VISUAL ASSESSMENT OF CARDIOVASCULAR SYSTEM RESPONSE TO EXERCISE BY MEANS OF COGNITIVE COMPUTER GRAPHIC IMAGE

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Background. The development of simple and reliable tools for assessing the cardiovascular system response to exercise (CVSRE) is of great scientific and practical significance in the field of physiology, cardiology, sports medicine etc. Importantly, this issue could be partially solved by an adequate visibility of analyzed data, giving the clinician a possibility to interpret them appropriately.

Purpose: to study the patterns of CVRSE in athletes and healthy volunteers (HV) by means of visual interpreting the cognitive computer graphic image (CGI).

Methods. We enrolled 28 athletes (box, wrestling, triathlon; age range: 18-24 ys; group 1) and 112 HV (age range: 19-24 ys; group 2). Both groups were comparable by age and sex. We performed the Ruffier functional test (20 squats in 30 seconds). Single channel electrocardiogram was performed at baseline (B), on the top of exercise (TE) and at 3 minutes of restitution (R3). The original software analyzed 100 cardiac complexes and assessed 5 parameters of CVRSE: heart rate (HR, bpm), βT (units), ST segment deviation (ΔST, mV), T-wave duration (DurT, s) and amplitude (AT, mV). The βT is attributable to the symmetry of T-wave, and assessed by the construction of ECG phase «portrait» on the phase plane in coordinates $z(t),\dot{z}(t)$, where $\dot{z}(t)$ is a velocity of change of the heart electrical activity signal. All these parameters are analyzed at each step of the test, begetting the 5 patterns of CVRSE: 1) «maximum» (P1); 2) «minimum» (P2); 3) «increase» (P3); 4) «decrease» (P4); and 5) «stable» (P5). The integral assessment of the patterns of all 5 CVRSE parameters provides the compatibility of patterns shape and creation of CGI, generated by the original software.

Results. The group 1 was characterized by such dominating patterns, as: 1) P1 for HR (60,7% of participants); 2) P1 for βT (67,9%); 3) P2 for ΔST (46,4%); 4) P2 for DurT (60,7%); and 5) P2 for AT (53,6%). Contrary, the group 2 was significantly associated with the higher frequency of 4 dominating patterns, comparing with group 1: 1) P1 for HR (92,9%; p<0,001 vs. group 1); 2) P1 for βT (91,9%; p<0,001); 3) P2 for ΔST (78,6%; p=0,002); and 4) P2 for AT (82,1%; p=0,003). The frequency of P2 for DurT in group 2 did not differ significantly from those in group 1 (71,4%; p=0,385 vs. group 1).

Conclusion. The four studied CVRSE patterns (except those related to DurT) were more prevalent in HV group comparing with athletes. The differences, revealed in present study, indicate the higher and lower clinical heterogeneity of CVRSE patterns in athletes and HV, respectively, which could be partially related to the differences in coronary flow reserve. Further studies of CVRSE in HV and patients with coronary artery disease with the use of CGI are warranted.