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**ATHLETE'S HEART - DIFFERENCE BETWEEN NORMAL AND PATHOLOGICAL MEDICAL FINDINGS****SUMMARY**

*Athlete's heart is a significant enlargement of the size and functional ability of a heart as a result of adaptable answer to intensive-long lasting training of mostly aerobic capacity. Changes in organism caused by an intensive training are huge: functional and anatomic, short-term (during the training) and long term (after many years of training). Most of these changes lead to increased work activity thus they are useful for the health but some unfortunately are not, and the sport may stimulate certain pathological processes.*

**1. INTRODUCTION**

Difference between physiological and pathological changes in athletes, whether they happen as a response to the training or they were some undiscovered previous diseases, it is very important to make this difference in order to prevent disease and sudden deaths of athletes. In this respect, the most important thing is to make the difference between "athlete's heart" syndrome and hypertrophic cardiomyopathy, dilated cardiomyopathy, arrhythmogenic right ventricular dysplasia and myocarditis as the most common causes of sudden deaths in sport. Doing regular checkups of athletes before they start to do sport, as well as during the training and competitions, are the only way to bring the number of sudden deaths in sport to a minimum.

**2. OBJECTIVE OF PAPER**

The aim of this paper is to show how to distinguish physiological changes from pathological changes and the importance of conducting the cardiovascular screening in order to prevent pathological changes in the heart.

**3. TOPIC ANALYSIS**

Physiological adaptation of athletes to an intensive physical effort covers the structures and functional changes of cardiovascular system which sometimes can be incorrectly interpreted as pathological. Dynamic sports, e.g. rowing and swimming, cause enlargement of heart cavities and increase in left ventricular myocardial mass. Static sports such as weight lifting, cause increase in left ventricle wall thickness and left ventricular mass, but with no enlargement of heart cavities. Aforementioned changes in size and thickness of walls may change ECG which then may be incorrectly interpreted as pathological left ventricular pressure, ischemia or myocardial inflammation. Dynamic sports also cause heart rate acceleration when body is still, and increase in vagal tone thus generating first-degree atrioventricular block and atrial flutter. Bradycardia may generate increased number of ventricular extrasystoles and short ventricular tachycardia. All these heart rhythm disorders

normally disappear during physical pressure of athletes (during trainings and tests with physical pressure). Sometimes it is hard to differ myocarditis from athlete's heart. Sometimes it can originate from infection or be a consequence of use (misuse) of certain medicaments and doping. Complex arrhythmia is possible to appear in an active phase and after that as well, due to unstable electric activity of the heart. They very often cause sudden deaths in active athletes. Degree of increase in dimensions and left ventricular hypertrophy **kolerise** well with a degree of aerobic training, which results in maximal oxygen consumption (MVO<sub>2</sub>) during **the strongest** pressure. Thus, athletes with the highest MVO<sub>2</sub> (e.g. bicyclists and marathon runners) have highly enlarged heart. Weight lifters (static sport) have very thick left ventricular walls, up to 16 mm. Athletes with enlarged heart ventricles may have changed physical medical findings, systolic heart murmur, loud third and fourth heart sounds. False positive (abnormal) ECG in most of the cases makes diagnostic process even more complex. That is how Pelliccia and his collaborators, while analyzing ECG in more than 1000 athletes, showed that 17% of men and 8% of women had clearly abnormal ECG, and 28% of men and 14% of women slightly abnormal ECG. When they continued to analyze athletes whose ECG was clearly abnormal, it appeared that most of these athletes did extremely aerobic sports. Further evaluation confirmed that out of 145 persons with clearly changed ECG finding, 14 of them suffer from cardiovascular diseases, and in the rest 131, the echocardiography confirmed hypertrophy or enlarged left ventricle. These evaluations show that the most of the athletes with abnormal ECG do not suffer from cardiovascular diseases, and that this was the case of false positive results. In order to avoid incidents such as sudden death, injury prevention so as prevention of nondiagnostic injuries, the cardiovascular screening was introduced in most of the countries. Recommendation of American Association of Cardiology suggests doing the first screening before starting to do sports, and then doing it on regular basis once in four years beginning from high school until college. American Association of Cardiology made a simple screening program which consists of 12 steps, and it includes taking medical history and basic clinical checkup. According to these recommendations, ECG is not being done routinely due to financial reasons. Recommendations of European Association of Cardiology and Italian screening program support totally different opinion: ECG is the obligatory part of every checkup. Evaluation of athletes requires knowing the type of the sport person is doing – dynamic or static sport so as intensity degree of physical activity. The Report of 36<sup>th</sup> Bethesda Conference: Eligibility Recommendations for Competitive Athletes With Cardiovascular Abnormalitie, held in Bethesda, USA, in 2005, gives a detailed overview of all main sports, intensity of physical efforts in each sport individually so as recommendations such as „which level of physical activity is acceptable in athletes with diagnosed structural or functional disorders of cardiovascular system, therefore, for instance, persons with mild aortic valve stenosis can participate in all competitive sports”, while persons with moderate aortic valve stenosis can participate only in low to moderate intensity static and dynamic sports. Persons who refuse to receive anticoagulant therapy should not do hard sports and activities where they possibly may be injured. Well known is the fact that all doctors are obliged to do in their patients' best interests, including athletes. This implies that in case if a doctor suspects the existence of cardiovascular disease, he is obliged to deprive such a person of permission to do sport again, until the doctor confirms that such a disease exists or not. Screening of older athletes (over the age of 35) who want to participate in recreational fitness programs is a special kind of challenge. In this case it is necessary to implement the health benefit which is achieved through moderate

physical activity, so as the possible risk. Regular physical activity reduces the risk of sudden cardiac death, but the sudden cardiac death most often happens during some physical activity. In order to exclude primarily the existence of coronary heart disease, it is recommended to make the physical fitness test before starting the activity, and then regularly once a year.

### **3. DISCUSSION**

With regard to the fact that a huge number of people who do sport at different levels (high schools, colleges, professionals, amateurs) have a low possibility of sudden cardiac death in athletes, so as no big need for financially sustainable health system, in some countries (USA), the cardiovascular screening of athletes are done by “well trained health professionals” (medical technicians) who are not doctors. According to European recommendations, the screening of athletes can be done only by doctors with adequate knowledge of sport medicine. Previous experience in efficiency of existing screening programs (especially American, which does not include obligatory ECG) regarding prevention of sudden cardiac deaths, unfortunately are not encouraging. For instance, in one retrospective study of 24 out of 134 young athletes who died of a sudden death, 115 of them did the screening test. In only 4 of them existed a certain level of suspicion of some kind of a cardiovascular disorder (without requesting additional diagnostics), in only one athlete a clear diagnosis of cardiovascular disease has been set. This study supports the suspicion that American screening program is not sensitive enough to discover important cardiovascular diseases in young athletes (sensitivity about 3%). Cardiovascular screening of athletes has numerous objective difficulties. Medical history and physical checkup are not specific enough to discover diseases which may cause sudden cardiac death: ventricular tachyarrhythmia, coronary artery anomalies and coronary disease mostly have negative findings. Specificity of ECG is low. Also, other non-invasive tests (physical fitness test, echocardiography) are in some cases non-sensitive (e.g. coronary artery anomalies). More sophisticated technology (multi-slice CT, NMR) due to its high prices do not have its own place in screening, but exclusively in symptomatic athletes in further diagnostic procedure.

### **4. CONCLUSION**

Implementation of cardiovascular screening program aims to reduce often sudden cardiac deaths in athletes. It is necessary to set national recommendations which would clearly define the scope, organization and carrying out the screenings and regular checkups of athletes).

In a meanwhile, until special national recommendations are being set, we are of opinion that it is necessary that all clinical doctors who deal with sport medicine become well familiar with actual European and American recommendations.

### **LITERATURE**

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