

Autonomic Tone Variations Before the Onset of Paroxysmal Atrial Fibrillation

To the Editor:

In their recent report, Bettoni and Zimmermann¹ have made an important contribution to the understanding of modulating factors favoring the occurrence of paroxysmal atrial fibrillation (pAF). However, there are methodological inconsistencies that raise some concerns about the data as presented. Of concern is the interindividual comparison of “24-hour” parameters of heart rate variability (HRV) in a patient population with sustained episodes of pAF (>30 minutes) during 24-hour Holter recordings. It is reasonable to assume that the episodes of pAF occurred randomly and with various durations, and therefore there must have been a significant variety in the proportion of sinus rhythm/atrial fibrillation within the recordings. The authors did not mention whether 24-hour HRV parameters were measured from recordings including episodes of pAF. However, neither the measurement of 24-hour HRV from recordings including pAF nor the comparison of HRV assessed from various durations of pure sinus rhythm is methodologically valid.² Furthermore, 24-hour, 1-hour, and 5-minute values of HRV cannot be compared intraindividually, as circadian rhythms cannot be obtained from smaller windows. As longer recording durations are certainly associated with higher standard deviations of HRV, the significant alterations of SDNN (standard deviation of RR-intervals) and SDANN (standard deviation of the averages of RR-intervals for 5 minutes segments) (Tables 5 and 6) are merely due to different recording durations rather than to a shift of the autonomic tone. The measurement of 5-minute SDANN, which itself is defined as the standard deviation of 5-minute means of the NN-intervals, is more than questionable and again not in accordance with the guidelines of the Task Force on HRV.² It has been demonstrated that more than 50% of patients with pAF exhibit an increased atrial ectopy in the minutes before the onset of pAF.³ Even though the interval before and after a premature beat was excluded from the analysis, there is turbulence of the heart rate after a premature beat. Thus, the increase of SDNN within 10 minutes before onset of pAF, even with a coincidental increase of the underlying heart rate (Table 6), might be the result of a higher atrial ectopy rather than an increase of vagal predominance.

Therefore, it would be of great interest to evaluate changes of HRV in those episodes of pAF without preceding atrial arrhythmias (ie, sudden onset episodes).

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1. Bettoni M, Zimmermann M. Autonomic tone variations before the onset of paroxysmal atrial fibrillation. *Circulation*. 2002;105:2753–2759.

2. Task Force of The European Society of Cardiology, and The North American Society of Pacing, and Electrophysiology. Heart rate variability: standards of measurement, physiological interpretation, and clinical use. *Circulation*. 1996;93:1043–1065.
3. Hoffmann E, Janko S, Steinbeck G, et al. Onset scenarios of paroxysmal atrial fibrillation using new diagnostic pacemaker functions. *Pacing Clin Electrophysiol*. 2000;23:656. Abstract.

Response

We were interested in the comments by Drs Bonnemeier and Wiegand concerning our paper.¹ Methodological aspects of heart rate variability (HRV) analysis are complex, and application of these sophisticated techniques in clinical practice are necessarily imperfect. To minimize errors in interindividual comparisons of 24-hour parameters of HRV, only patients with more than 70% of normal sinus rhythm during the recording period were included. Therefore, total duration of atrial fibrillation episodes could not exceed 30% of the total recording period, and interindividual period of analysis was always less than 30%. We agree that results of time-domain HRV analysis are questionable and interpretation difficult when analyzed on short periods of time. This point has been emphasized in the “study limitations” section of the paper. However, the main conclusion of our study is based on frequency-domain analysis, which is certainly a better tool to investigate short-time recordings. The problem of increase in atrial ectopy before the onset of paroxysmal atrial fibrillation is of crucial importance, and in our study, only patients with more than 80% of N-N intervals during the various periods of recording were considered for analysis (see “Methods” section of the article), and all intervals before and after a premature beat were excluded. These criteria for inclusion have been arbitrarily chosen. Too many premature beats will certainly affect analysis, but too strict inclusion criteria will certainly introduce a bias in the patient selection. A careful analysis of all beats during the recording periods was performed, with manual validation. Only normal-to-normal intervals were included in the HRV analysis. Each non N-N interval (ectopic beat, post-extrasystolic pause, artifact, etc) was excluded or replaced by the value of the next valid N-N interval. Only segments or periods with >80% of qualified N-N intervals were accepted for analysis. Patients with bad quality recordings and patients with frequent supra- or ventricular premature beats (>20% of all beats during the period) were not included in the present study. Finally, we do agree that analysis of HRV changes in the subgroup of patients with sudden onset episodes of paroxysmal atrial fibrillation would be of great interest, and this particular aspect deserves further study.

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1. Bettoni M, Zimmermann M. Autonomic tone variations before the onset of paroxysmal atrial fibrillation. *Circulation*. 2002;105:2753–2759.