

## **DYNAMICS OF HEART RATE TURBULENCE CHANGES AND RISK FACTORS FOLLOWING MYOCARDIAL INFARCTION WITH PRIMARY PTCA**

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**Abstract:** The significance of heart rate turbulence (HRT) as a prognostic determinant after myocardial infarction (MI) is well known. The impact of the changes of HRT parameters following MI is not clear. The aim of this study was to assess the connection between the established coronary artery disease (CAD) risk factors and the dynamics of HRT changes after MI. The study population consisted of 85 pts with acute MI treated with successful primary PTCA in whom the prevalence of risk factors of CAD was recorded. On the third day after primary PTCA and following 12 months 24-hour Holter monitoring was performed in all pts. The HRT parameters calculated from both Holter recordings were compared for each patient. After 12 months in 51 pts (Group 1) the significant improvement of HRT was recorded. Remaining 34 pts (Group 2) presented with the worsening of both HRT parameters. Groups were comparable in regard to demographic characteristics, localization of MI, results of coronary angiography, and the treatment. Among low-risk, asymptomatic patients treated with primary PTCA those in whom the HRT changed for worse during one year postinfarction period more often had the risk factors connected with autonomic and/or endothelial dysfunction. In conclusion, in postinfarction pts with multiple risk factors HRT parameters should be monitored because of the tendency for changing towards prognostically unfavourable values.

### **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  $TO > 0\%$  and  $TS \leq 2,5 \text{ ms/RR}$  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. The assessment of the connection between the presence in acute phase of MI the known risk factors and the dynamics of HRT changes following MI could help to separate those patients in whom HRT analysis should be repeated after effective primary PTCA. The aim of this study was to analyse the dynamics of HRT changes following 12 months after primary PTCA. The second purpose was to assess the usefulness of the knowledge about risk factors found at the moment of infarction in the prediction of the type of HRT changes dynamics.

### **METHOD**

The study population consisted of 85 patients aged  $55 \pm 10$  years with acute MI treated with successful primary PTCA (TIMI 3) in whom the prevalence of risk factors of CAD was recorded. The PTCA procedure was performed within first 6 hours after the onset of chest pain in all patients. The most important inclusion criterium was the presence of premature ventricular beats in Holter recording. On the third day after primary PTCA and following 12 months 24-hour Holter monitoring was performed. 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 recorded. 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 between both groups in regard to the presence of risk factors is shown in the Table:

Risk factor	% of patients		P
	Group 1	Group 2	
Smoking	39,2	90,3	<0,001
Hyperlipidemia	70,6	87,1	<0,05
Diabetes mellitus	3,9	48,4	<0,001
Arterial hypertension	39,2	51,6	<0,01
CRP > 6mg/dl	25,5	87,1	<0,001
Family history of CAD	35,5	28,9	0,234
Obesity	26,9	32,8	0,061

Using multivariable model of the logistic regression it was shown that diabetes (OR=6,876), smoking (OR=1,924) and high CRP (OR=1,248) which were present during hospitalization significantly increased the risk of worsening HRT following 12 months after myocardial infarction.

## DISCUSSION

According to our knowledge this is the first study which describes the changes of HRT in long-term observation after MI. Obtained results allowed us to separate two types of the dynamics of HRT changes in asymptomatic postinfarction patients. The most alarming type seems to be the worsening of both HRT parameters which was observed mainly in patients with numerous risk factors connected with unfavourable prognosis. The most important risk factor which increased the risk of HRT worsening was diabetes mellitus. Autonomic neuropathy which was described in diabetic patients is first of all caused by the injury of parasympathetic nerves [4,5]. Therefore, the parasympathetic dysfunction seems to play the important role in the worsening of HRT parameters following MI.

## CONCLUSIONS

1. Following 12 months after successful primary PTCA the significant changes of HRT parameters are present.
2. One year after MI the increase of TS and decrease of TO was observed mainly in pts with unfavourable risk factors profile.
3. In postinfarction pts with multiple risk factors HRT parameters should be monitored because of the tendency for changing towards prognostically unfavourable values.

## References:

1. Schmidt G, Malik M, Barthel P, et al. Heart rate turbulence after ventricular premature beats as a predictor of mortality after acute myocardial infarction. *Lancet* 1999; 353: 1390-1396.
2. Schmidt G, Morfill GE, Barthel P, et al. Variability of ventricular premature complexes and mortality risk. *PACE* 1996; 19: 976-980.
3. Ghuran A, Reid F, La Rovere MT, et al. Heart rate turbulence –based predictors of fatal and non-fatal cardiac arrest (The autonomic tone and reflexes after myocardial infarction substudy). *Am J Cardiol* 2002; 89: 184-190.
4. Van de Borne P, Hausberg M, Hoffman RP, et al. Hyperinsulinemia produces cardiac vagal withdrawal and nonuniform sympathetic activation in normal subjects. *Am J Physiol* 1999; 276: R178-R183.
5. Vanninen E, Uusitupa M, Lansimies E, et al. Effect of metabolic control on autonomic function in obese patients with newly diagnosed type 2 diabetes. *Diabetes Med* 1993; 10: 66-73.