

DYNAMICS OF HEART RATE TURBULENCE CHANGES AND HEART RATE VARIABILITY FOLLOWING MYOCARDIAL INFARCTION TREATED WITH PRIMARY PTCA

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Abstract: The correlation between heart rate turbulence (HRT) and heart rate variability (HRV) was described in numerous studies. The aim of this study was to evaluate the relationship between HRV assessed soon after myocardial infarction (MI) and the dynamics of HRT detected during long-term observation in post- MI pts. The study population consisted of 85 pts with acute MI successfully treated with primary PTCA. On the third day after the procedure 24-hour Holter monitoring (HM) with HRV analysis was performed (the first HM). Frequency domain HRV analysis was performed separately for the day and night periods. LF/HF ratios were obtained for the daytime (LFd/HFd) and for the nighttime (LFn/HFn). $\Delta\text{LF}/\text{HF}$ was calculated according to the formula: $\Delta\text{LF}/\text{HF} = \text{LFd}/\text{HFd} - \text{LFn}/\text{HFn}$. In case of $\Delta\text{LF}/\text{HF} < 1$ the impaired circadian pattern of autonomic activity was diagnosed. One year after MI Holter monitoring was repeated (the second HM). The HRT parameters (TO and TS) calculated from both Holter recordings were compared for each patient. After 12 months in 51 pts (Group 1) the significant improvement of HRT was observed. Remaining 34 pts (Group 2) presented with the worsening of both HRT parameters. In early postinfarction HM patients from Group 2 presented with significantly lower time domain parameters of HRV than patients from Group 1. Additionally in Group 2 the impaired circadian rhythm of the autonomic activity measured with the frequency- domain HRV analysis was observed. In conclusion, HRV analysis performed early after the primary PTCA could help to separate patients in whom the tendency for changing HRT towards prognostically unfavourable values is observed following one year after myocardial infarction.

INTRODUCTION

In 1999 Schmidt et al. introduced a new electrocardiographic method – HRT. It describes fluctuations of sinus rhythm cycle length following premature ventricular beats. HRT is characterized by two parameters: Turbulence Onset (TO) and Turbulence Slope (TS). Based on a retrospective analysis of 100 postinfarct patients they found that $\text{TO} > 0\%$ and $\text{TS} \leq 2,5 \text{ ms/RR}$ are abnormal values. HRT has been found to be a quite potent risk stratifier after myocardial infarction (MI). [1-3] However most studied patients were conservatively treated during acute phase of infarction and only 50% of them received thrombolytic medications. At present, the primary coronary angioplasty (PTCA) is a recommended method in acute myocardial infarction. Patients treated with successful primary PTCA are the low-risk population. However even in such patients the progression of atherosclerosis is present following MI. It is interesting whether HRT also changes in long-term observation after MI. Primary coronary angioplasty not only improved the prognosis after MI but also shortened the duration of in-hospital treatment. Contrary to exercise test Holter monitoring could be safely performed before discharge even on the 3rd day after primary PTCA. It was reported that analysis of HRV is of important prognostic significance after MI. The aim of this study was to evaluate the relationship between HRV assessed soon after myocardial infarction (MI) and the dynamics of HRT detected during long-term observation in post- MI pts.

METHOD

The study population consisted of 85 pts with acute MI successfully treated with primary PTCA (TIMI 3 in infarct-related coronary artery). On the third day after the procedure 24-hour Holter monitoring (HM) with HRV analysis was performed (the first HM). Time domain HRV analysis was done from the entire 24 hours. Frequency domain HRV analysis was performed separately for the day and night periods. LF/HF ratios were obtained for the daytime (LFd/HFd) and for the nighttime (LFn/HFn).

$\Delta LF/HF$ was calculated according to the formula: $\Delta LF/HF = LFd/HFd - LFn/HFn$. In case of $\Delta LF/HF < 1$ the impaired circadian pattern of autonomic activity was diagnosed. One year after MI Holter monitoring was repeated (the second HM). The HRT parameters (TO and TS) calculated from both Holter recordings were compared for each patient.

RESULTS

During one-year follow up there were no new coronary events and all pts were asymptomatic. After 12 months in 51 pts (Group 1) the significant increase of TS (from $8,51 \pm 5,93$ to $10,87 \pm 6,76$, $p < 0,01$) and the decrease of TO (from $-1,96 \pm 1,84$ to $-4,21 \pm 2,98$, $p < 0,01$) was observed. Remaining 34 pts (Group 2) presented with the decrease of TS (from $7,41 \pm 4,23$ to $3,22 \pm 2,21$) and increase of TO (from $-1,47 \pm 1,84$ to $-0,24 \pm 1,22$). Groups were comparable in regard to demographic characteristics, localization of MI, results of coronary angiography, and the treatment. The comparison of the HRV parameters between both groups is shown in the Table.

Parameter	Group 1	Group 2	P
SDNN	86 ± 29	64 ± 26	$< 0,005$
Triangle Index	23 ± 9	17 ± 7	$< 0,005$
RMSSD	34 ± 31	21 ± 10	$< 0,05$
LF	1259 ± 166	1386 ± 322	Ns
HF	253 ± 134	214 ± 98	Ns
$\Delta LF/HF$	$1,64 \pm 1,2$	$-0,52 \pm 0,53$	$< 0,001$

Only the last parameter was found in multivariate analysis as significantly connected with HRT worsening following one year after MI (OR-0,238, $p < 0,001$). The relationship was inversely proportional (lower $\Delta LF/HF$ higher risk of the worsening of HRT)

DISCUSSION

HRV parameters obtained during Holter monitoring reflect the sympatho-vagal autonomic balance. In this study all time domain HRV parameters shown the significant influence on the risk of HRT worsening during long term observation after MI. However, the abnormal circadian pattern of autonomic activity expressed by the lowering of $\Delta LF/HF$ was the only parameter which in multivariate analysis significantly influenced the risk of HRT worsening after MI. The impairment of the circadian rhythm of autonomic activity may be the result of parasympathetic as well as sympathetic dysfunction [4,5]. The connection of this pathology with the worsening of HRT which is predominantly under vagal control suggests the important role of parasympathetic dysfunction in individuals with abnormal circadian pattern of autonomic activity.

CONCLUSION

HRV analysis performed early after the primary PTCA could help to separate patients in whom the tendency for changing HRT towards prognostically unfavourable values is observed following one year after myocardial infarction

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