Echocardiographic and ergospirometric assessment of cardiac function in elite male basketball players of national level

School of Medicine University of Belgrade, Dept. of Physiology, Belgrade, SCG

Introduction
The response of the body to vigorous physical activity is a multiorgan system phenomenon. The integrated functioning of each of these organ systems is very important, but the cardiovascular system plays a critical role in mediating that activity. As a result, the heart undergoes profound morphologic, functional and electrophysiological alterations, which have been identified as the “athletes heart syndrome”. But as there are different kinds of physical activities, also the degree of those morphological changes is highly variable. It is needless to say how important it is to know where is the border of normal changes of the heart due to physical activity, and when those changes become unhealthy. Also it is very important to distinguish physiological changes of the heart due to physical activity and pathological changes due to some cardiac diseases. The clear border has to be established for every kind of physical training, every sports discipline and level.

Methods
In this study, we investigated cardiac parameters in 9 elite male basketball players of the national level by using matched-pair procedures. The control group was healthy sedentary subjects matched for age, sex and body surface area. Mono- and bidimensional echocardiography and Doppler method was used to assess resting cardiac parameters. VO2max and heart rate at rest, during maximal workload and at the time of limiting anaerobic threshold, were obtained using ergospirometry, by continuous incremental maximal exercise test.

Results
We obtained following parameters: left atria dimension (LA, 3.37 ± 0.18 cm in athletes vs. 3.53 ± 0.25 cm at sedentary controls, not significantly higher in athletes, p > 0.05), aorta diameter (AoD, 3.37 ± 0.09 cm in athletes vs. 3.03 ± 0.18 cm in sedentary, highly significantly higher in athletes than in sedentary subjects, p < 0.01), LA/Ao index (1.04 ± 0.25 vs. 1.17 ± 0.06, not significantly different in these two groups, p > 0.05), interventricular septum diastolic wall thickness (IVSd, 1.06 ± 0.05 cm in athletes vs 0.94 ± 0.06 cm in sedentary, p < 0.01), left ventricular end-diastolic diameter (LVd, 5.60 ± 0.12 cm vs 5.28 ± 0.12 cm, p < 0.01), left ventricular end-systolic diameter (LVs, 3.20 ± 0.30 cm vs. 3.30 ± 0.12 cm, not significantly different, p > 0.05), posterior wall thickness (PWT = 1.14 ± 0.05 cm vs 0.92 ± 0.03 cm, p < 0.01), fractional shortening (FS in athletes 40.50 ± 0.30 % vs 41.30 ± 0.28 % at sedentary controls, p < 0.01), ejection fraction (EF in athletes 70.38 ± 2.38 % vs 70.75 ± 0.60 % at sedentary, p > 0.05), transaortic flow velocity (TAFV, 1.26 ± 0.13 m/s, vs 1.06 ± 0.07 m/s, p < 0.01), tricuspid flow velocity (TPFV, 1.03 ± 0.14 m/s vs 0.81 ± 0.06 m/s, p < 0.01), tricuspidal flow velocity (ET = 0.94 ± 0.06 m/s vs 0.55 ± 0.04 m/s, p < 0.01), early (E = 0.77 ± 0.14 m/s vs 0.60 ± 0.11 m/s, p < 0.01) and late (A = 0.54 ± 0.23 m/s vs 0.52 ± 0.15 m/s, p > 0.05) diastolic filling velocity of the left ventricle, and E/A index = 1.48 ± 0.10 vs 1.15 ± 0.12, p < 0.01. VO2max in athletes was 53.84 ± 2.38 ml/kg TT vs 43.50 ± 4.44 ml/kg TT in sedentary controls, p < 0.01. Heart rate at rest was 73.25 ± 2.25 bpm in athletes vs 79.33 ± 2.50 bpm in sedentary, p < 0.05; at maximal workload 184.14 ± 5.31 bpm vs 185.11 ± 4.67 bpm, p > 0.05 and at the time of limiting anaerobic threshold 171.00 ± 4.00 bpm vs 182.00 ± 5.12, p < 0.01.

Conclusion
Analysing these parameters we concluded that there are significant morphological and hemodynamic changes of the heart responsible for better work efficiency in basketball players comparing with non athletes, and those are: dilatation of the heart, left ventricular hypertrophy, lower heart rate at rest and lower heart rate needed for limiting anaerobic threshold during the test. Diastolic function of the heart, changed by increased E, E/A index and Et, and systolic function changed by decreased FS, while EF remains unchanged, demonstrates the dynamic of blood movements in the heart that kind of athlete. According to relation IVSd/PWT that is less than 1.3 and increased E/A index we can conclude that there is no criteria for hypertrophic cardiomyopathy. The changes of cardiac parameters in elite basketball players are an adaptive response to vigorous physical activity, and not a consequence of some pathological conditions.