

INFLUENCE OF SINUS NODE DYSFUNCTION, DIABETES MELLITUS AND SURGICAL HEART DENERVATION ON HEART RATE TURBULENCE

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Abstract:

Heart Rate Turbulence is a new non-invasive parameter useful in post-MI risk stratification. Nevertheless, pts with coronary disease (CAD) frequently presented concomitant disorders like diabetes mellitus (DM) or sinus node dysfunction (SND), influencing the reflex mechanism underlying the HRT.

Aim of study: evaluation of clinical factors influencing HRT in relation to its prognostic value in CAD-patients.

Study population: All 143 pts included pts were divided into 4 groups: group I - pts with CAD related SND, group II - 31 pt. with 1st type of DM, Group III - 10 pts after orthotopic heart transplantation (HTx) and group IV - 32 healthy persons.

Methods: All pts underwent 24-hour ECG Holter monitoring. These of pts who revealed at least 5 VPB in 24-hours ECG were referred to HRT analysis (45 pts from gr I, 22 pts from gr II, 8 pts from gr. III and 23 pts from group IV). The following parameters of HRT were evaluated: turbulence onset (TO) and turbulence slope (TS). Evaluated HRT parameters were compared between groups I, II, III and IV.

SND leads to significant reduction of TO, DM related neuropathy significantly diminish TS, whereas surgical denervation after HTX attenuates both HRT parameters.

Conclusions:

1. Different clinical circumstances may affect the value of HRT parameters.
2. Influence of sinus node dysfunction or diabetic neuropathy should be considered during HRT analysis as a prognostic factor in post-MI patients.

INTRODUCTION

Sudden cardiac death (SCD) is the leading cause of cardiovascular mortality in developed countries [1]. There are a number of diagnostic parameters such as low left ventricular ejection fraction (LVEF), low heart rate variability, abnormal signal-averaged electrocardiograms and T wave alternans, which, if present, indicate an increased risk for SCD [1,2]. Heart Rhythm Turbulence (HRT) is a new, non-invasive marker of increased risk of sudden cardiac death in post-MI patients [3,4]. Patients with coronary artery disease (CAD) frequently suffered from concomitant disorders like diabetes mellitus (DM) or sinus node dysfunction (SND), influencing the reflex mechanism underlying the HRT. The question is, how far concomitant disorders may false the results of HRT analysis.

The aim of our study is an evaluation of influence of disorders, potentially disturbing the mechanism underlying HRT such as: sinus node dysfunction (SND), diabetes mellitus type 1 (DM) and surgical heart denervation, on the parameters of Heart Rhythm Turbulence in relation to their prognostic properties.

STUDY POPULATION.

We included 143 patients (98 male, 45 female) aged 19-77 years (mean age 51 yrs). All pts presented sinus rhythm in standard ECG. There were no symptoms of heart failure. Pts were divided into four groups.

Group I included 70 pts with sinus node dysfunction with ischemic etiology (52 male and 18 female), aged 30-77 yrs, (mean age 51,49 yrs). Clinical characteristics of the study group are presented in Table 1.

Table 1. Clinical characteristics of the group I

Clinical characteristics	%
Syncope	41,43
Presyncope	32,86
Vertigo	12,86
Sinus bradycardia	78,57
Sinus arrest	8,57
Bradycardia – tachycardia syndrome	21,43
Paroxysmal atrial fibrillation	5,71
Extrinsic SNRT [ms]	1688,80
Intrinsic SNRT [ms]	1731,30
Extrinsic CNRT [ms]	722,10
Intrinsic CNRT [ms]	876,80

Group II included 31 pts (14 male and 17 female), aged 19 -33 yrs (mean age: 26,7) with history of 10 to 22 yrs (mean 14,3 yrs) of diabetes mellitus type I treated with intensive insulinotherapy, without clinical symptoms of diabetic neuropathy. Clinical characteristics of the group II are presented in Table 2.

Table 2. Clinical characteristics of the group II.

Hypertonia arterialis	56,3 %
History of MI	4,7 %
Retinopatya	56,3 %
Nephropaty	43,8 %
HbA C1 concentration	5,3-9,3 (7,3)
LVEF [%]	50-70 (61)
BMI	16,9-32 (24,0)

Group III included 10 pts. (1 female and 9 male), aged 29-54 (mean 41), who were 8-12 months after HTx. The pts were on standard triple-drug model of immunosuppression (Cyclosporine A, Azathioprine, Prednisone). All pts were on sinus rhythm, without atrio-ventricular conduction disturbances, frequent supraventricular premature beats (less than 1% of all QRS complexes) and complex ventricular arrhythmias. Routine surveillance endomyocardial biopsy (EMB) were performed in all pts. Acute rejection was excluded in EMB specimens which were examined histopathologically and

graded according to the ISHLT classification (< A3 grade).

Group IV included 32 sex and age matched healthy volunteers, 23 men and 9 women, aged 20- 70 yrs (mean age 52,3 yrs).

METHODS

All pts underwent 24-hour ECG Holter monitoring using 3-channel ECG recorder (Oxford MR3 4500) with use of following leads -CS2, CM5 i IS. ECG analysis was performed with computerized system Oxford Medilog Excel 2. All drugs potentially influenced the heart rhythm and autonomic reflexes were discontinued for five or more half-lives periods before the ECG registration. Patients with at least 5 ventricular premature contractions registered during 24-hours ECG Holter monitoring was referred to further HRT analysis. There were 45 pts from group I, 22 pts from group II, 8 pts from group III and 23 pts from group IV. Analysis of HRT was performed with commonly accepted methods [4]. HRT View Version 0.60-01 software was used for HRT analysis.

The following HRT parameters were analyzed: Turbulence Onset (TO) - initial phase of sinus rhythm response to premature ventricular contraction.

Turbulence Slope (TS) describing the slowing of sinus rate following its initial rise after premature ventricular beats (terminal phase). Evaluated HRT parameters were compared among groups I, II, III and IV.

RESULTS

SND leads to significant reduction of TO (0,2541 vs 2,499 %), DM related neuropathy significantly diminish TS (7,6238 vs 16,4297 ms/rr), whereas surgical denervation after HTx attenuates both HRT parameters (TO: 0,565 vs 2,499 %; TS: 1,23675 vs 16,4297 ms/rr). Results are presents in Table 3.

Table 3. Results of TO and TS in each groups.

	SND	DM	HTx	Control
TO [%]	0,25	3,14	0,57	2,50
<i>p</i>	0,05	NS	0,04	
TS [ms/rr]	12,36	7,62	1,24	16,43
<i>p</i>	NS	0,005	0,0001	

DISCUSSION

Our study showed an important influence of concomitant disorders disturbing the mechanism underlying Heart Rate Turbulence, with a tendency to decrease HRT parameters. Heart Rate Turbulence was used as a predictor of cardiac death in evaluation of retrospective 24 hours ECG Holter monitoring in MPIP, EMIAT and ATRAMI trials, in a large populations of patients after myocardial infarction [5,6]. In all these trials, which included more than 3000 patients, HRT parameters seemed to be the strongest predictors of sudden cardiac death [4-6]. An increased risk of SCD in patients after myocardial infarction was concerned with decreased value of HRT parameters: TO and TS [3]. As it was proved above these concomitant disorders can cause, by themselves, decrease of these parameters, leading to false increased risk of sudden cardiac death in patients after myocardial infarction in whom HRT was used for risk stratification. It was noticed, that different disorders acted in different sites of mechanism of reflex, influencing in different way on HRT. In available literature it was no reports about this problem.

It is interesting, that surgical heart denervation in patients with orthotropic heart transplantation did not completely attenuate of HRT. In these patients the reaction on ventricular premature contraction seems to be a result of intracardiac reflexes, leading to heart rhythm turbulence accordingly to a degree of stretching of right atrium by venous return. Taking into consideration an influence of some disorders on HRT, in assessment of risk stratification in patients after myocardial infarction concomitant diseases should be always analysed to avoid false positive results.

CONCLUSIONS.

1. Different clinical circumstances may affect the value of HRT parameters.
2. Influence of sinus node dysfunction or diabetic neuropathy should be considered during HRT analysis as a prognostic factor in post-MI patients.

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