Objectives

• Definition of sports – define the athlete, the activity and the risk
• CV adaptation – recognizing normal physiology and pathology
• The Grey Zone – reference ranges, registries and specialized centers for care of athletes.
Disclosures

- Astra Zeneca (DSMB)
- Biomedical Systems (Consultant)
- Biotie (DSMB)
- Co-Chair Participation Recommendations for Competitive Athletes (AHA/ACC)
- Cook MED Institute (CEC)
- Eli Lilly (DSMB, Consultant)
- NFL Cardiovascular Committee
- TEVA (DSMB)
CONFERENCE REPORT

Protecting the Heart of the American Athlete

Proceedings of the American College of Cardiology Sports and Exercise Cardiology Think Tank
October 18, 2012, Washington, DC

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Death in Young Athletes

- Suspected SCA: 35 cases
- Confirmed SCA: 121 cases
- Non-cardiac:
  - Heat stroke
  - PE
  - Asthma
  - Dehydration
  - Sickle cell
  - Head trauma
  - MRSA
  - Meningitis
  - Aneurysm

Drezner JA. Heart Rhythm. 2008
Causes of SCD in US Athletes

Maron, NEJM, 2003
Top Causes of Sudden Cardiac Death in Young Athletes

- Hypertrophic Cardiomyopathy
- Commotio Cordis
- Coronary Artery Anomalies
- Arrhythmogenic Right Ventricular Cardiomyopathy
- Myocarditis
- Long QT Syndrome
Facts and Figures (U.S.)

- 44 Million Youth Sports Participants
- 10 Million High School Athletes
- 500,000 Collegiate Athletes
- 541,000 Marathon Runners
- 1,000,000 Adult Congenital Survivors
- Countless “Weekend Warriors”
Annual Incidence of SCD in Athletes

CHD (40 year old man)

Breast / prostate cancer

Auto Accident

Lightning

Deaths Per 100K/Year

Maron 1998
NCAA Div III
NCAA Div II
NCAA Div I
NCAA Black Males
NFL
NCAA Div I BB

Within the Sport there is Significant Heterogeneity
Cardiovascular adaptation in athletes

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\textbf{ABSTRACT}

Millions of athletes train for and participate in competitive athletics each year. Many of these athletes will present to a cardiovascular specialist with signs or symptoms that might indicate heart disease and these athletes/patients will ask for advice on their ability to continue to train and compete safely. By virtue of their training, athletes’ hearts may undergo significant structural and electrical change, presenting a special challenge for the cardiovascular specialist. It is important to understand normal adaptive changes in order to separate normal physiology from pathology.

\textbf{Keywords:} Athlete’s heart, Sports cardiology, Exercise, Athlete, Cardiomyopathy, Hypertrophy.

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The diagram illustrates the effects of different activities on heart function.

1. **Normal**
   - Activity: Bicycling
   - Effect: The heart appears normal with regular contractions.
   -图示：心电图显示正常。

2. **Trained**
   - Activity: Weight lifting
   - Effect: The heart shows enhanced muscle mass and improved function.
   - 图示：心电图显示训练后的变化。

3. **Detrained**
   - Activity: Rest
   - Effect: The heart returns to its original state, indicating the benefits of rest.
   - 图示：心电图显示恢复期的变化。

The cycle emphasizes the importance of a balanced lifestyle, alternating between physical activity and rest to maintain optimal heart health.
The Harvard Athlete Initiative
Freshmen Rowers

$\Delta \text{ LV Mass} \ (g/m^2)$

ANOVA $p = 0.74$

Baggish Unpublished
Grey Zone Considerations

- Physiologic Left Ventricular Hypertrophy or Hypertrophic Cardiomyopathy?
- Congenital Long QT syndrome or Physiologic Response to Bradycardia?
- Congenital Aortopathy or Effect of Large Body Size?
- Physiologic Right Ventricular Dilation or Arrhythmogenic RV Cardiomyopathy?
NFL Scouting Combine Facts and Figures

- 1500 participants 2011-2015
- Age: 21-24 years
- Height: 5’5” – 6’9”
- Weight: 150 – 400+ lbs.
NFL 2011-2013

~ 10% ≥ 1.3 cm.
Aortic Size in NFL Scouting Combine Participants

AHA Abstract Nov. 2013
Medical Specialties for which GeneDx offers tests

C

Cardiac Disorders
- Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC)
- Brugada Syndrome (BrS)
- Cardio-Facio-Cutaneous Syndrome
- Catecholaminergic Polymorphic Ventricular Tachycardia (CPVT)
- CHARGE Syndrome
- Congenital Heart Disorder due to Micro Del/Dup Syndrome
- DiGeorge syndrome
- Dilated Cardiomyopathy (DCM)
- Hereditary Hemorrhagic Telangiectasia (HHT)
- Heterotaxy
- Holt-Oram syndrome
- Hypertrophic Cardiomyopathy (HCM)
- Left Ventricular Noncompaction (LVNC)
- LEOPARD Syndrome
- Looss-Dietz syndrome (LDS)
- Long QT Syndrome (LQTS)
- Lujan syndrome (LS) (Lujan-Fryns syndrome)
- Marfan Syndrome/LDS/Related Disorders
- Noonan Syndrome
- Oculo Facio Cardio Dental Syndrome
- Pulmonary Arterial Hypertension
- Short QT Syndrome (SQTS)
- Shprintzen-Goldberg syndrome
- Simpson-Golabi-Behmel Syndrome (SGBS)
- Sotos Syndrome
- Sudden Cardiac Arrest
- Sudden Unexplained Death
- Supravalvular Aortic Stenosis
- Thoracic Aortic Aneurysm and Dissection (TAAAD) and Related Disorders
- Truncus Arteriosus Aneurysmosis
- Velocardiofacial syndrome
- Williams-Beuren syndrome
- Wolff-Parkinson White Syndrome
Making Decisions in the Gray Zone

- Understand the athlete and the training.
- Consider complimentary imaging techniques.
- Advocate for registration of large data sets.
- There will still be a gray zone where decisions are complex.
Should NFL Teams Still Be Worried About Star Lotulelei's Heart?

BY DAVE SIEBERT (FEATURED COLUMNIST) ON APRIL 8, 2013

Use your ← → (arrow) keys to browse more stories
Worried About Heart Defects, Some NCAA Schools Take Action

Routine cardiac testing of athletes has been adopted by some teams even though the American Heart Association doesn’t recommend it.

As a Kent State University football player, Jason Bitsko was seemingly healthy—until he died after practice on Aug. 20. The coroner determined that the cause of death was HCM, or...
Return to Play Legislation in Indiana

HOUSE BILL No. 1290

Requires that the student athlete who is symptomatic be removed from play... and be cleared before return to play...

Effective: July 1, 2014.

Bacon, Dermody, McNamara, Pelath, Porter
Implementation of IC 20-34-8

SUDDEN CARDIAC ARREST
A Fact Sheet for Parents

FACTS
Sudden cardiac arrest is a rare, but tragic event that claims the lives of approximately 500 athletes each year in the United States. Sudden cardiac arrest can affect all levels of athletes, in all sports, and in all age levels. The majority of cardiac arrests are due to congenital (inherited) heart defects. However, sudden cardiac arrest can also occur after a person experiences an illness which has caused an inflammation to the heart or after a direct blow to the chest.

WARNING SIGNS
There may not be any noticeable symptoms before a person experiences loss of consciousness and a full cardiac arrest (no pulse and no breathing).

Warning signs can include a complaint of:
- Chest Discomfort
- Unusual Shortness of Breath
- Racing or Irregular Heart Beat
- Fainting or Passing Out

How can I help my child prevent a sudden cardiac arrest?
Daily physical activity, proper nutrition, and adequate sleep are all important aspects of lifelong health. Additionally, parents can assist student athletes prevent a sudden cardiac arrest by:
- Ensuring your child knows about any family history of sudden cardiac arrest (onset of heart disease in a family member before the age of 50 or a sudden, unexplained death at an early age)
- Ensuring your child has a thorough pre-season screening exam prior to participation in an organized athletic activity
- Asking if your school and the site of competition has an automatic defibrillator (AED) that is close by and properly maintained
- Learning CPR yourself
- Ensuring your child is not using any non-prescribed stimulants or performance enhancing drugs
- Being aware that the inappropriate use of prescription medications or energy
Sudden Cardiac Arrest
A Fact Sheet for Coaches

FACTS
Sudden cardiac arrest is a rare, but tragic event that claims the lives of approximately 500 athletes each year in the United States. Sudden cardiac arrest can affect all levels of athletes, in all sports, and in all age levels. The majority of cardiac arrests are due to congenital (inherited) heart defects. However, sudden cardiac arrest can also occur after a person experiences an illness which has caused an inflammation to the heart or after a direct blow to the chest. Once a cardiac arrest occurs, there is very little time to save the athlete, so identifying those at risk before the arrest occurs is a key factor in prevention.

WARNING SIGNS
There may not be any noticeable symptoms before a person experiences loss of consciousness and a full cardiac arrest (no pulse and no breathing).

How can I help prevent a sudden cardiac arrest from occurring?
Daily physical activity, proper nutrition, and adequate sleep are all important aspects of lifelong health. Additionally, coaches can:
- Ensure that all student athletes and parents have been given the fact sheet and returned the acknowledgement form
- Make a list of athletes who have informed you about a family history of sudden cardiac arrest (onset of heart disease in a family member before the age of 50 or a sudden, unexplained death at an early age)
- Ask if your school and the site of competition has an automatic defibrillator (AED) that is close by and properly maintained
- Learn CPR yourself
- Be aware that the inappropriate use of prescription medications or energy
IC 20-34-8 Implementation

- Fact sheets drafted in collaboration with Indiana Chapter of the American College of Cardiology, Riley Hospital for Children and Peyton Manning Children’s Hospital
- Fact sheets and parent letters posted on the Indiana Department of Education website http://www.doe.in.gov/
- Implementation in 2015
Sudden Cardiac Arrest

Posted: Tue, 02/17/2015 - 9:54am       Updated: Thu, 02/26/2015 - 2:07pm

Sudden Cardiac Arrest Law

- **Law** - Link to a copy of the law from the Indiana Legislature (IC 20–34–8)

Forms to Implement the Sudden Cardiac Arrest Law

- **Fact Sheet for Coaches**
- **Fact Sheet for Parents**
- **Fact Sheet for Student Athletes**
- **Concussion and SCA Acknowledgement and Signature Form for Parents and Student Athletes**
- **Sudden Cardiac Arrest Flow Chart**
- **Sudden Cardiac Arrest FAQ Document**
- **Suspected SCA Symptoms – Documentation for Schools** – Sample form for schools to use for documenting SCA symptoms in student athletes
- **SCA Release to Play Form** – Sample form for schools to use to obtain written permission from parents in order for a student athlete to return to play

http://www.doe.in.gov/student-services/health/sudden-cardiac-arrest
Take Home Lessons

• Know the athlete and the sport in detail.
• Understand what is usual and unusual for the competitive athletes that you care for.
• Familiarize yourself with the regulatory landscape.
• Leverage networks of experts