TITLE

The Critical Role of the Autonomic Nervous System (ANS) in the Development and Progression of Cardiovascular Diseases: For the First Time, Easily Assessed and Applied to Patient Management

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The ANS has a profound influence on the development and progression of the major cardiovascular diseases hypertension (HTN), coronary artery disease (CAD), congestive heart failure (CHF), neurogenic orthostatic hypotension (NOH), and is a major factor in sudden cardiac death (SCD) of Type 2 Diabetics (DM II). New technology, the 3.0 ANX AUTONOMIC MONITOR (Physio PT, Atlanta, GA USA), has, for the first time, provided accurate measurement of parasympathetic (P) and sympathetic (S) activity, whose sum equals heart rate variability(HRV), that is easily, quickly acquired in either an office or hospital setting. This article reviews our studies that suggest pharmacologic therapies of P and S abnormalities which reduce mortality and morbidity of these illnesses. How this new technology differs from all previous methods of HRV measurement and can be used in the daily practice of cardiology is also explained.

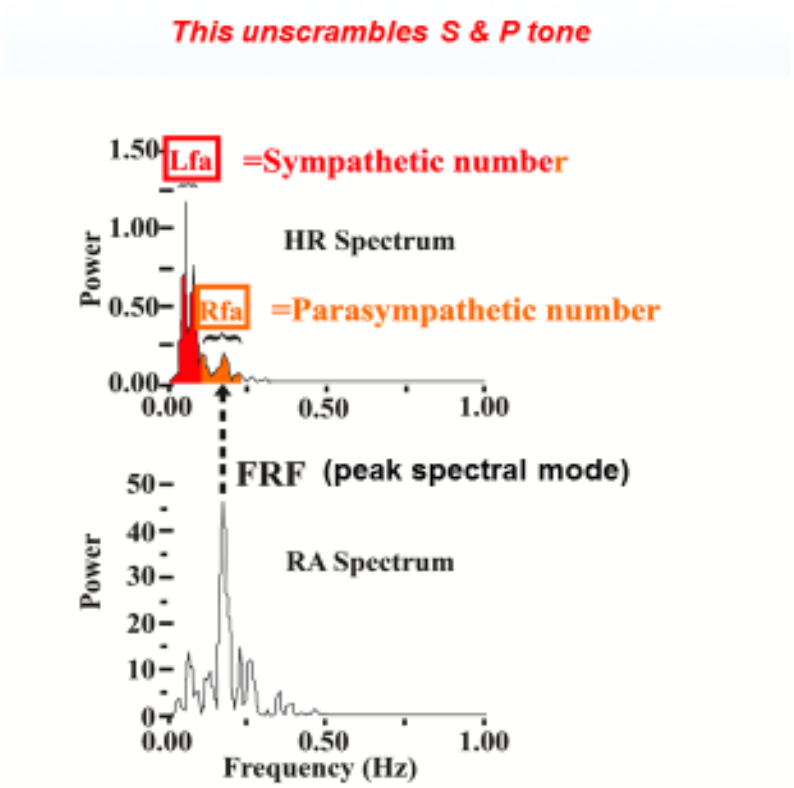
INTRODUCTION

In the 2nd century A.D., Wang Shu Ho stated, "If the heartbeat gets as regular as the knocking of the woodpecker or the dripping of the rain on the roof, the patient will die within 4 days". One century ago, the critical role of the ANS in health and disease was prophesized. In 1990, HRV (HRV = S + P) was 1st used in clinical cardiology, emphasizing reduced HRV is associated with a poor prognosis in all major cardiovascular diseases. In 2000, HRV was included in SCD risk stratification. High S and critically low P are associated with life-threatening ventricular arrhythmias, congestive heart failure (CHF), and acute coronary syndromes (ACSs). However, ANS testing is very rarely used in today's patient management. Why not?

Until recently, ANS measurement in the frequency domain yielded only total ANS activity, resulting assumptions and approximations of the independent contributions of S and P to total HRV. Since HRV = S + P, both must be accurately identified mathmatically. Furthermore, once in possession of this inaccurate S and P information, what were we told to do with it? So we needed accurate information and knowledge of S and P application to patient management in order to utilize this powerful tool.

ACCURATE MEASUREMENT OF S AND P

A technologic breakthrough was developed, validated, and verified by the 1st joint Bio-Medical Engineering program group from Massachusetts Institute of Technology and Harvard [1-5], and is now available for user-friendly routine clinical use. It is P&S Monitoring using the ANX 3.0 MONITOR(Physio PT, Atlanta, GA USA)=. The breakthrough quantifies the independent contributions of S and P to total HRV through two simultaneous measurements: (1) ECG monitoring which establishes total HRV (Low Frequency area [0.04-0.15 Hz] under the HR time-frequency spectral curve), simultaneously with (2) Impedance Plethysmography which independently quantitates P (a 0.12 Hz-wide window area under the HRV spectral curve centered on the modal peak of the time-frequency Respiratory Activity (RA) spectral curve; HRV due to RA is solely P-dependent). Therefore, S = HRV – P; where P is no longer assumed to be the area under the curve between 0.15-0.40 Hz, but now is quantitatively measured as the Respiratory Frequency area. The curves are analyzed using continuous wavelet transforms rather than the frequency-only fast Fourier transforms. The latter, although accurate for stationary signals, compromises time and frequency resolution due to the fixed length windows used in analysis.



S(LFa) = HRV – P(RFa)