

Heart rate turbulence in patients with nonishhemic heart failure

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Heart rate turbulence (HRT) is new method for the evaluation of the risk sudden death in patients with heart diseases (Shmidt et al, 1999). Earlier it was described that HRT the most powerful risk stratifier in patients with ischemic heart disease, diabetes mellitus, congestive heart failure, idiopathic dilated cardiomyopathy, Chagas disease and in healthy adults, but this kind of studies has never been conducted with children. The aim of this study: to investigate significance of HRT in children with ventricular premature beats (VPB).

PATIENTS AND METHODS. 64 children, 1-17 years (mean age $7 \pm 8,2$ years), 30 boys 34 – girls. All pts had VPB: 5 – dilated cardiomyopathy (DCMP) with ejection fraction less 40%, (43 without evidence heart diseases), 3 with Long QT syndrome, 9 - of catecholaminergic ventricular tachycardia (CVT); 43 children without evidence heart disease (healthy); 9 – right ventricular dysplasia (ARVD); 1 - Brugada syndromes (SB); 1 – short QT syndrome (SQTS); 1- idiopathic ventricular fibrillation (VF). Holter Monitoring (HM) Oxford Medilog, UK; Reynolds, UK were performed in all pts. 20 children had syncope:2 healthy children;all children with LQTS;all children with DCM;all children with CVT;the child with ARVD;the child with SQTS;the child with VF. During the follow-up period of 6 ± 4.9 years 8 (12.3%) children had sudden cardiac death (1 children with DCM suddenly died during HM); 26 (40.0%) patients had adverse passing disease: syncope, heart failure, and tolerance towards antiarrhythmic treatment.

HRT ANALYSIS

Turbulence onset (TO) is the percentage difference between the heart rate immediately following PVB and the heart rate immediately preceding PVB.

$$\text{TO} = \frac{(\text{C}+\text{D})-(\text{A}+\text{B})}{\text{A}+\text{B}} * 100$$

with A and B being the first two normal intervals preceding the VPB; C and D the first two normal intervals following the VPB. Turbulence slope (TS) is defined as the maximum positive slope of a regression line assessed over any sequence of five subsequent sinus-rhythm RR intervals within the first 20 sinus rhythm intervals after a VPB.

Inclusion criteria for HRT analysis (G.Shmidt et al, 1999): a coupling interval of less than 80% of the average of the preceding five sinus intervals; a compensatory pause exceeding 120% of the preceding sinus intervals; if they were embedded into two preceding and 15 succeeding N-N intervals; cycle length of more than 300 ms but less than 2000 ms; difference to the reference interval of less than 20%. 1687 VPBs have been analyzed in 64 children (from 15% till 100% of all arrhythmias):Turbulence onset (TO) in all children (100%); Turbulence slope (TS) in 21 children (31,3%)

RESULTS of HRT analysis

(Normal: TO <0%, TS > 2,5 ms per RR interval)

GROUP	N *	Turbulence onset (TO), %	Turbulence slope (TS), ms/RR
LQTS	3	- 4.3 ± 9.9	40.8 ± 0.8
CVT	9	4.1±11.7	43.9 ± 18.3
ARVD	1	- 5.8 ± 4.02	20.06 ± 11.8
SB	1	-8.98 ± 49.7	wasn't analyzed
SQTS	1	-6.26 ±5.9	68.8±1.13
DCM	5	0.50 ± 1.02	4.15 ± 1.33
VF	1	6.57±19.2	46.13±38.12
Healthy	4 3	- 4.08 ±4.60	41.27 ± 19.4

15 children with abnormal value of TO Clinical character of 15 patients with abnormal value of TO: 14 children were having syncope and/or tolerance towards antiarrhythmic treatment; 1 child – healthy (without evidence heart disease). The sensitivity (Se) and specificity (Sp) for prediction of syncope and/or tolerance towards antiarrhythmic treatment were 54% and 97%. Relationship between TO and TS ($r = -0,057$). Measures TS in groups were normal. Abnormal TS has defined only in the patient with DCM, who died during HM. Measures TS before 6 months was normal ($TS=4.4\pm2.6$), but TO was blunted ($TO=0,06\pm 1.15$). Ventricular fibrillation and cardiac arrest in child with DCM, who suddenly died during HM ($TO=1,86\%$, $TS=2,2ms/RR$) (Fig.)

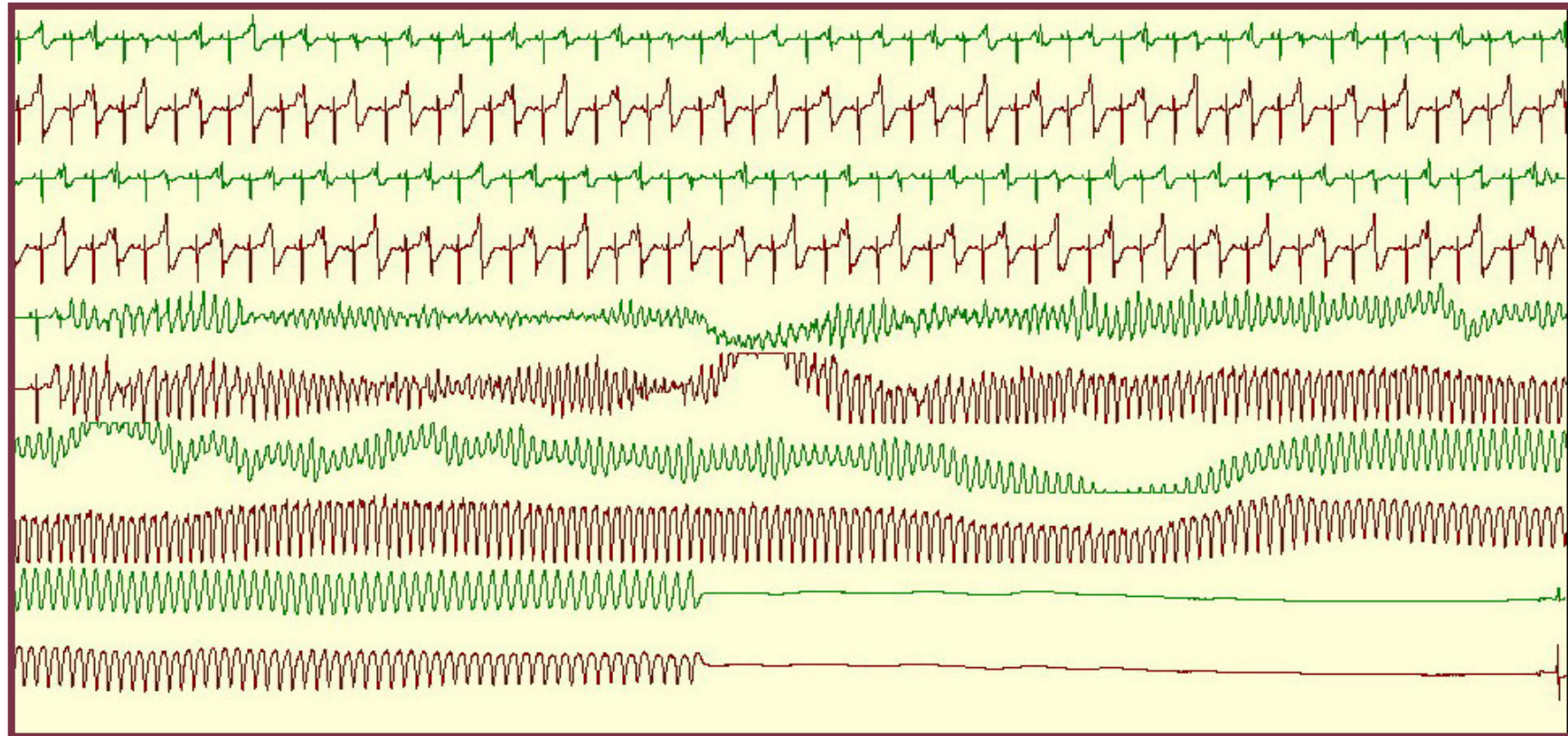


Fig. Girl. 14 years old. Ventricular fibrillation and cardiac arrest in child with DCM

CONCLUSION. Abnormal value of TO is high-specific criteria of the prediction for adverse passing disease in patients with heart diseases. $TS < 2,5$ ms per RR interval may be used as a relatively specific tool for risk stratification of sudden death in patients with heart disease.