

Is Any Significant Impact of Average RR Interval on Prognostic Ability of Sympatho Vagal Homeostasis

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Introduction

Over the last decades, assessment of Heart Rate Variability (HRV) has increased in various fields of research. HRV describes the changes in instantaneous heart rate, due to autonomic neural regulation, i.e involvement of both sympathetic and parasympathetic nervous systems. HRV is the degree of fluctuation in the length of the intervals between heart beats or R - R intervals (ms) in the electrocardiogram [1]. Analysis of HRV has emerged as a simple, non-invasive method to evaluate the Sympatho-vagal homeostasis. Generally a normal heart and a healthy (autonomic nervous system) ANS will yield a continuous variation of the sinus cycle, thus reacting a balanced Sympatho-vagal state and a normal HRV [2].

Sympatho vagal balance is the ratio of absolute LF to absolute HF power, or LF/HF ratio. Increase in this ratio indicates increased sympathetic activity [3]. As a consequence of the inverse curvilinear relationship between HR and R-R interval, identical changes in HR will elicit profoundly different changes in the R-R interval variability depending upon the baseline HR [4]. Several studies have reported that a strong inverse correlation between HR and various time domain indices of HRV (e.g., the Standard Deviation (SD) of normal beats, SDNN such that R-R interval variability increases as average HR decreases [5].

Frequency domain analysis of HRV is similarly affected by mean HR. Sacha and co-workers (demonstrated that the High Frequency (HF) component of HRV was inversely, while the low frequency (LF) component was directly, related to average baseline HR of the subject. As such, differences in average HR per se will influence HRV magnitude independent of cardiac autonomic nerve activity either magnifying or masking(diminishing)the autonomic component of HRV as mean HR/RR changes. HF component predominately a consequence of vagal activity. LF component probably due to combination of sympathetic and parasympathetic activity. LF/HF ratio has been used as a non-invasive index of sympathovagal balance [6].

The mean RR interval is an indicator of the ratio of the cardiac sympathetic to parasympathetic tones or Sympatho-vagal balance [7]. Since HRV is significantly associated with average RR interval, and it provides information on two parameters. HR and its variability play a vital role in the prognostic value of HRV. The association between HRV and mean RR interval is not only a physiological mechanism but also due to non-linear (mathematical) relationship between RR interval and HR. If normalizes HRV to its average RR interval, may get exact variability independent on mean HR/RR interval and free from the mathematical problems. Mean HR /RR interval independent provide better prognostic information than standard HRV measurements? It may vary in patients, control subjects and gender groups result from their differences in average HR/ RR interval. These issues may help to

answer for the contribution of average HR or RR interval to the clinical value of HRV (Figure 1).

As per the recommendations of the Task Force [8], Mean of all the RR intervals (mean RR), standard deviation of the normal to- normal RR intervals (SDNN), root mean square of successive differences between adjacent RR intervals (RMSSD) and the percentage of number of RR intervals with differences >50 ms (pNN50) were calculated in the time-domain. Frequency-domain measures were obtained by fast Fourier transformation and we included the absolute powers obtained by integrating the powers in the very low frequency (VLF) band of 0.0033–0.04 Hz, low frequency (LF) band of 0.04–0.15 Hz, high frequency (HF) band of 0.15–0.4 Hz, and the total power in all the 3 bands together. The normalized units (nu) of LF and HF power, as well as the LF/HF ratio, were considered.

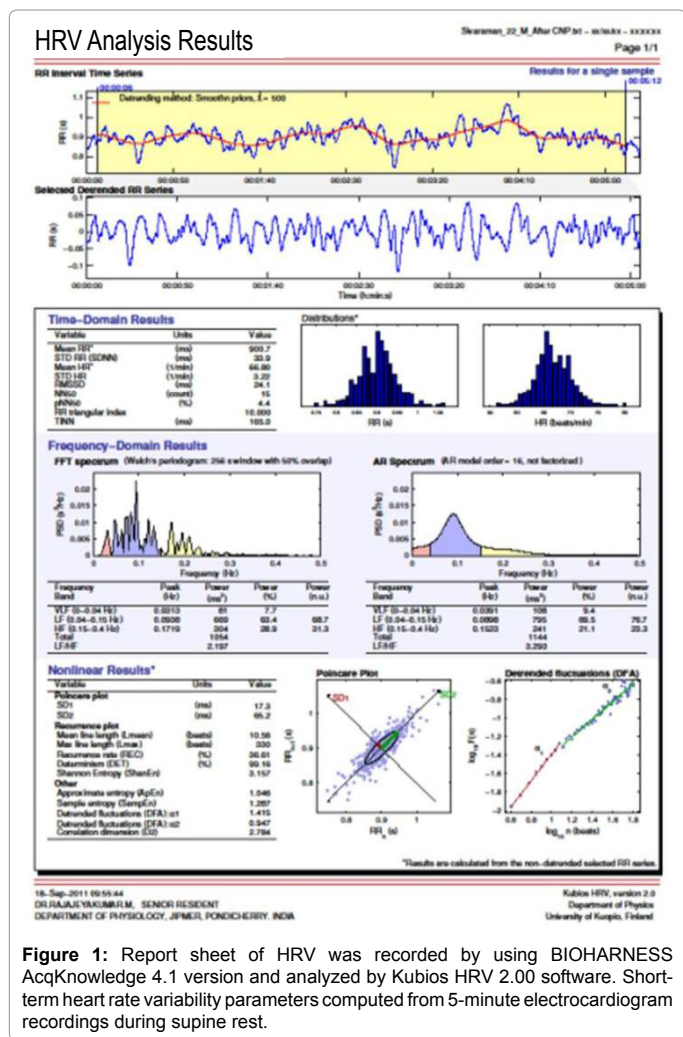
Furthermore, it will increase the prognostic value of HRV by the suitable changes of its relationship with mean HR/ RR interval. Using this approach; however, the concept requires further investigations in various clinical situations. Well-established time domain and frequency domain parameters (including both Fast Fourier Transform as well as autoregressive methods) are discussed controversially when it comes to their physiological interpretation and their psychometric properties like reliability and validity, and the sensitivity to cardiovascular properties of the variety of parameters seems to be a topic for further research. Moreover, recently introduced parameters like pNN and new methods such as approximate entropy and detrended fluctuation analysis offer new potentials and warrant standardization. This Research topic will cover recent advances in the application of HRV [9]. In summary, the mathematical manipulation of RR-interval spectral power is, to inspire confidence, reliable metric, and grounded solidly on physiological principles. It will stand on its own merits & demerits and need for attention to major dysfunctions with the construct of sympathovagal homeostasis.

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Figure 1: Report sheet of HRV was recorded by using BIOHARNESS AcqKnowledge 4.1 version and analyzed by Kubios HRV 2.00 software. Short-term heart rate variability parameters computed from 5-minute electrocardiogram recordings during supine rest.

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