

Metabolic processes evaluation in cardiac muscles on the basis of cardiometry

Vladimir A. Zernov¹, Konstantin K. Mamberger¹,
Dmitry F. Makedonsky¹, Sergey M. Rudenko^{1*}

¹ Russian New University
Russia, 105005, Moscow, Radio str., 22

* Corresponding author:
phone: +7 (908) 194-29-99,
e-mail: rudenko@cardiometry.net

Abstract

The article briefly discusses the cardiometric approach to the evaluation of metabolic processes in cardiac muscle. Reactions occurring during the various phases of the cardiac cycle, primarily in the QRS complex, are shown. The dynamics of energy processes occurring before and after physical load, as well as the reactions occurring during it, are presented. The ECG derivative is used.

Keywords

Metabolic process, ECG, Cardiac cycle phase, Cardiac muscle, Derivative, Physical load

Imprint

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Introduction

The processes of the dynamic contraction and static muscle tension are provided by the biochemical reactions. Thus, the main QRS complex, in which the transition from the muscles relaxation to the static tension occurs, is provided with oxygen stocked during the diastole. At the same time, the initial process of muscle contraction is carried out with the maximum initial stock of ATP in the mitochondria. The low oxygen content is reflected in the rate of heart muscles contraction [1-9]. What can be controlled by the first derivative of ECG? The amplitude of the first

derivative will indicate the power of contraction. The smaller is the amplitude, the less is the power.

Materials and methods

Considering the heart anatomy and the fact that the QRS complex is formed by the interventricular septum and myocardium contraction amplitudes, first the interventricular septum contracts, as it is exposed to a lesser resistance since the myocardium muscles are not pre-loaded yet. When the myocardium muscles are contracted, they are exposed to a greater load than the interventricular septum, as the interventricular septum remains static. It allows evaluating the difference in energy consumption for each group of muscles. It is enough to compare the amplitude of the first derivative, characterizing the muscle contraction rate during the Q – R and R - S periods. The general formula will be of a simple form as follows:

$W = R' / S'$ (relative units) where:

W – conventional energy of the process;

R' – the amplitude of the ECG first derivative characterizing the interventricular septum contraction rate; S' -the amplitude of the ECG first derivative characterizing the myocardium contraction rate.

Results

The practice shows that the method has a high sensitivity. The data before and after training are very informative and indicate trends of heart energy resource dynamics. Considering that the QRS complex is a basic part of the cardiac cycle and the muscles are evaluated from the time of complete relaxation to the time of creation of the initial conditions for other energy processes, the studies have shown that the W rate evaluates the energy level corresponding to the aerobic processes in the body. Therefore, can be used for the aerobic processes evaluation. After an intensive load, the W rate for aerobic processes will decrease. The studies have shown that the W rate is linked to acid –alkaline balance. However, if W is greater than 1, it is close to the lower limit of blood glucose level. The processes in the S - L phase occur in the same way as it is the case with the QRS complex. The essential difference is that they occur against the background of the interventricular septum and myocardium muscles tension. A combination of dynamic and static muscle performance is observed herein. This phase is very

important in hemodynamics of circulation. Its performance forms the blood flow structure that allows providing blood flow with minimal friction.

Then the L - j rapid ejection phase begins. At the beginning of this phase the aortic valve opens, and blood starts flowing into the aorta. The studies have shown that this phase can be manifested on ECG several times only in case of great physical load. The multiple phase manifestation occurs only in case of necessity to intensify the phosphocreatine reactions due to high physical loads [10,11]

It should be noted that all above reactions are closely interconnected. Their common basis is the balance of oxygen and carbon dioxide in the body. Their transport systems: L - carnitine, serotonin and tryptophan are also important.

Discussion and conclusions

The method allows efficiently and easily monitoring the metabolic processes in the heart muscle. Further research is aimed at building a scale of correlation between the relative units used in the method and the conventional generally accepted units mmol/liter.

Statement on ethical issues

Research involving people and/or animals is in full compliance with current national and international ethical standards.

Conflict of interest

None declared.

Author contributions

All the authors read the ICMJE criteria for authorship and approved the final manuscript.

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