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Heart Rate Variability in the Setting of a Syncopal Event

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Summary

We studied the usefulness of standard parameters of heart rate variability (HRV) as markers of subsequent arrhythmic events in 20 patients with a syncopal event, 10 with and 10 without coronary artery disease. During a 4-year follow-up four patients with a previous myocardial infarction (MI) died probably from sudden arrhyhtmic death. Heart rate variability, identified high risk patients with low left ventricular ejection fraction (LVEF). All four patients who died had depressed values of SDNN and HRV index. Parasympathetic tone was increased in patients with previous MI and diminished LVEF, probably due to amiodarone alone or amiodarone combined to betablocker treatment.

Introduction

Syncope is a common and important clinical problem and its prognostic importance depends largely on its etiology which is not always easy to determine (1). A recent large prospective trial from our Institution showed that a standardized evaluation performed in the emergency departement allowed to establish or suspect the cause of syncope in nearly 75% of cases (2). In this sense syncope of cardiovascular origin is particularly important to identify as it is associated with up to a 30% incidence of sudden cardiac death in the following year (1). Available tests to predict the risk of potentially malignant arrhythmias in patients with a history of syncope include determination of ventricular ectopy and left ventricular function, signal-averaged ECG, tilt-table and electrophysiologic testing

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(3). Heart rate variability measured from Holter recordings has emerged in recent years as a powerful predictor of all-cause and/or arrhythmic mortality particularly in patients after a myocardial infarction and in those with heart failure. However, in the setting of a syncopal event almost all studies of HRV were conducted in patients wth neurally mediated syncopes and not in syncopes expressing an arrhythmic event (4).

The aim of the present study was to determine the usefulness of traditional HRV parameters taken from 24-hour recordings as markers of subsequent arrhythmic events in patients with a syncopal event, with and without coronary artery disease.

Patients and Methods

We used data from the patient population included in the recently conducted trial at our Hospital and which prospectively measured the diagnostic yield of a standardized sequential evaluation of syncope (2). Among the 650 patients included, 69 (10.6%) had a cardiac cause of syncope and 23 (3.5%) had an underlying coronary artery disease. Of these 23 patients we could finally obtain complete data and above all good quality 24-hour Holter recordings in only 10 patients (group 1). Patients were subdivided into group 1A with normal LVEF and group 1B with LVEF <35%. We subsequently identified a control group (group 2) of 10 age-matched patients without coronary artery disease. The following data were compared between groups: 1. medical history and treatment; 2. ECG and echocardiographic analysis; 3. mean number of ventricular ectopic complexes (VPC's) per hour taken from the Holter recording; 4. HRV parameters measured from 24-hour Holter tapes.

The 24-Hour Holter recordings (Delmar Avionics, HRV Analyzer, CA) were all manually analysed with a strict selection of normal R-R intervals in the 24 hour registrations. R-R intervals before and after ectopic beats and intervals that varied by more than 20% were excluded from the analysis. The software calculated the following time domain indices: standard deviation of all normal R-R intervals (SDNN); root mean square successive difference (rMSSD) and percentage of all normal R-R intervals exceeding the adjacent R-R intervals by greater than 50 ms (pNN 50). The 24-hour R-R histogram was then derived from the computer, including the total variability (TV) and the HRV triangular index (HRVi). Power spectral analysis included the low frequency (LF) and the high frequency (HF) power and the ratio of the two components.

Statistical Analysis

Data were compared by using analysis of variance (ANOVA), as well

as unpaired t-tests, when appropriate. Differences were considered significant at a p value <0.05. Results are expressed as mean±standard error (±SE).

Results

A total of twenty patients were studied with a 4-year follow-up. Group 1A and 1B were each composed of 5 patients with 4 and 3 women, resepectively, and the control group of 10 patients with 7 women . Mean age was comparable in the 3 groups: 74±5, 76±12 and 73±13 years, respectively in groups 1A, 1B and 2 (p=NS). Three patients in group 1A and 5 in group 1B had had a previous MI. Mean LVEF was 54±17% and 25±4%, respectively in group 1A and group 1B. As seen in the table, mean heart rate (HR) and mean number of VPC's were significantly higher in patients of group 1A when compared to the control group. Total variability was lower and rMSSD and pNN50 were higher in patients of group 1B when compared to patients of group 2. During follow-up a total of 4 patients died, 2 in group 1A and 2 in group 1B, after a mean of 20±5 months (range 8-29 months) after the initial syncopal event. All 4 patients who died had had a previous MI. In all 4 death was sudden, presumably arrhythmic, however not documented. Mean HR in all 4 patients was >75/minute, almost all patients had >10 VPC's per hour on 24-hour Holter recording. SDNN was 77 in one and <50 ms in three and HRV index was <20 Units in all 4 patients.

Discussion

The data of our study showed that patients with a syncopal event and a previous MI have a bad prognosis. As seen in our study all patients who died probably suffered from sudden arrhyhtmic death. Although in previous studies (5-6) patients with advanced heart failure and diminished LVEF were considered at especially high risk regardless of the etiology of syncope, we found that patients with normal LVEF, but with previous MI, are also at high risk, as seen in the two group 1A patients who died. In these patients variables such as mean HR and mean VPC count appeared to be useful for risk stratification when comparing to the control group (Table). Patients of group 1B had significantly lower TV values than those of the control group, indicating depressed global HRV (Table). Although this was not corroborated for all patients by other parameters reflecting overall variability, such as SDNN and/or HRV index, the 4 patients who died had highly depressed values of SDNN and HRV index. Finally, the total sympathovagal balance expressed by the LF/HF ratio was comparable in the three study groups (Table). One interesting finding of our study were the sig-

Table. Mean heart rate, mean number of VPC's per hour, time domain, geometric and spectral measures in groups 1A, 1B and 2

	group 1A (normal LVEF) (n=5)	group 1B (LVEF <35%) (n=5)	Control group (group 2) (n=10)
mean HR *(beats/min)*	84±6	78±7	73±2*
VPC's *(mean number /hour)*	33.2±14.8	267.4±234.9	7.5±3.3*
SDNN *(ms)*	98±14	94±20	116±14
HRV index *(units)*	27±14	26±12	30±12
Total variability *(ms)*	487±67	429±95	603±42
rMSSD (ms)	23±3	25±5	21±2+
pNN50 (%)	4.1±4.7	6.04±2.2	3.6±1.3+
LF (ms2)	131±64	195±59	196±64
HF (ms2)	301±249	279±125	220±92
Ratio LF/HF	1.2±0.3	1.6±0.8	1.6±0.6

*p<0.05 when comparing group 2 to group 1A values; +p<0.05 when comparing group 2 to group 1B values

HR: heart rate; VPC's: ventricular premature complexes; SDNN: standard deviation of all normal R-R intervals (SDNN); TV: total variability; HRVi: HRV triangular index; rMSSD: root mean square successive difference; pNN 50: percentage of all normal R-R intervals exceeding the adjacent R-R intervals by greater than 50 msec; LF: low frequency component; HF: high frequency component

nificantly higher values for the HRV parameters reflecting mainly parasympathetic tone (rMSSD and pNN50) in patients of group 1B. This increase was probably due to their antiarrhythmic treatment consisting of amiodarone alone or of amiodarone combined to betablocker.

Heart rate variabilty identified high risk patients with low LVEF. Patients who probably died from sudden arrhythmic death had depressed SDNN and HRV index, whether their LVEF was normal or not. In our study, spectral parameters were comparable between the three study groups and thus, were not useful markers for predicting events.

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