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Sports Cardiology: Caring for the Athletic Heart

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2023 Heart & Vascular Conference: State of the Heart
September 29, 2023

 @JeffHsuMD

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Outline

What is Sports Cardiology?

Core Competencies

- Pre-Participation Screening
- Athlete's Heart vs Pathology
- Return to Play

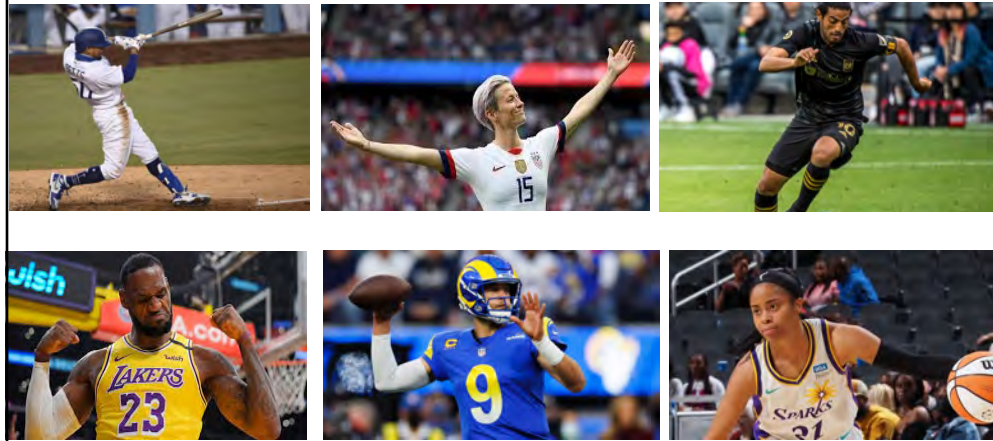
Masters Athlete



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What is Sports Cardiology?

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A grid of six images showing professional athletes in action: a baseball player swinging a bat, a soccer player celebrating, a soccer player running, a basketball player flexing, a football player throwing a pass, and a basketball player with a ball.

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What is Sports Cardiology?

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A grid of six images showing people engaged in various fitness activities: a man and woman running, a man and woman in a gym, a group of people at the gym, a group of people with dumbbells, a woman swimming, and a man and woman jogging on a trail.

**Cardiovascular Care for
Competitive Athletes and Highly Active Patients**

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Spectrum of Sports Cardiology Patients

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Competitive Athletes & Highly Active Patients

Common Features:


- Competitive Mindset: “Type A”
- Exercise = Identity, Community
- Technology Avid
- Multiple Stakeholders

STRAVA


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Core Competencies


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Pre-Participation Screening



Athlete's Heart vs Pathology




Return to Play /
Return to Exercise

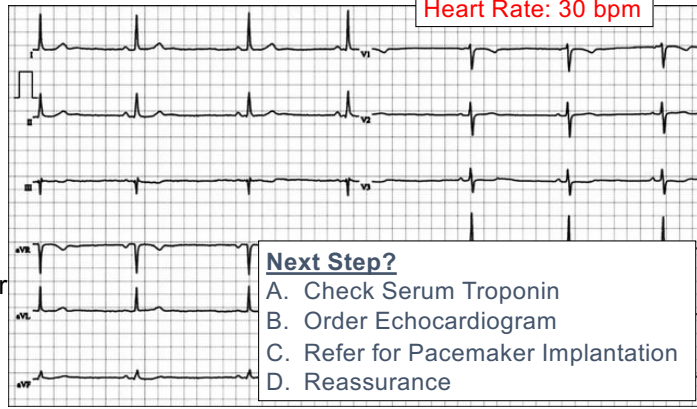
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Case 1: The Ultra Workup

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32 yo M
Caucasian
Ultra-Marathon Runner
Asymptomatic



Heart Rate: 30 bpm


Next Step?

- A. Check Serum Troponin
- B. Order Echocardiogram
- C. Refer for Pacemaker Implantation
- D. Reassurance

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Pre-Participation Screening: Why?



*Reggie Lewis, Boston Celtics
SCD on July 27, 1993*

Sudden Cardiac Death (SCD) in Young Athletes

Incidence:
~1/46,000 to ~1/917,000 athlete-years (AY)

Subgroups:
 UK Adolescent Soccer Players: ~1/15,000 AY
 Male African-American Collegiate Basketball Players: ~1/2,000 AY

1:500 players will have SCD over 4-yr college career

Malhotra et al, NEJM 2018; Peterson et al, BJSM 2020

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Pre-Participation Screening: Why?

USC five-star freshman Vince Iwuchukwu sidelined indefinitely after suffering cardiac arrest this summer

The Trojans' prized big man reveals to CBS Sports that he was hospitalized in July, but is on the mend and in good spirits

By [Matt Norlander](#) Sep 29, 2022 at 2:50 pm ET • 2 min read

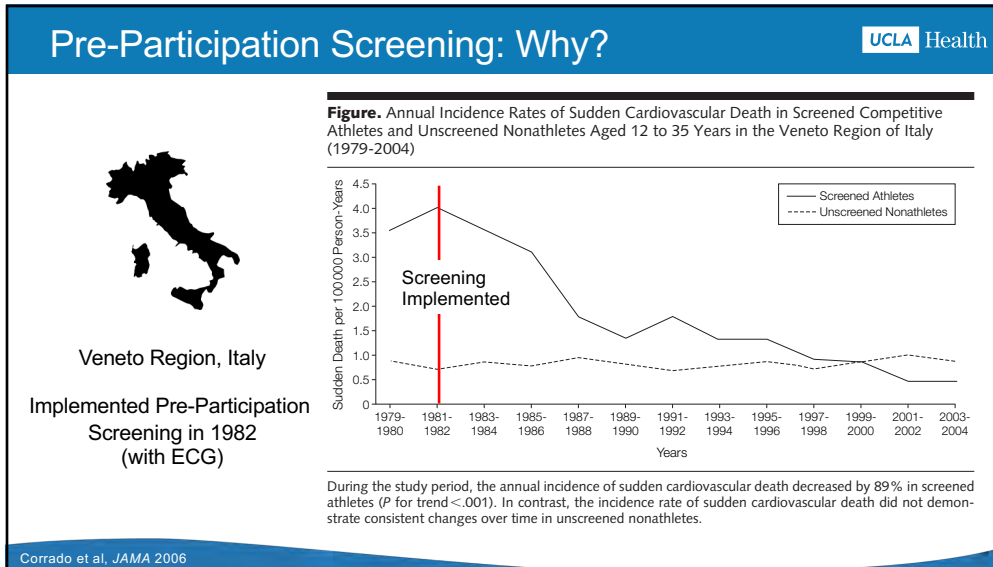




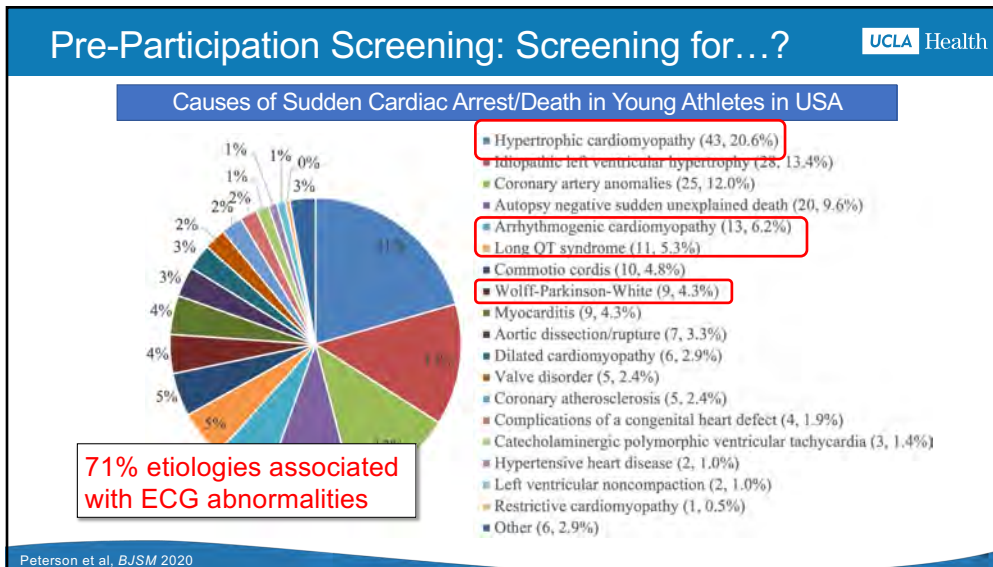
Damar Hamlin in critical condition after suffering cardiac arrest; Bills-Bengals postponed

January 3, 2023

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AHA/ACC 14-Point Pre-Participation Evaluation UCLA Health


Personal History	Family History	Physical Exam
Exertional CP, discomfort, tightness	Premature death (<50 years old from heart disease)	Heart Murmur
Exertional syncope or near-syncope	Disability from heart disease in close relative <50 years old	Femoral pulses (Aortic coarctation)
Excessive or unexplained fatigue/dyspnea with exercise	Specific knowledge of certain cardiac conditions (HCM, DCM, LQTS, Marfan, arrhythmias)	Physical stigmata of Marfan syndrome
Prior heart murmur		Brachial BP
Elevated SBP		
Prior restriction from sports participation		
Prior heart testing ordered by physician		

(+) screen = Further evaluation + ECG

Maron et al, *Circulation* 2014

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Cardiac Adaptation in Athletes UCLA Health



Electrical changes

- Sinus bradycardia
- Sinus arrhythmia
- First degree AV block
- Voltage criteria LVH and RVH
- Incomplete RBBB

Structural changes

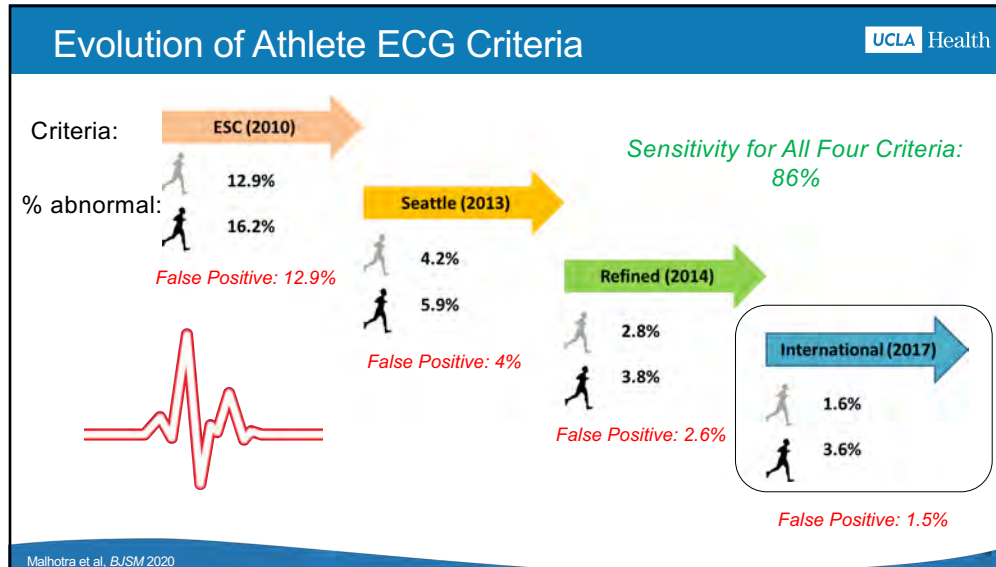
- Increased left ventricular wall thickness
- Increased left and right ventricle cavity
- Bi-atrial enlargement

Functional changes

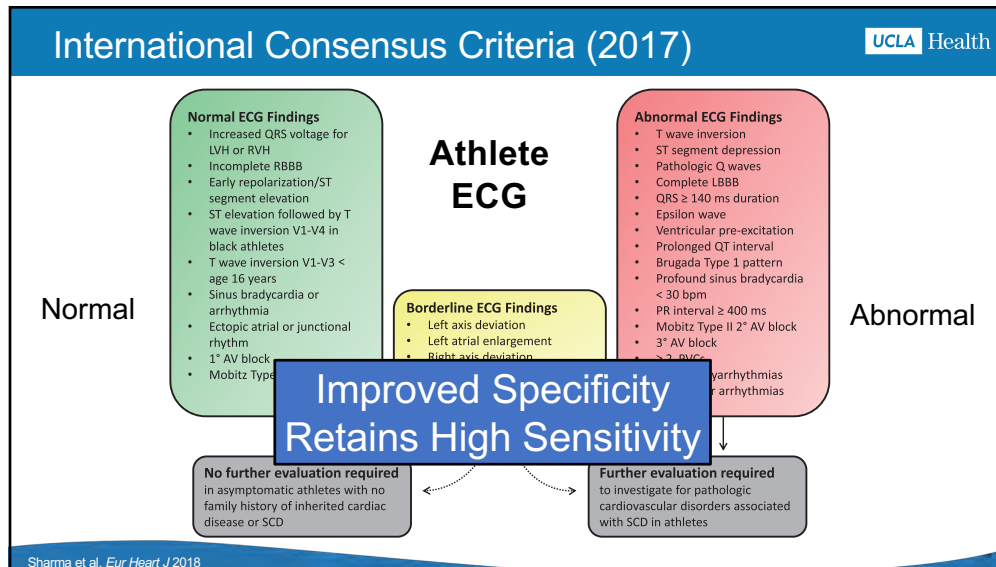
- Increased diastolic filling
- Increased augmentation of stroke volume

Ozo & Sharma, *Eur Cardiol Rev* 2020

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Case 1: The Ultra Workup UCLA Health



32 yo M
Caucasian
Ultra-Marathon Runner
Asymptomatic

Transthoracic Echocardiogram:

- Biatrial enlargement
- ? Right atrial mass

Cardiac CT with contrast:

- Unable to visualize mass, but suboptimal contrast bolus timing

Cardiac MRI:

- No cardiac mass identified


- Anxiety
- Resource Utilization
- Sports Restriction / QOL

“Diagnostic Creep”



PD Thompson, ACC.org 2019

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Core Competencies UCLA Health



Pre-Participation Screening

Athlete's Heart vs Pathology



Return to Play /
Return to Exercise

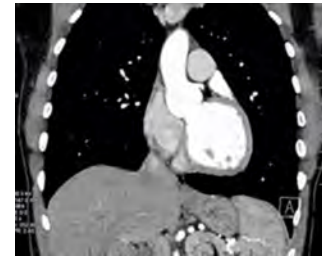
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Case 2: The Upper Limits

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25 yo M Caucasian Professional Basketball Player

- **Height 6'11"**
- No known personal or family cardiac history
- No cardiopulmonary symptoms
- TTE (team protocol):
 - **Aortic root 4.4cm** (Z-score 3.1)
 - LVEF 68%, LVEDD 6.2cm
- Aortic root size confirmed on CTA chest



OK to Play?

ACC Care of the Athletic Heart 2022

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Imaging the Athlete's Heart

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Cardiac Adaptation in Athletes

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Ozo & Sharma, *Eur Cardiol Rev* 2020

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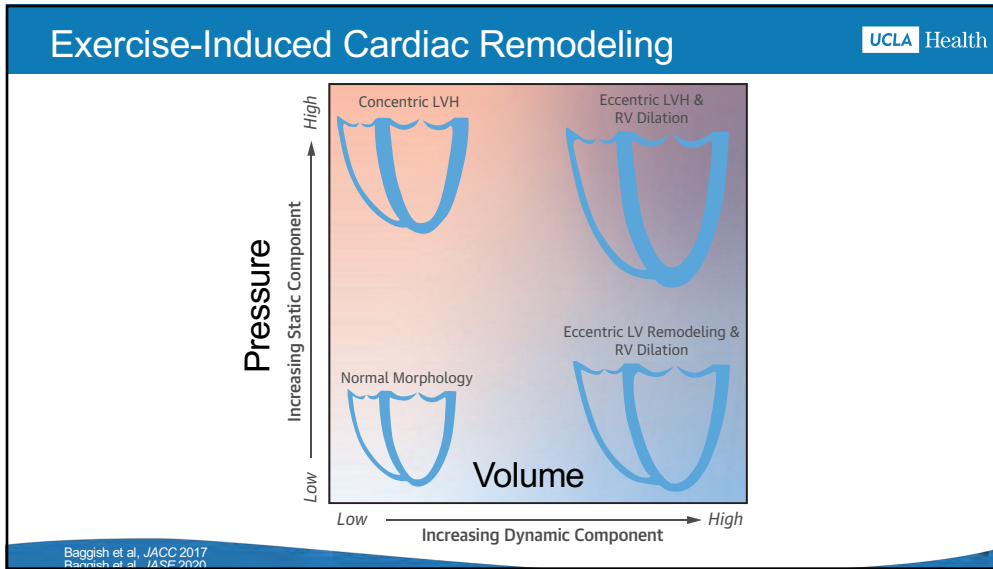
Sports Classification System

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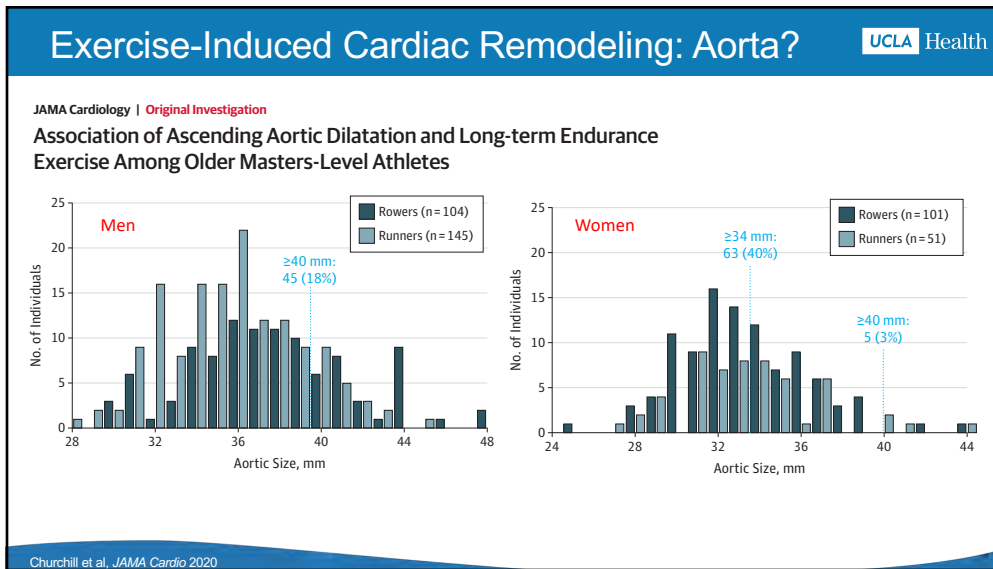
Increasing Static Component (Isometric Load)	III. High (>30%)	Body building*† Downhill skiing Skateboarding*† Snow boarding*† Wrestling*		
	II. Moderate (10-20%)	Archery Auto racing*† Diving*† Equestrian*† Motorcycling*†	American football* Field events (jumping) Figure skating Rodeoing*† Rugby Running (sprint) Surfing Synchronized swimming† "Ultra" racing	Basketball* Ice hockey* Cross-country skiing (skating technique) Lacrosse* Running (middle distance) Swimming Team handball Tennis
	I. Low (<10%)	Baseball/Softball Fencing Table tennis Volleyball		
		A. Low (<50%)	B. Moderate (50-75%)	C. High (>75%)
		Increasing Dynamic Component (Isotonic Load)		

Levina et al, *Circulation* 2015

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NBA Athletes: To Scale...






Manute Bol & Muggsy Bogues




Yao Ming, Christina Aguilera,
Shaquille O'Neal



Kevin Durant, Nellie & Melisa Hsu

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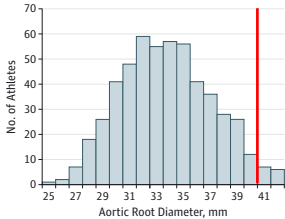
The NBA Athlete Heart: What is Normal?



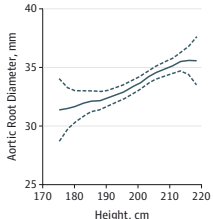
Athletic Cardiac Remodeling in US Professional Basketball Players

Figure 3. Aortic Root Diameters at the Sinuses of Valsalva in National Basketball Association Athletes

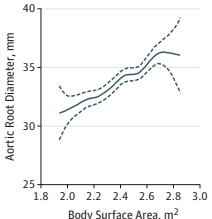
A Distribution of aortic root diameter



B Association of aortic root diameter with height




C Association of aortic root diameter with BSA




Engel et al. *JAMA Cardio* 2016

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Core Competencies UCLA Health



Pre-Participation Screening



Athlete's Heart vs Pathology




Return to Play /
Return to Exercise

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Case 3: The Save UCLA Health

29 yo M Professional Soccer Player

- No known cardiac history
- Collapses on field mid-match with cardiac arrest
- Successfully resuscitated on field
- Underwent ICD placement



OK to Return to Play?

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Euro Cup 2020 UCLA Health

The New York Times
Euro 2020: Denmark's Christian Eriksen Hospitalized After Collapsing on Field


Denmark's Christian Eriksen collapsed on the field. He is responsive and awake.

June 12, 2021




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Return to Play UCLA Health



Safety of Sports for Athletes With Implantable Cardioverter-Defibrillators
Results of a Prospective, Multinational Registry



Demographic

- N = 372 Athletes; 31 months follow-up (median)
- Ages 10-60 years old, 33% Female
- 20% Long QT, 17% HCM, 14% ARVC

Findings

- No death during/after sports participation or shock-related severe injury
- 121 shock episodes in 77 athletes (21%)
- 48 athletes (13%) appropriate shock, 40 athletes (11%) inappropriate shock

Lampert et al. Circulation 2013

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Return to Play: AHA/ACC Recommendations

AHA/ACC SCIENTIFIC STATEMENT

Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 9: Arrhythmias and Conduction Defects

Recommendation	Strength
Class IA sports with ICD reasonable (if no ICD shocks x3 months)	Class Iia, Level of Evidence C
>Class IA sports with ICD may be considered (if no ICD shocks x3 months), with appropriate counseling	Class Iib, Level of Evidence C
Desire to continue competition should not be primary indication for ICD	Class III, Level of Evidence C

Zipes et al., JACC 2015


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Return to Play


CNN Sports Football Tennis Golf Olympics US Sports Climbing Motorsport Esports LIVE TV CNN+ 🔍 🗲

Christian Eriksen makes first appearance since cardiac arrest 259 days ago February 27, 2022



Denmark's Christian Eriksen scores goal with first touch in his return after Euro 2021 cardiac arrest

March 26, 2022




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Return to Play: Special Caution


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Hypertrophic
Cardiomyopathy



Long QT
Syndrome

Arrhythmogenic
Cardiomyopathy



Catecholaminergic
Polymorphic VT

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Return to Play: Emerging Data

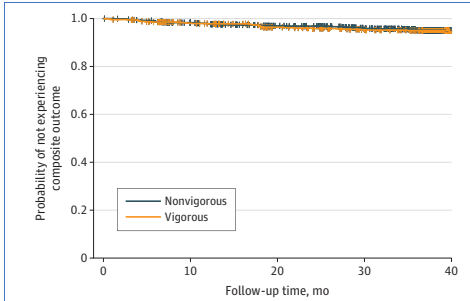
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LIVE - HCM

Risks of Vigorous Exercise in Hypertrophic Cardiomyopathy

Mean age 39 years, 60% male

 Vigorous Exercise:
Participation in 1 activity >6 METs for at least 60 hours / year



No. at risk			
Nonvigorous	961	852	262
Vigorous	699	608	193


Lampert et al. JAMA Cardiology 2023

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Return to Play: Emerging Data UCLA Health

New data on outcomes of elite athletes with genetic heart disease who return-to-play

Ongoing registries will help provide more data to inform risk communication



Definitive Diagnosis

Hypertrophic Cardiomyopathy (HCM) 53%	Long QT Syndrome (LQTS) 23%	Other 24%
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Initial Sport Disqualification (55/76, 72%)

Sports Cardiology Expertise Center

Disease-Specific Risk Stratification and Guideline-Directed Treatment **and** Competitive Sport Eligibility Process (Shared Decision-Making)

Sport Eligibility and Clinical Outcomes

Athlete Decided to Terminate Competitive Sports (n = 3/76, 4%)	Athlete Opted to Return to Competitive Sports and Resumed Full Training and Competition Following SMC (n = 69/76, 91%)	Athlete Opted to Return to Competitive Sports But Was Disqualified by the Sporting Organization (n = 4/76, 5%)
BCF: Unlimited to Exercise (2/69, 9%)		BCF: During Exercise (1/69, 1.5%)

Martinez et al. JACC 2023

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Return to Play: Emergency Action Plan UCLA Health

- SCD events will continue to occur
- Emergency Action Planning (EAP) for SCD is critical for all sporting organizations

Create Your Emergency Action Plan

- ✓ Design a venue-specific written EAP with specifications regarding role of on-site/offsite personnel & location of AED
- ✓ Ensure there are measures in place for regular rehearsal and practice of EAP
- ✓ Distribute the written EAP to local EMS agencies, hospitals, sports organization administrators, coaches, athletic trainers, and team physicians

Requirements for Onsite Personnel

- ✓ Identify the personnel on-site that will take action during a SCA (athletic trainers, team physicians, etc.)
- ✓ Establish a communication system (ie, radio, text, etc.) in which the EAP coordinator can communicate with other first responders

Requirements for Offsite Personnel

- ✓ Identify the personnel off-site that may be contacted for a SCA event (ie, advanced cardiac care facilities)
- ✓ Establish an accessible entry and exit route for ambulances
- ✓ All individuals who suffer from an SCA event will require hospital transfer for comprehensive cardiac evaluation

Requirements for Emergency Equipment

- ✓ Identify all emergency medical equipment required in the event of an SCA (ie, AED, AED supplies)
- ✓ Document the location of the AED with a map and ensure all required parties are aware of location
- ✓ Identify individuals who will maintain the emergency equipment and ensure proper function

Frequent Training & Rehearsal

- ✓ Rehearse the EAP annually (at minimum) with all on-site personnel identified in the EAP
- ✓ The EAP coordinator should consider any revisions to the EAP on a yearly basis or following an SCA
- ✓ Consider mock scenarios in which each individual can practice their designated role

Malik, ... Hsu et al. Clin Cardiol 2023

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The Masters Athlete

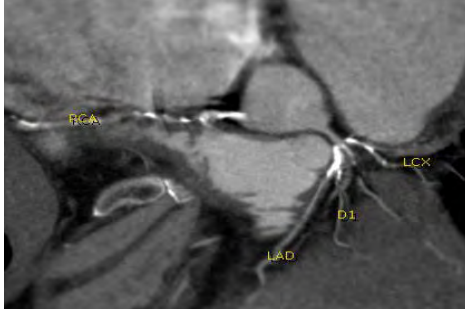
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Case 4: The Ironman

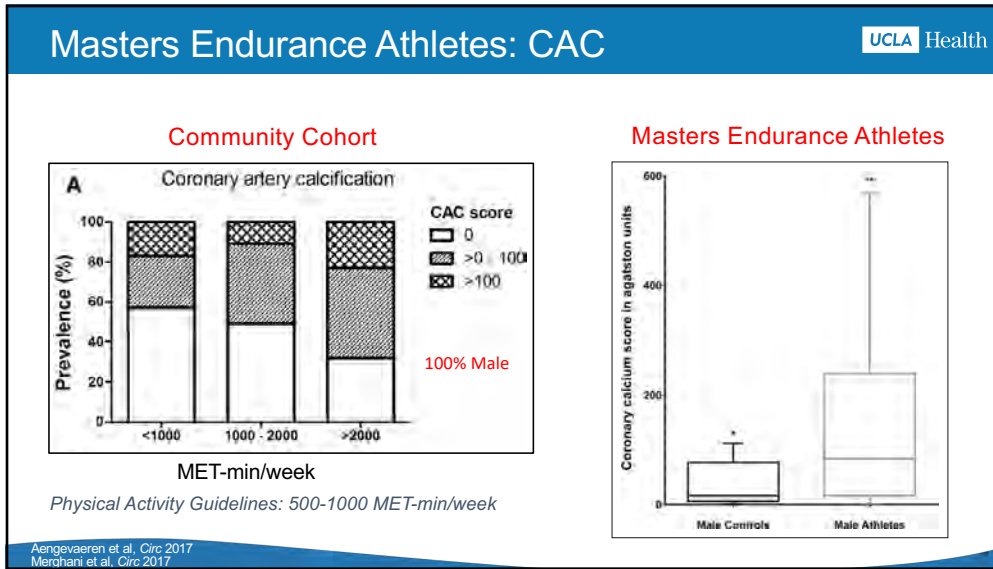
45 yo M Ironman Triathlete

- Competitive >10 years
- COVID-19 Pandemic:
 - Decreased training intensity
 - Palpitations → Dx AFib
- AFib Ablation workup:
 - CTA chest → +CAC
- Successful AFib ablation
- Now asymptomatic

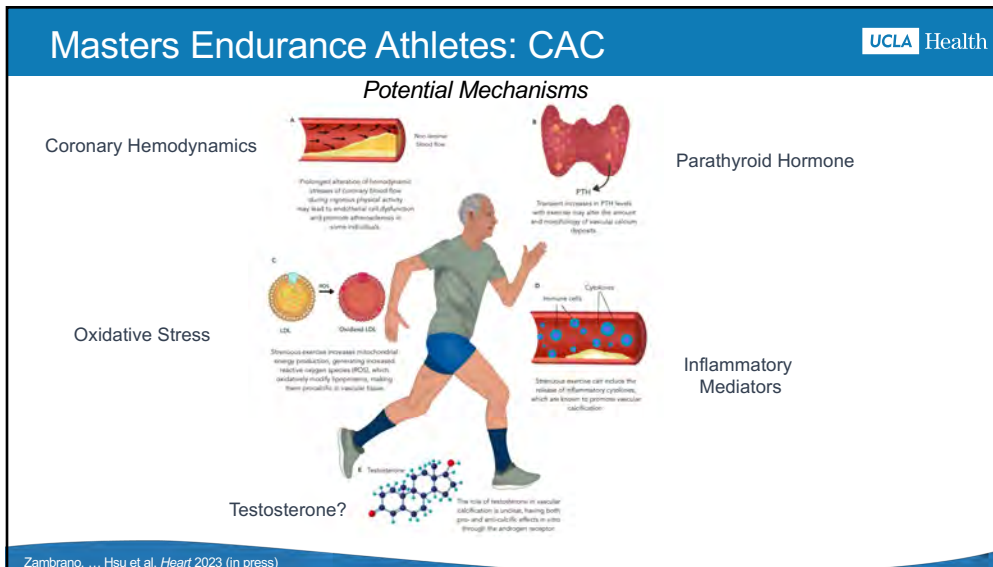


Coronary Artery Calcification (CAC)

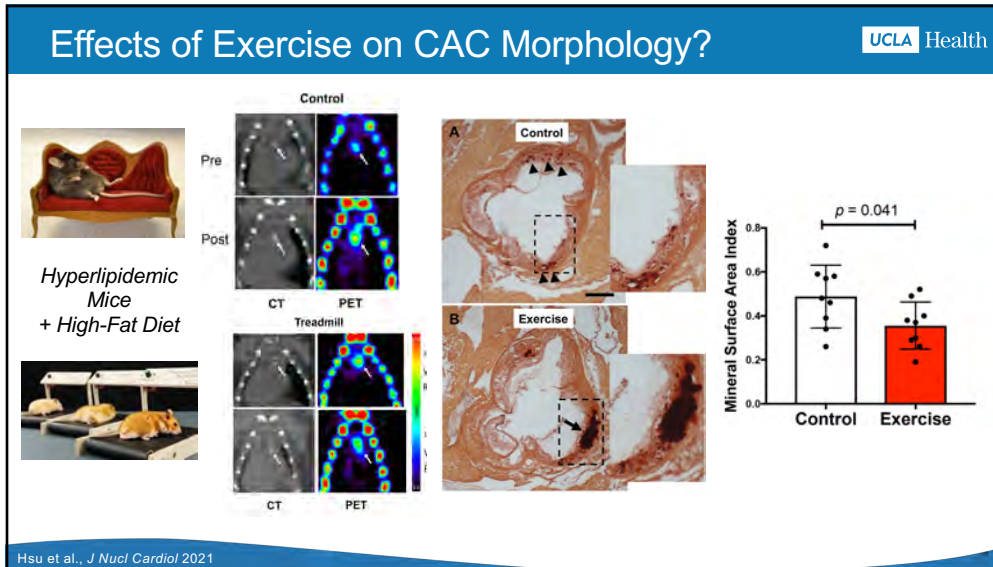
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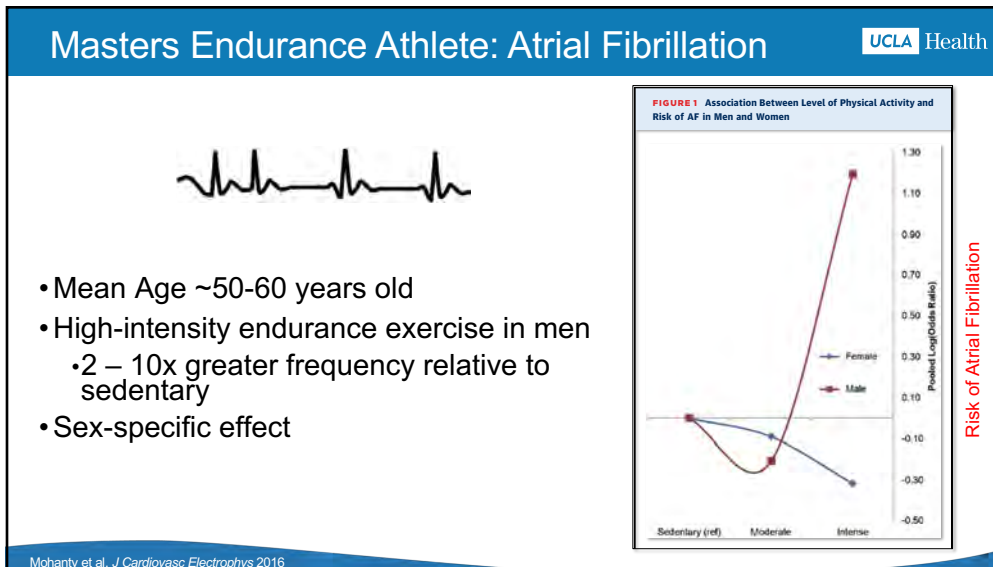
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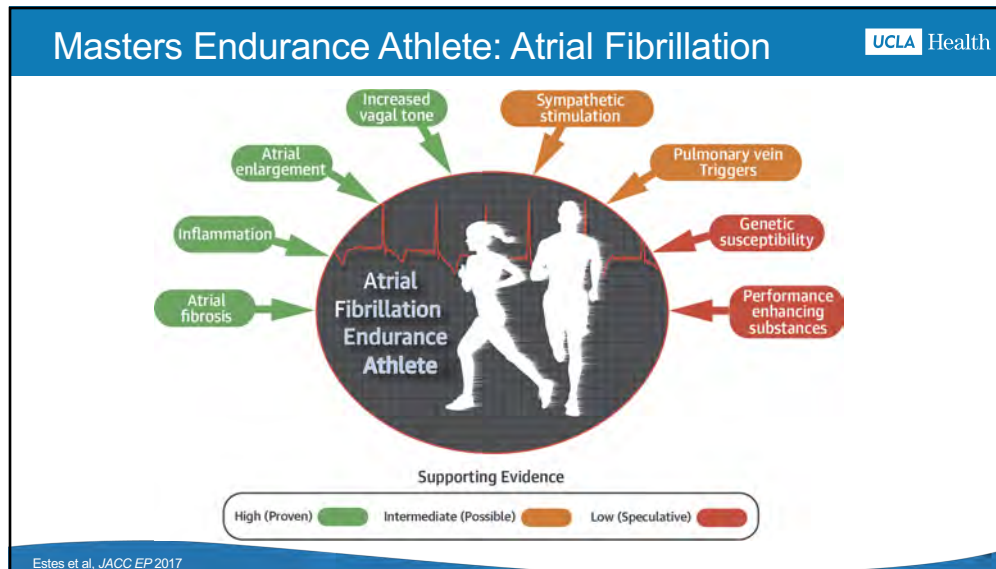
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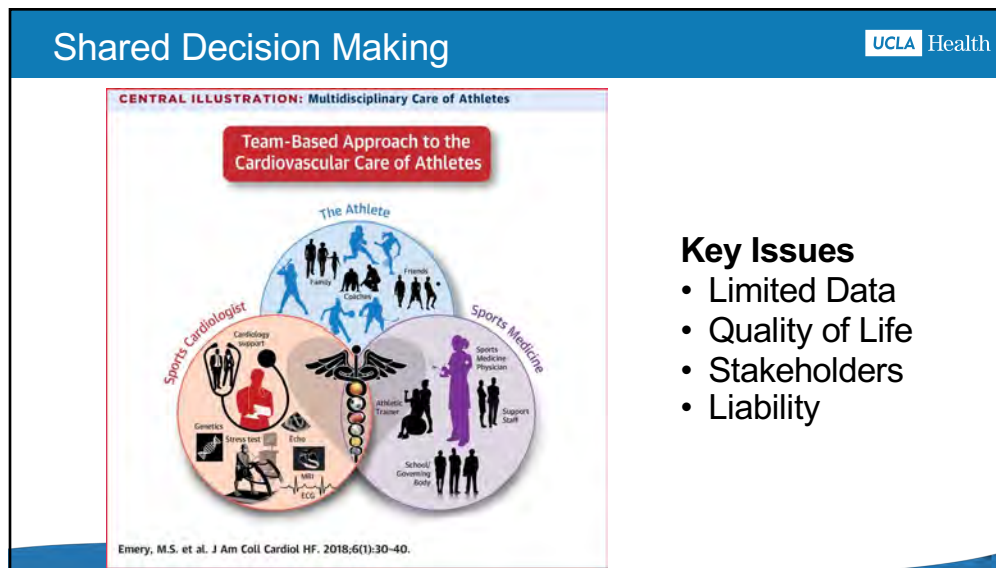
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Summary

What is Sports Cardiology?

Core Competencies

- Pre-Participation Screening
- Athlete's Heart vs Pathology
- Return to Play

Masters Athlete



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Acknowledgments

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ACC Athletic Heart 2022: Washington, DC



MGH Feb 2018



Lakers CPR Training 2018



ACC Athletic Heart 2019: Washington, DC


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Questions?

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