

Prevention of Sudden Death in Athletes

P Syamasundar Rao*

Departments of Pediatrics and Medicine, University of Texas-Houston Medical School, USA

*Corresponding author: P. Syamasundar Rao, Professor, Department of Pediatrics and Medicine, Emeritus Chief of Pediatric Cardiology, University of Texas-Houston Medical School, Children's Memorial Hermann Hospital, 6410 Fannin Street, UTPB Suite # 425, Houston, Texas, 77030, USA, Tel: 713-500-5738; Fax: 713-500-5751; E-mail: P.Syamasundar.Rao@uth.tmc.edu

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Introduction

Sudden cardiac death (SCD) may be defined as any natural death due to cardiac causes within minutes to 24 hours of strenuous exercise. The SCD may be related to arrhythmia or circulatory collapse. The annual prevalence of SCD in children is approximately 600 in the USA; this is in contradistinction to incidence of sudden infant death syndrome of 7, 000 to 10,000 per annum and SCD in adults of 300,000 to 400,000 per annum. The most common causes are hypertrophic cardiomyopathy, congenital coronary artery anomalies, known structural heart defects such as repaired tetralogy of Fallot, Mustard or Senning operation for transposition of the great arteries, Fontan operation for single ventricle lesions, un-operated congenital heart defects, including aortic stenosis and complex forms of mitral prolapse and Marfan's syndrome [1-3]. Less common causes are myocardial disorders such as arrhythmogenic right ventricle and acute or chronic myocarditis, pulmonary hypertension, long QT syndrome, other coronary abnormalities such as Kawasaki disease and familial hyper beta hyperlipoproteinemia, catecholaminergic polymorphic ventricular tachycardia, Brugada syndrome and commotio cordis [2,3].

Preparticipation Screening

Pre-sports participation screening is generally recommended by all sports and physician societies. However, the cardiac conditions with predisposition to SCD occur in 5 out of 100,000 individuals and SCD occurs in 1 out of 200,000. This low risk makes assessment difficult and cost-effectiveness of screening methods low. The objective is to identify subjects at risk for SCD during strenuous exercise non-invasively and cost-effectively. No universally accepted standards for screening exist.

The current recommendations by the American Heart Association (AHA)/American College of Cardiology (ACC) [3,4] are to scrutinize personal history and family history and to perform regular and complete physical examination, whether it is performed in primary care physician's office or in mass preparticipation screening programs. Items in personal history are exertional chest pain or discomfort, unexplained syncope or near-syncope, excessive exertional and unexplained dyspnea/fatigue associated with exercise, prior recognition of a heart murmur, elevated systemic blood pressure, prior restriction from participation in sports and information on prior testing of the heart by another physician. Issues to be looked into in the family history are premature death (sudden and unexpected, or otherwise) prior to age 50 years secondary to a cardiac issue in more than 1 relative, disability from heart disease in a close relative less than 50 years of age, specific knowledge of certain cardiac conditions in family members such as hypertrophic or dilated cardiomyopathy, long QT syndrome or other ion channelopathies, Marfan syndrome, or clinically important arrhythmias. Preparticipation physical

examination should be complete physical examination including that for heart murmur, palpation of femoral pulses to exclude aortic coarctation, physical stigmata of Marfan syndrome and brachial artery blood pressure in sitting position.

If abnormalities are found in the above described, 14-Element AHA/ACC recommendations for preparticipation cardiovascular screening, further testing as appropriate should be performed. Routine electrocardiograms (ECGs) and echocardiograms for this screening are not recommended by AHA/ACC. However, the International Olympic Committee and the European Society of Cardiology guidelines call for routine screening with a 12-lead ECG (in addition to history-taking and physical examination). Preparticipation screening ECG may not improve the diagnostic yield, is impractical, insensitive and non-specific. But, it may identify patients with hypertrophic cardiomyopathy, long QT syndrome, pre-excitation syndrome, atrioventricular block and Brugada syndrome.

The rationale behind AHA/ACC recommendations for not routine performance of ECG during pre-sports participation screening may be summarized: 1. ECG is insensitive and non-specific with false-positive results occurring well in excess of true-positives ECGs, 2. The prevalence of cardiovascular conditions responsible for sports-related deaths is relatively low (5 out of 100,000 individuals), 3. The athlete cohort to be screened is of substantial size (10 million in USA alone), 4. Such ECG screening will cost approximately 2 Billion dollars/year, and 5. Lack of physician manpower to perform and interpret ECGs.

Echocardiograms may be performed to address concerns or abnormalities in history, physical examination, or ECG. Hypertrophic cardiomyopathy and other types of cardiomyopathy, congenital coronary artery anomalies (they should be specifically looked for) and aortic root dilatation in Marfan's may be detected easily on echo studies. Other modalities such as exercise testing, Holter or event monitor, electrophysiology study, catheterization and angiography, genetic screening (for hypertrophic cardiomyopathy, Marfan's, long QT syndrome) may be utilized to investigate specific problems identified during screening evaluation. It should be noted that in Italy where history, physical examination, ECG, exercise testing and echocardiogram are performed during screening, low incidence of hypertrophic cardiomyopathy is found among SCD.

The current AHA/ACC recommendations are that screening evaluations are performed by qualified examiners and include the 14-key elements of personal and family history and physical examination. These examinations should be performed in an environment conducive to optimal cardiac auscultation. These comprehensive screening evaluations should be repeated in 2 years for high school athletes and in 3 years for the college student-athletes. It is not realistic to assume that standard large-scale screening examinations are able to

exclude all clinically relevant disease entities. The author of this editorial strongly believes that these evaluations should be performed by the primary care physicians as a part of their yearly routine physicals, but they should ensure inclusion of AHA/ACC recommended 14-key elements of personal and family history and physical examination.

Conclusions

It may be concluded that sudden death during sports often has a cardiac etiology and the two most common causes are hypertrophic cardiomyopathy and congenital coronary artery anomalies. The current recommendations are a pre sports participation complete history and thorough physical examination, preferably in the primary care physicians' office. Further investigations should be performed if abnormalities in history or physical examination are detected. Use of ECG and Echo as routine screening methods is controversial and is not recommended by the author of this editorial. The purpose of pre-participation examination is to enable as many youths as possible to participate rather than exclude from sports

References

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