Essentials of Sports Cardiology in Prevention

Elizabeth H. Dineen, DO, FACC
University of California Irvine

13th Annual Orange County Symposium on Cardiovascular Disease Prevention
“In Pursuit of Prevention: New Advances in Cardiovascular Disease”
Saturday, October 30, 2021
Disclosures and conflict of interest

• None
Objectives

• Understand specialty of sports cardiology
• Review benefits of exercise
• In context of physical activity/athletics, discuss:
  • Hypertension
  • Coronary artery disease
  • Compliance/stiffness of the heart
  • Atrial fibrillation
• Risk assessment/evaluating the athlete
• Discuss controversies and data behind risks of exercise
Sports Cardiology

- **480 B.C.**  Father of sports medicine - Herodicus (480 B.C.)
  - Tutored Hippocrates and taught gymnastics
  - Proposed association between good diet and exercise with good health

- **201 B.C.** Galen of Pergamum first team doctor, physician for gladiators

- **2005** Sports cardiology integrated within section of preventive and rehabilitation cardiology by the ESC

- **2011** Emergence of the Exercise and Sports Cardiology Section by the ACC
  - Membership from 150 to over 4000 members within two years

Sports Cardiology

Core Curriculum for Providing Cardiovascular Care to Competitive Athletes and Highly Active People


CAHAP = competitive athletes and highly active people

EICR = exercise-induced cardiac remodeling
Prevention and the Athlete

• Hypertension
• Coronary artery disease
• Risk stratification/demands of sport
• Returning to sport post-MI
Defining the exposure targets

654,827 Men & Women, 82,465 deaths

No lower threshold for benefit
Steep early slope
About 70% of benefit reached by 8.25 MET-hr/wk
No apparent upper threshold
No obvious best amount
No evidence of increased risk at high end

150-300 Min MPA
@ 3.3 METs
(3 miles per hour)

Leisure time physical activity (MET-hr/wk)

Moore, et al. PLOS Medicine, 2012

From ACC Care of the Athletic Heart Conference 2021 **
Survey of 591 masters athletes (>35 y/o participating in competitive sport) in Boston.

64% had at least one traditional cardiovascular risk factor (family history, prior smoking, hyperlipidemia, etc).

10% had established cardiovascular disease (atrial fibrillation and ASCVD most commonly).

1 in 7 masters athletes were disappointed in the medical system for dismissing concerns given their athletic status.

^Figure showing prior exposure to CV screening tests.
Key: Athletes are not immune from traditional cardiovascular risk factors! Need to assess risk, counsel on diet, exercise and cholesterol-lowering medications, ex: statin, if indicated
Hypertension and the Athlete

- In general, exercise improves blood pressure, and decreases arterial stiffness as described later
- American style football has been associated with an increase in arterial stiffness and can increase blood pressure (J Kim et al, JAMA Cardiology 2019)
- Need to address potential risk factors: obesity, OSA, diet, medications/supplements (NSAIDS, OCPS), EtOH/drugs/performance enhancers
- Medication considerations: diuretics are generally banned in competitive sport, beta blockers can decrease performance and are banned in some skill sports (archery)

Differentiating the Athletic Heart From Pathology

Overview of the clinical assessment of the 4 cardinal "gray zone" conditions: hypertrophic cardiomyopathy (HCM), ischemic cardiomyopathy (ICM), dilated cardiomyopathy (DCM), and pericardial effusion (PE). The left panel shows the clinical factors associated with each condition, while the right panel presents the differential diagnoses. The middle panel highlights the imaging data associated with each condition. The figure is adapted from Martinez et al., JACC 2021.
Pre-Participation Evaluation for Masters Athletes (>35-years-old) for Exercise Program/Competition

- **CVD risk**
  - Low CVD risk (SCORE <5%)
    - No cardiovascular risk factors and physically active
    - No further investigations
  - High or very high CVD risk (SCORE ≥5%)
    - or other additional risk factors* or sedentary
    - Intensity of Physical Activity
      - Low
        - No further investigations
      - Intermediate
        - Maximal Exercise Test*, functional imaging† test or CTCA
      - High
        - High risk‡ features
        - Invasive coronary angiography
      - Very High
        - Normal
        - No further investigations
        - No restrictions
ESC SCORE is similar to ACC/AHA Pooled Cohort Risk Equation for predicting risk of having a cardiovascular event.
Case Example

60M Marathoner Cardiac Arrest During Marathon, s/p PCI to Severe Proximal Left Anterior Descending Lesion. Wants to Get Back Into Running Safely

LVEF 60%, no wall motion abnormalities
Residual 50-60% right coronary artery disease
Asymptomatic

Recommend maximum exercise test. If asymptomatic, no inducible ischemia or electrical instability, then consider graded return to sport with cardiac rehabilitation program. Wait at minimum 3 months to return to competition, level of intensity to be customized with shared decision-making. Can consider cardiac MRI to help risk stratify.

Importance of reducing cardiovascular risk factors and taking optimal medical therapy, including statin.
Conflicting data regarding statin use and muscle injury/exercise performance

Overall, statins tend to increase CK levels especially with increasing age. Statin benefits are still clear.

If symptoms, consider starting with lower doses of long acting statins (rosuva, atorva, pivastatin) every other day with ezetimibe.
The Exercise Paradox

All-cause mortality risk associated with each doubling of habitual physical activity volume, and by linear increase in physical activity.

Stewart et al, JACC, 2017
Eijsvogels, Sports cardiology, 2018

No exercise (highest risk)

Extreme Exercise Hypothesis

Most benefit of exercise

Current guidelines

Low

High

Low

High

Exercise training volume
Many of these topics are highly debated and still being evaluated.
Increased Coronary Artery Calcium…

Hearts of Stone?
Aengevaeren et al, Circulation, 2020
Higher levels of PA associated with lower mortality

<table>
<thead>
<tr>
<th>Physical Activity Category, MET-min/wk</th>
<th>CAC Category, HR (95% CI)</th>
<th>Age-Adjusted</th>
<th>Fully Adjusted*</th>
<th>Age-Adjusted</th>
<th>Fully Adjusted*</th>
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<tbody>
<tr>
<td>All-cause mortality</td>
<td></td>
<td></td>
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<tr>
<td>1500-2999</td>
<td>0.73 (0.53-1.01)</td>
<td>0.78 (0.56-1.07)</td>
<td>0.82 (0.62-1.10)</td>
<td>0.87 (0.65-1.17)</td>
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<td>≥3000</td>
<td>0.55 (0.32-0.94)</td>
<td>0.52 (0.29-0.91)</td>
<td>0.72 (0.49-1.08)</td>
<td>0.77 (0.52-1.15)</td>
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<tr>
<td>CVD mortality</td>
<td></td>
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<tr>
<td>1500-2999</td>
<td>0.69 (0.31-1.52)</td>
<td>0.66 (0.29-1.51)</td>
<td>0.58 (0.31-1.09)</td>
<td>0.66 (0.36-1.23)</td>
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<tr>
<td>≥3000</td>
<td>0.45 (0.11-1.83)</td>
<td>0.39 (0.08-1.79)</td>
<td>0.75 (0.36-1.54)</td>
<td>0.80 (0.39-1.64)</td>
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Analyzed through Cooper Center Longitudinal Study data
Coronary Artery Calcium: Current Perspective

• Calcium score of zero or lower CAC still carries better prognosis than higher score

• If score > 400 then recommend stress test (ideally sport specific, symptom limited max test). If abnormal stress test, then shared decision making regarding coronary angiogram, especially if only borderline abnormal

• Traditional risk factor assessment: lower LDL <50% of baseline, some advocate for <55 mg/dL, Mediterranean diet, blood pressure control
The major findings from the present study were as follows: (1) four to five weekly sessions of exercise over a lifetime was associated with a reduction in central arterial stiffness in seniors, similar to what we have previously observed regarding myocardial stiffness; (2) a lifelong casual exercise frequency (2–3 sessions per week) was associated with lower carotid artery stiffness, left ventricular afterload (Eai) and central blood pressures in the seniors, while this dose of exercise training did not affect the central arterial stiffness
Observational study. At least 4-5 exercise sessions/week (“committed exercisers”) continued for life show some preserved compliance and distensibility.
2 year study 28 exercise training vs 25 control in previously sedentary seniors. Exercise worked up to 5-6 hours/week including 2 HIIT sessions, 2 base pace workouts, a recovery day.

“Exercise is Medicine”

Howden et al, Circulation, 2018
12 of 102 marathon runners found to have late gadolinium enhancement on MRI (mix of CAD and non-CAD pattern)

*50% of cohort were current or prior smokers

**2 of 102 controls with CAD pattern vs 5 or 102 runners, p value becomes insignificant 0.44

***if CAD risk factors along with exercising then can develop ischemic pattern over time. Work on prevention/risk stratification

Levine Editorial Circulation 2015
In healthy seniors with well-documented long-term physical activity histories and cardiovascular fitness assessment, increasing levels of lifelong (>25 years) physical activity were not associated with focal areas of myocardial fibrosis.
Atrial Fibrillation

Mean age 52, 93% men. Odds Ratio 5.29

Abdulla et al, EP Europace, 2009
Mohanty et al, J Cardiovasc Electrophys, 2016
Atrial Fibrillation Endurance Athlete

Supporting Evidence

- Increased vagal tone
- Sympathetic stimulation
- Pulmonary vein Triggers
- Genetic susceptibility
- Performance enhancing substances

Objectives Revisited

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Thank You!

Comments/feedback/questions?

Beth Dineen, DO, FACC
dineene@uci.edu

Clinic locations: Newport Beach, Orange, soon to be Laguna Hills

Focus: Preventive, Integrative and Sports Cardiology