TABLE 1

THE 12 ELEMENTS OF THE AHA GUIDELINES FOR PREPARTICIPATION CARDIOVASCULAR SCREENING

Personal medical history:

1. Chest pain or chest discomfort during exercise
2. Unexplained syncope or near-syncope deemed not to be vasovagal
3. Excessive exertional and unexplained dyspnea/fatigue associated with exercise
4. History of a heart murmur
5. Elevated blood pressure

Family history:

6. Sudden and unexpected death before age 50 due to heart disease in 1 relative
7. Disability from heart disease in a close relative <50 years of age
8. Presence of genetic cardiac conditions in family members such as hypertrophic or dilated cardiomyopathy, long-QT syndrome, Marfan syndrome, or significant arrhythmias

Physical examination:

9. Heart murmur
10. Normal and equal peripheral pulses in all extremities
11. Physical findings suggestive of Marfan syndrome
12. Sitting brachial artery blood pressure

Source: American Heart Association

Parental verification of personal and family histories is recommended for high school and middle school athletes.

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The Heart Center

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Cardiac Screening

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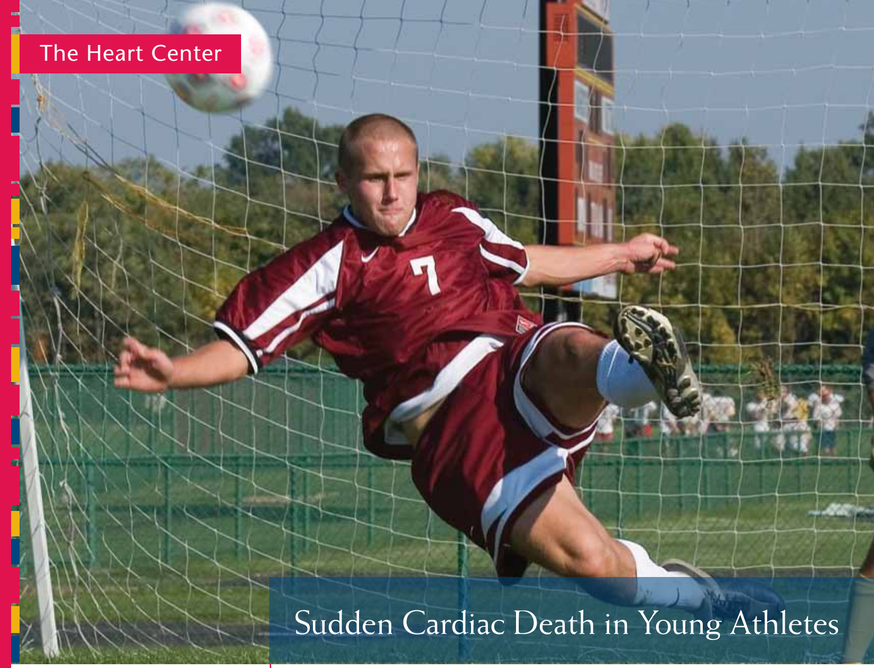

Sudden Cardiac Death in Young Athletes

:: Overview
:: Causes
:: Cardiac Screening for Sports Participation

NATIONWIDE CHILDREN'S HOSPITAL℠

About The Heart Center

The Heart Center at Nationwide Children's Hospital has earned an international reputation for innovation and forward thinking. From the creation of the world's first Hybrid Cardiac Catheterization Suites and the first Hybrid Congenital Cardiac Operating Room in the nation, to the development of a comprehensive adolescent and adult congenital heart disease program, The Heart Center team is constantly looking to improve care options. Recently ranked as one of America's best for Heart and Heart Surgery by *U.S.News & World Report*, you can be assured that your patients have access to the expertise and resources able to handle any level of care necessary.

Our world-class team, comprised of cardiologists, surgeons, intensivists, nurses and technicians, have all the comprehensive services and resources readily available for you and your patients such as, electrophysiology, interventional cardiology, cardiothoracic surgery and echocardiology, just to name a few. We offer convenient outpatient cardiology services at our main campus and *Close To Home*SM Center locations throughout Columbus and throughout the Ohio region.

About Cardiothoracic Surgery

The cardiothoracic surgical program at Nationwide Children's Hospital is dedicated to the treatment of patients with congenital disorders of the thorax which includes heart, lungs, mediastinum and chest wall. Surgeons in the cardiothoracic program treat non-cardiac thoracic diseases including chest wall deformities, such as Jeune's Syndrome and pectus deformaties, in addition to Benign Thoracic Disorders and Primary or Secondary Malignant Thoracic Diseases. Successful diagnosis and treatment is accomplished by a multidisciplinary team of specialists from Hematology/Oncology/BMT, Pulmonary Medicine, Physical Therapy, Plastic Surgery and Cardiothoracic Surgery, who tailor the treatment to meet individual patient needs.

Nationwide Children's is a pioneer in the development of new strategies for treating patients as one of the first children's hospitals in the nation to utilize 3D Video Assisted Thoracopy. This technology provides improved clarity to perform the most delicate maneuvers within the thoracic cavity and allows us to expand the use of minimally invasive techniques to the treatment of our patients.

To refer a patient to The Heart Center, please call (614) 722-6200, fax referrals to (614) 722-4000 or visit us at www.NationwideChildrens.org.

PHYSICIAN DIRECT CONNECT LINE
(614) 355-0221
Toll-free 877-355-0221

FEATURED CARDIOLOGIST

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Attending Physician at The Heart Center at Nationwide Children's Hospital. Associate Professor of Clinical Pediatrics at The Ohio State University College of Medicine

- :: *ICAEL Accredited Echocardiography Laboratory*
- :: *OptumHealth Center of Excellence for Congenital Heart Disease (CHD) and Heart Transplant*
- :: *Ranked as one of America's best for Heart and Heart Surgery by* U.S.News and World Report
- :: *Named one of America's top three in cardiology/cardiothoracic services by* Parents *magazine*
- :: *Aetna Institute of Excellence for Pediatric Congenital Heart Surgery*
- :: *CIGNA LIfeSOURCE Transplant Network, Center of Excellence*

Sudden Cardiac Death

Sudden cardiac death (SCD) can be defined several ways. It is generally accepted as a nontraumatic, nonviolent, and unexpected death resulting from sudden cardiac arrest within six hours of a previously witnessed state of normal health or within one hour of onset of symptoms. SCD involving young athletes associated with physical exertion continues to achieve high public visibility through the media and generate considerable concern in our society. The issue of screening for causes of SCD in this population remains controversial and emotionally charged. After all, these young student athletes are deemed some of the healthiest and most fit members of society.

SCOPE OF THE PROBLEM

As with any public health issue, the scope of the problem must be considered when creating any screening program. Reliable estimates of the frequency of SCD in young athletes are complicated due to numerous factors. There are an estimated 6-10 million high school and college students who participate in some form of organized competitive athletics annually in United States. Nontraumatic sports-related deaths are rare. From 1983 to 1993, the National Center for Catastrophic Sports Injury Research found that nontraumatic sports-related deaths occurred in 126 high school athletes and 34 college athletes (approximately 16 deaths per year); 100 of these deaths were cardiovascular in origin.[1] Other regional and state level studies have estimated rates of approximately 0.3-0.5 deaths per 100,000 high school athletes per academic year in the United States.[2,3] For comparison, the leading causes of death published from the Center For Disease Control and Prevention among 15-19 year teenagers in 2005 in the United States were accidents, homicide and suicide with rates of 37, 13 and 10 per 100,000 respectively.

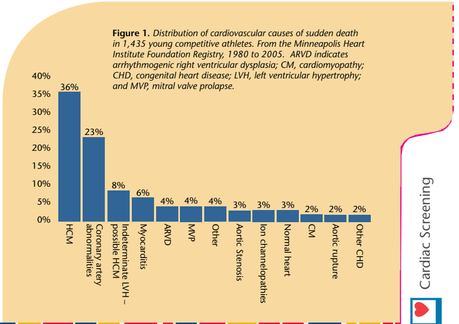

Figure 1. *Distribution of cardiovascular causes of sudden death in 1,435 young competitive athletes. From the Minneapolis Heart Institute Foundation Registry, 1980 to 2005. ARVD indicates arrhythmogenic right ventricular dysplasia; CM, cardiomyopathy; CHD, congenital heart disease; LVH, left ventricular hypertrophy; and MVP, mitral valve prolapse.*

REGIONAL SERVICES AVAILABLE

The Heart Center offers patient evaluation for infants, children and adolescents, as well as the following services:
- :: ECG, Echocardiography
- :: Evaluation of murmurs
- :: Evaluation of chest pain and syncope with possible cardiovascular causes
- :: Cardiology clearance for school sports participation
- :: Follow-up visits for cardiac patients

Visit us at NationwideChildrens.org/HeartCenter for more information, including:
- :: Custom driving directions for your patients
- :: Downloadable fact sheets
- :: Physician information

Cardiac Screening for Sports Participation

For children with known heart disease, there are published guidelines regarding sports participation that incorporate the specifics of the heart disease with the physiologic demands of individual sports including training. The primary goal of a screening program is to identify student athletes who have undiagnosed or unrecognized cardiovascular disease that may place them at risk. Figure 1 shows the most common cardiovascular abnormalities associated with sports-related sudden cardiac death based on the Minneapolis Heart Institute Foundation Registry.[4]

Hypertrophic cardiomyopathy (HCM) is a genetic disease in which one of the contractile proteins of cardiac muscle is abnormal. This abnormality results in thickening (hypertrophy) of the muscle primarily in the ventricles and is the most common cause of sports-related sudden cardiac death. An estimated 45% of cases represent sporadic mutations, no family history may exist. The severity of HCM varies significantly and many people have no symptoms. Approximately 70 percent of subjects with hypertrophic cardiomyopathy have some degree of obstruction. The obstruction can worsen during exercise. During exercise, the hypertrophy can result in decreased blood flow from the heart, thus lowering blood pressure in the body while increasing pressure inside the heart. This situation reduces coronary blood flow to the abnormally thick heart muscle resulting in ischemia and potential arrhythmias (irregular heart rhythms).

Abnormalities of the coronaries arteries is the next largest category of cardiac disease, both congenital and acquired. These conditions, as well as stenosis of the aortic valve, also produce decreased blood flow and oxygen supply to the heart muscle during periods of increased demand, ultimately leading to life-threatening arrhythmias.

CURRENT PRACTICES

There are no national mandated standards for the screening of student athletes in the United States and no specific qualifications for the evaluators. Some form of medical clearance by a physician or other healthcare professional is typical. The screening varies, but typically entails a history and physical exam.

In 2007, the committee from the AHA published updated recommendations.[4] The revised recommendations focus on a more detailed history and physical examination. The history portion of the screening now includes a personal as well as family history in attempt to identify student athletes at risk for unrecognized cardiovascular disease.

It is also recommended that the screening be performed by a healthcare worker trained in the evaluation of cardiovascular disease, preferably a licensed physician. A screening should be repeated every 2 years. The recommendations do not include any medical testing. The table, on the back of this page, from the report shows the main elements of the screening process. It remains unknown how effective such recommendations will be at identifying at risk individuals or to what extent they will be implemented.

Cardiac Screening

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