of heart rate response and metabolic need and demand.

There is a kind of intellectual romance to the mathematical concept of chaos and that charm has stolen the minds and hearts of those who write about HRV. HRV looks like chaos, but only if you use a microscope. If you use a telescope it is not random at all as the variability is in response to very minute changes in systemic/whole body metabolic needs. Even the sympathetic/parasympathetic tug of war/embrace of love is responding to the metabolic thrill of an idea or the calming call of being near the ocean at dusk.

OK, now back to hotrods: your training, living, eating and contemplation/meditation/prayer must be such that it makes the exhaust system better (and, of course, the intake and engine better too): if you don't quickly clear the reactive oxygen species and other detritus of the oxidation/reduction phosphorylation of mitochondria then the engine can't slow down fast enough because there are all those 'unburned' gases left in the exhaust cycle of the engine; boy I am really leaning on the engine metaphor but it is helpful.

Where this runs into the common error is that most people's understanding of HRV derives from observed variance at rest and they then miss the cellular level component that underpins it at the organismic level. You can't have a perfectly healthy relationship between the sympathetic and parasympathetic systems in an unhealthy cellular environment.

So now you know, for example, why the Tempus training model, well OK, my training model, has so much interval work and focus on the heart rate profile; this was/is my way of looking at the cellular level health of the system which will ultimately lead to the foundation for improved HRV.

Several years ago I coined the term or phrase to capture what happens when you ignore or take too lightly these issues: I said that the trend in all phases of biological life, from hormones, to heart rate variability tended to 'monotonic convergence.' The range gets trimmed, the dynamics are lost, and flexibility becomes less. A flat line on an EKG or EEG, think brain, is the ultimate 'monotonic convergence.'

Most of you will remember that on my patient intake form I ask about relationships, spiritual discipline, and hobbies. This turned out to be an almost funny Rorschach test about how fashionable atheism has become. What I was trying to elicit was the occasion to discuss the disciplines that help the resting state HRV and the more general stress responses and assets.

Breathing, Qigong, Yoga, Christian Prayer of the Breath, Body Scanning, Meditation, Contemplation, The Rosary. They work; this is not, or not merely, an assertion about the metaphysical structure of reality, but it is an empirical fact about the way humans are made. Without these, or similar, disciplines our sympathetic/parasympathetic systems are out of, very technical medical term coming, the systems are out of 'whack.' This leads to stress, cancer, high blood pressure, heart disease, depression and hangnails.

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Heart Rate Variability *(continued)*

The behaviorally controllable relationship between relaxation, exercise intensity, avoidance of inflammatory dietary behavior and all cause mortality is well documented. Eat right, exercise right, pray and play right; you can avoid or beat cancer, you can live ten or twenty years longer in full possession of your intellect and memory; but you must so choose.

Almost all of you recall Nixon's declaration of War on Cancer on, I looked it up, 12/23/71. Some progress, frighteningly little, has been made. And yet at the statistical level we already have the cure; we only need the will to take the medicine. Inform the intellect and give the assent of the will.