Exercise related ventricular arrhythmias in young athletes

Vukomanovic Goran, Parezanovic V, Djukic M, Jovanovic I, Ilisic T, Milincic Z, Cuturilo G
Pediatrics Sports Medicine Center, University Children's Hospital, Belgrade, SCG

Introduction
Exercise induced (EI) ventricular arrhythmias (VA) are rare, but very dangerous cardiac rhythm disturbances in childhood. Cardiac diseases can cause EIVA: cardiomyopathy (hypertrophic, dilated, arrhythmogenic right ventricular cardiomyopathy), congenital heart defects (including postoperative), mitral valve prolapse, Marfan disease. Exercise (or catecholamine) related arrhythmias could occur on apparently normal heart with “membrane cardiomyopathy”: long QT syndrome, Brugada syndrome. Unfortunately, dangerous ventricular arrhythmias can be first sign of subcellular heart defects on structurally normal heart (ECG and echocardiography are normal). EI ventricular tachycardia can lead to ventricular fibrillation, which is first cause of sudden death in young athletes. Aim of this paper is to reveal incidence and etiology of EIVA in young competitive athletes with no evidence of structural heart disease. Another goal is to redefine preparticipation screening approach regarding early diagnostic and treatment of exercise related ventricular arrhythmias.

Methods
Group A had 2041 young athletes (0.67 boys, 7 – 19) years. They had been directed to pediatric cardiologist by pediatrician or sports medicine specialist to assess usual symptoms (chest pain, palpitations and dizziness) or “innocent” heart murmurs. They underwent investigation protocol, which, beside physical examination, included: 12 leads ECG, echocardiography (echo) and stress test (Modified McMaster ergo cycle continuous supramaximal protocol). All athletes had no evidence of cardiac diseases (normal echo and ECG at rest). EIVA was diagnosed on stress test. Group B – preparticipation group included 257 highly trained competitive athletes (participate in water polo, rowing, swimming), which had been examined in preparticipation study following same investigation protocol as group A. They were asymptomatic, with no evidence of structural heart disease. There were 18 patients in group C (control group) who had cardiac diseases with high incidence of EIVA: 8 with arrhythmogenic right ventricular cardiomyopathy (ARVC), 10 with hypertrophic cardiomyopathy (HCM). All 18 patients participate in sport, 5 had been competitive athletes!

Results
In group A 10/2041(0.49%) had EIVA: 7 exercise induced ventricular tachycardia (EIVT), 3 exercise induced premature ventricular contractions (EIPVC). During follow up (13-61 months) 3/10 patient died despite medical treatment. One patient had complete regression of EIVA; others are on antiarrhythmic drugs. There were 2/257 (0.78%) athletes in group B with EIVA. First with EIPVC, second had EIVT. First patient had been excluded from competitive sport. After 38 months follow up his EIPVC disappeared. Second patient had complete regression of EIVT after four months of follow up. In group C 8/18 (7 with AVRC, one with HCM) had EIVA (7 EIVT, one EIPVC). One (1/7) patient died (4 years after diagnosis) in severe heart (right ventricle) failure.

Discussion/Conclusion
Preliminary results showed that incidence of EIVA was higher in preparticipation group (B 2/257) comparing with group A (10/2041). Incidence of sudden death in apparently healthy athletes (3/10) was significantly higher than in patients with cardiomyopathies (1/18, p<0.05). EIVA may occur in asymptomatic, apparently healthy young athletes. Current status of preparticipation cardiovascular screening of young athletes is poor. Only complete noninvasive assessment, including stress test can be effective in early diagnosis of exercise induced ventricular arrhythmias in highly trained competitive athletes. That can be good direction in prevention of sudden cardiac death in young athletes.

References
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