



ARISTOTLE UNIVERSITY OF THESSALONIKI, GREECE
SPORTS MEDICINE LABORATORY
DIRECTOR: PROF. E. KOUIDI

PREPARTICIPATION HEALTH SCREENING OF ATHLETES

ASTERIOS DELIGIANNIS
CARDIOLOGIST

EM. PROFESSOR OF SPORTS MEDICINE



No Conflict of Interest





Run for your life ...





- Exercise
- is...

...Health





14 April 2012 Last updated at 16:09 GMT



Italy footballer Morosini dies after collapse on pitch



Ημαθία: Πέθανε 17χρονος ποδοσφαιριστής - Κατέρρευσε μέσα στο γήπεδο



Newsroom , CNN Greece

① 09:27 Κυριακή, 17 Φεβρουαρίου 2019 - Ανανεώθηκε 09:36



NICOLA YAVIS

12:09 | 17-02-2019

Εαν ήμουν εισαγγελέας θα ζητούσα τον ιατρικό φάκελο του κακόμοιρου παιδιού και έπειτα θα επρατα! Μέχρι αποδημείας του εναντίον, οι εξετάσεις δεν πρέπει να είναι ολοκληρωμένες!

Συλλυπητήρια στους γονείς του παιδιού για τον αδικοχαμένο γιο τους!

**Έσπευσαν
άμεσα ο
γιατρός του
αγώνα Φ. Β.
και ο
αδελφός του
προπονητή
της
ΜελίκηςΒ.Ν.(
Νοσηλευτής-
Διασώστης
ΕΚΑΒ) οι
οποίοι του
έδωσαν τις
πρώτες
θεραπείες**

Κοινωνία / Γενικά

Δημοσίευση: 22 Φεβρουαρίου 2019 09:57

Αιφνίδιος θάνατος Εύζωνα στην Προεδρική Φρουρά

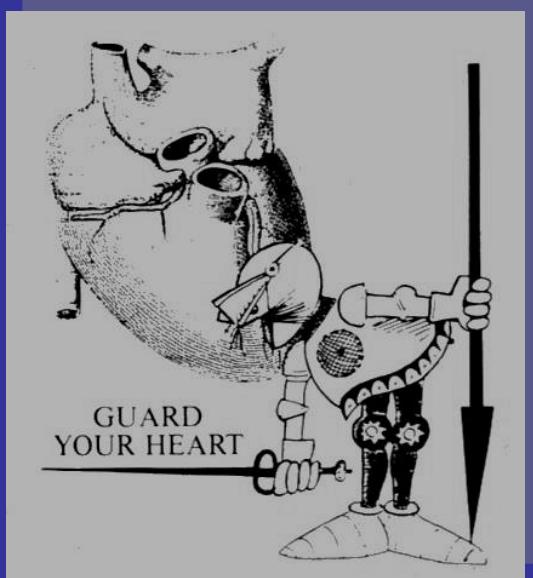
Αναστάτωση και θρήνος στην μονάδα για τον άδικο και πρόωρο χαμό του παλικαριού.

 Tweet  Like 299

 G+



EXERCISE PARADOX AND HEART



Systematic physical activity is associated with heart health, while intense exercise can lead to sudden death !

Barry J. Maron, M.D., 2000

QUESTION 1:

Journal of the American College of Cardiology
© 2003 by the American College of Cardiology Foundation
Published by Elsevier Inc.

Vol. 42, No. 11, 2003
ISSN 0735-1097/03/\$30.00
doi:10.1016/j.jacc.2003.03.002

Does Sports Activity Enhance the Risk of Sudden Death in Adolescents and Young Adults?

Domenico Corrado, MD, PhD,* Cristina Bassi, MD, PhD,† Giulio Rizzoli, MD,‡
Maurizio Schiavon, MD,§ Gaetano Thiene, MD†

Padua, Italy

OBJECTIVES

We sought to assess the risk of sudden death (SD) in both male and female athletes age 12 to 35 years.

BACKGROUND METHODS

Little is known about the risk of SD in adolescents and young adults engaged in sports. We did a 21-year prospective cohort study of all young people of the Veneto Region of Italy. From 1979 to 1999, the total population of adolescents and young adults averaged 1,386,600 (692,100 males and 694,500 females), of which 112,790 (90,690 males and 22,100 females) were competitive athletes. An analysis by gender of risk of SD and underlying pathologic substrates was performed in the athletic and non-athletic populations.

RESULTS

There were 300 cases of SD, producing an overall cohort incidence rate of 1 in 100,000 persons per year. Fifty-five SDs occurred among athletes (2.3 in 100,000 per year) and 245 among non-athletes (0.9 in 100,000 per year), with an estimated relative risk (RR) of 2.5 (95% confidence interval [CI] 1.8 to 3.4; $p < 0.0001$). The RR of SD among athletes versus non-athletes was 1.95 (CI 1.3 to 2.6; $p = 0.0001$) for males and 2.00 (CI 0.6 to 4.9; $p = 0.15$) for females. The higher risk of SD in athletes was strongly related to underlying cardiovascular diseases such as congenital coronary artery anomaly (RR 79, CI 10 to 3,564; $p < 0.0001$), arrhythmogenic right ventricular cardiomyopathy (RR 5.4, CI 2.5 to 11.2; $p < 0.0001$), and premature coronary artery disease (RR 2.6, CI 1.2 to 5.1; $p = 0.008$).

CONCLUSIONS

Sports activity in adolescents and young adults was associated with an increased risk of SD, both in males and females. Sports, *per se*, was not a cause of the enhanced mortality, but it triggered SD in those athletes who were affected by cardiovascular conditions predisposing to life-threatening ventricular arrhythmias during physical exercise. (*J Am Coll Cardiol* 2003; 42:1959–63) © 2003 by the American College of Cardiology Foundation

Sudden Cardiac Death

Sudden cardiac death is natural death due to cardiac causes, heralded by abrupt loss of consciousness within 1 hour of the onset of acute symptoms. Preexisting heart disease may or may not have been known to be present but the time and mode of death are unexpected.

Sudden Cardiac Death during Sport Activity

Sudden cardiac death during sport activity is an unexpected death without preceding symptoms which gets within 15 min from symptoms beginning. Preexisting heart disease may or may not have been known to be present but the time and mode of death are unexpected. Trauma or technical accidents during sport activity are not inclusive of this definition.

The rates of sudden cardiac death by cardiovascular diseases were 2.1 in 100,000 athletes per year, compared with 0,7 in 100,000 non athletes per year.



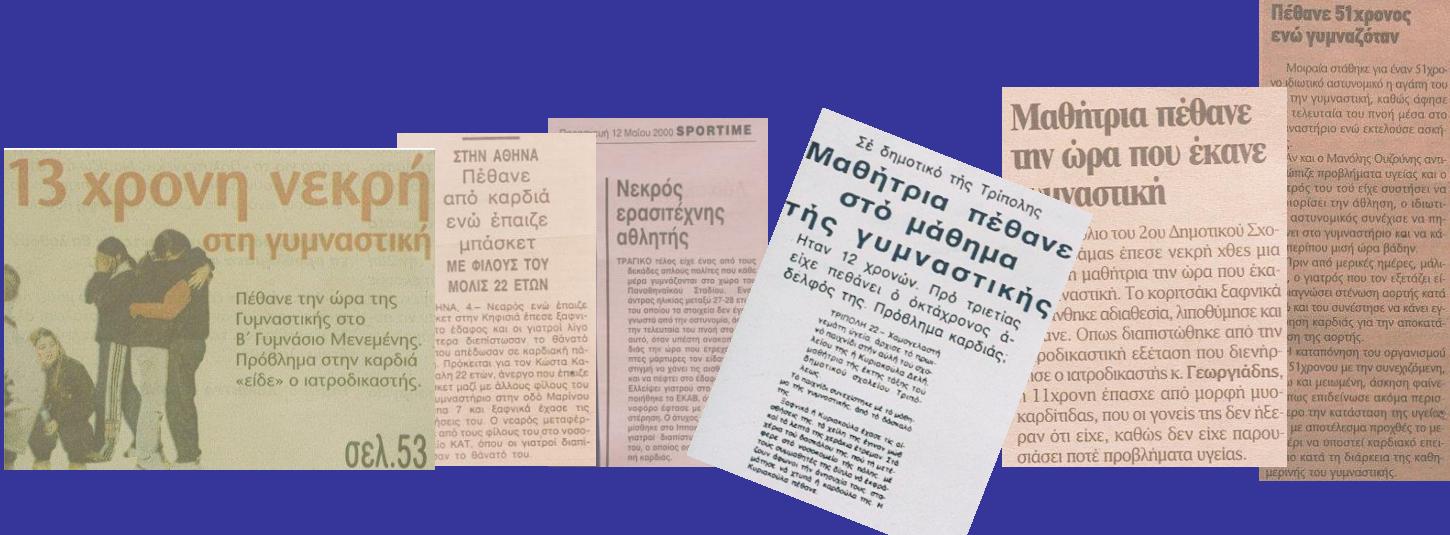
Πέθανε στο γήπεδο προπονήτρια

ERT.GR
28 Δεκ. 06

Τραγικό συμβάν κατά τη διάρκεια της προπόνησης του Ηρακλή Αμπελοκήπων, όπου η 31χρονη προπονήτρια Βάσω Μαιρουδάκη έχασε τη ζωή της από ανακοπή καρδιάς

Την τελευταία της πνοή ενώρα εφονδαίτιας άνωσε το απόνευμα η

Sudden cardiac death in young athletes usually occurs either during or immediately after athletic activity, suggesting that participation in competitive sports increases the likelihood of cardiac arrest.



Sudden Death During Different Types of Sport

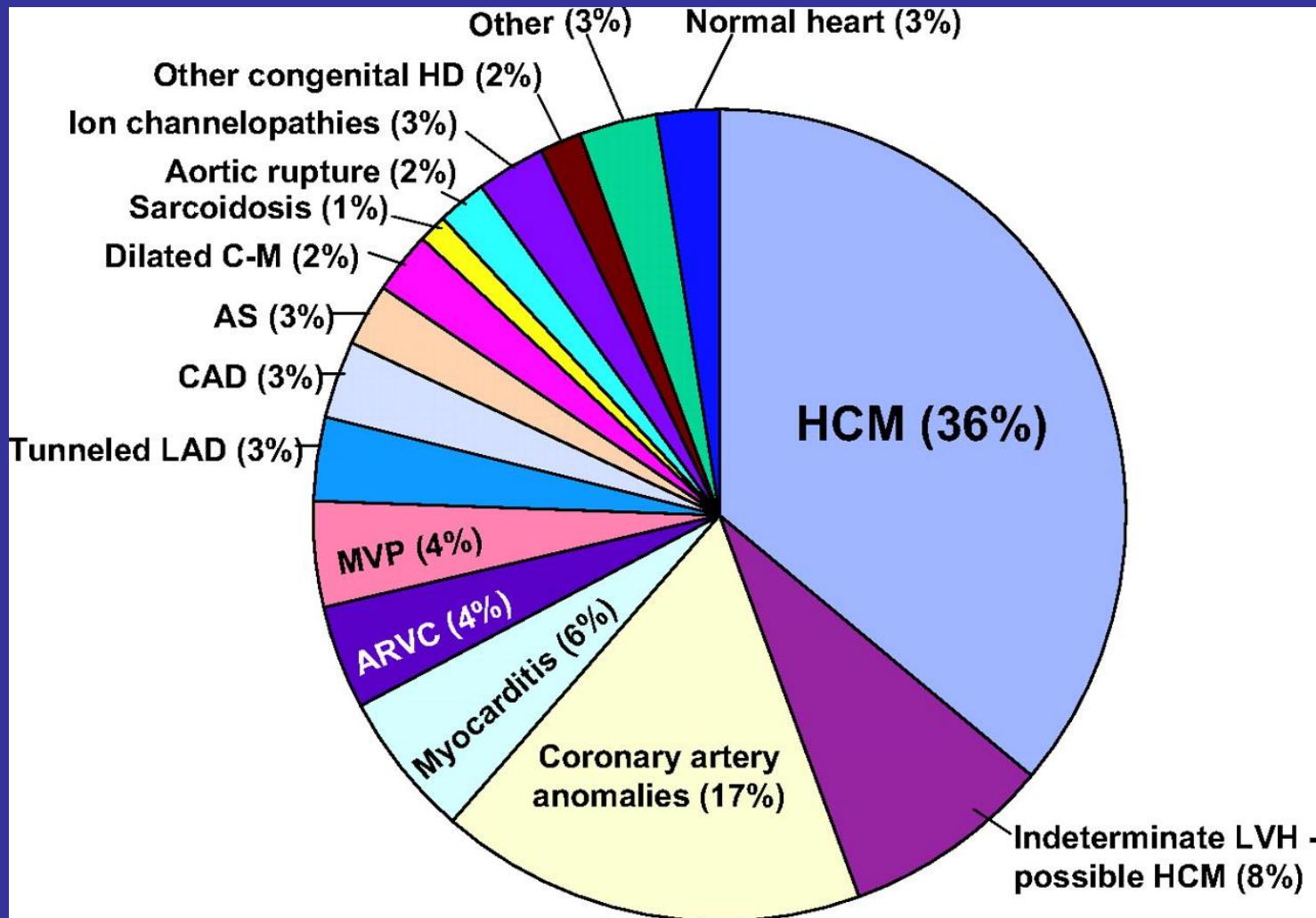
Types of Sport	Athletes %
Jogging	4,3
Tennis	3,2
Soccer	2,6
Other Ball Ga	1,6
Leisure sport	0,4

QUESTION 2

WHAT ARE THE COMMON CAUSES OF SCD
IN ATHLETES?



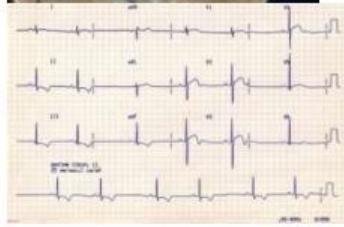
Figure. Distribution of cardiovascular causes of sudden death in 1435 young competitive athletes.



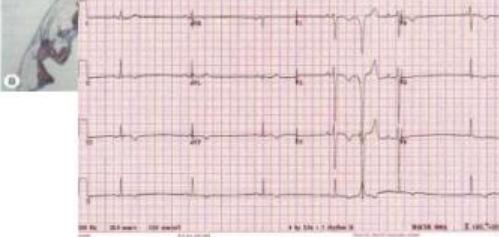
Maron BJ et al. Circulation 2007;115:1643-1655

American Heart Association 

Sudden Cardiac Death in Sport

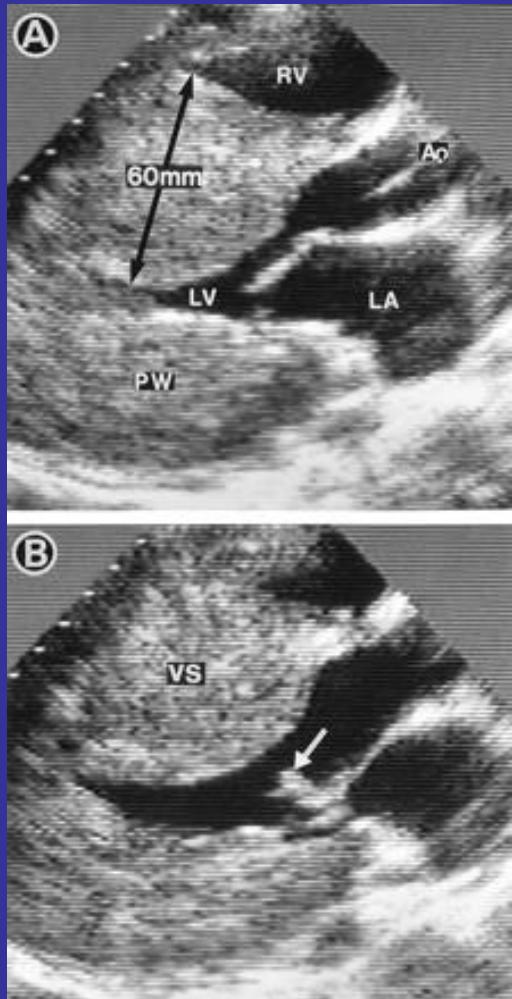


Hypertrophic
Cardiomyopathy



Arrhythmogenic right
ventricular cardiomyopathy

HOCM



Prevalence of the disease is 0.2% in the general population.

**Incidence, Cause, and Comparative Frequency
of Sudden Cardiac Death in National Collegiate
Athletic Association Athletes**
A Decade in Review

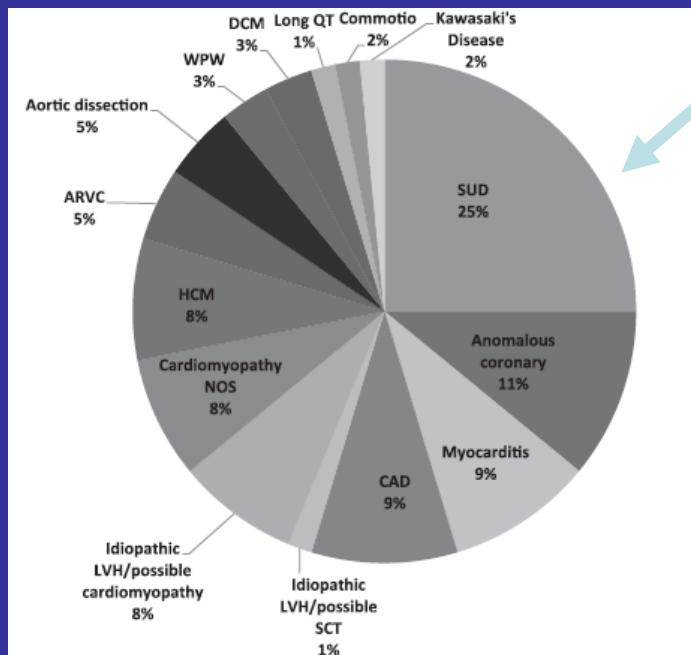
Circulation 2015 Jul 7;132(1):10-9

Kimberly G. Harmon, MD; Irfan M. Asif, MD; Joseph J. Maleszewski, MD;
David S. Owens, MD, MS; Jordan M. Prutkin, MD, MHS; Jack C. Salerno, MD;
Monica L. Zigman, MPH; Rachel Ellenbogen, MS; Ashwin L. Rao, MD;
Michael J. Ackerman, MD, PhD; Jonathan A. Drezner, MD

2003-2013

514 deaths

79 sudden cardiac deaths (15%)



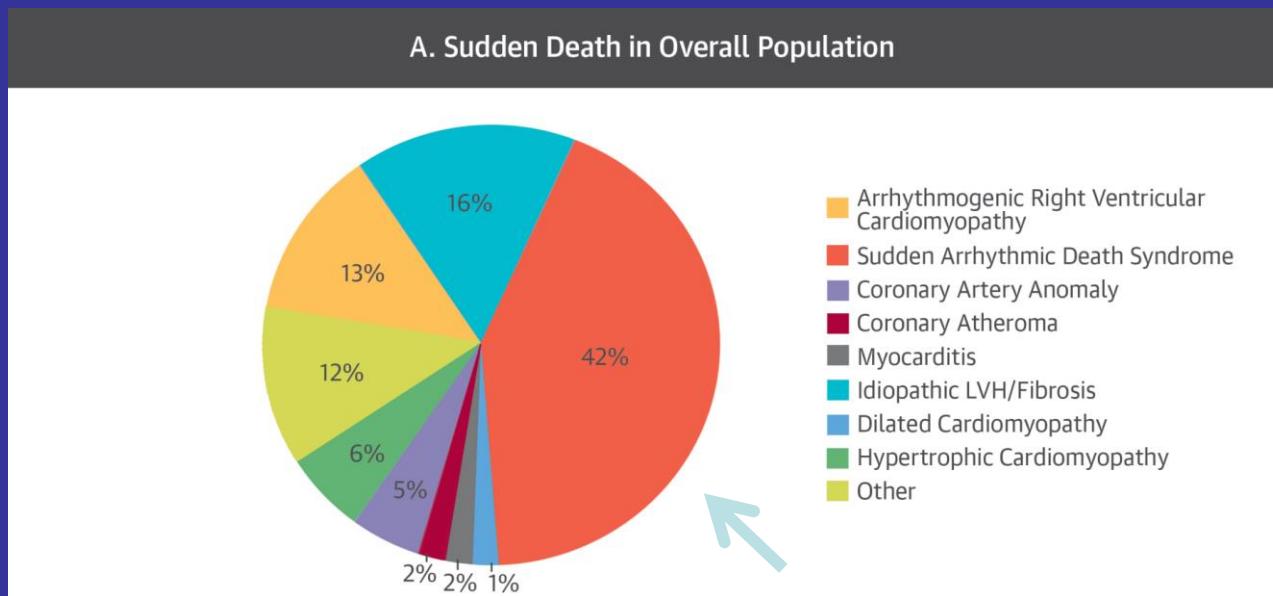
25% had a structurally
normal heart

Etiology of Sudden Death in Sports

Insights From a United Kingdom Regional Registry

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
© 2016 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
PUBLISHED BY ELSEVIER

357 consecutive athletes. Mean age 29 ± 11 years old.
92% Male. 69% competitive.



Finnocchiaro G, Sharma J Am Coll Cardiol. 2016;67(18):2108-2115

N Carolina basketball player died on court at Virginia game

| AP

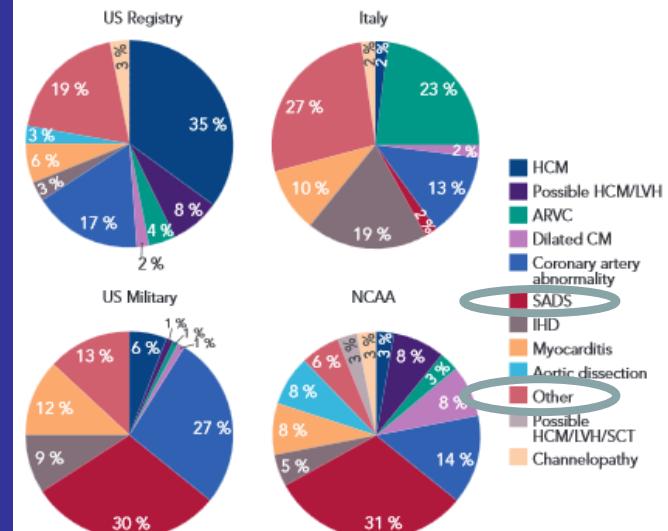
Updated 1:41 PM EDT May 27, 2018

Upshaw, 26, collapsed Saturday night at the DeltaPlex while playing during a game for the local NBA G-League team. He was rushed to the hospital, where he died late Monday morning after efforts to save his life failed. Upshaw also had a "slightly enlarged" heart.

Take at home:

Up to half of all sudden cardiac deaths may be associated with a structurally normal heart at postmortem examination and are referred to as autopsy negative sudden unexplained deaths.

Figure 1: Comparison of Causes of Sudden Cardiac Death



ARVC = arrhythmogenic cardiomyopathy; CM = cardiomyopathy; HCM = hypertrophic cardiomyopathy; IHD = ischaemic heart disease; LVH = left ventricular hypertrophy; NCAA = National Collegiate Athletic Association; SADS = sudden arrhythmic death syndrome; SCT = sickle cell trait. Reproduced with permission from Harmon et al.¹³ with data taken from Corrado et al.⁷

RISKS OF EXERCISE

Plaque rupture, coronary occlusion, ischaemia, and in turn ventricular fibrillation may also occur during exercise in young competitive athletes, but especially in middle aged or elderly runners or bikers who are not aware of existing plaques in their coronary arteries.

Exercise markedly increases blood flow velocity and pressure and induces inflammation with expression of cytokines such as interleukin-6 among others. Indeed, in marathon runners, excessive levels of these cytokines comparable to those found in sepsis have been reported.

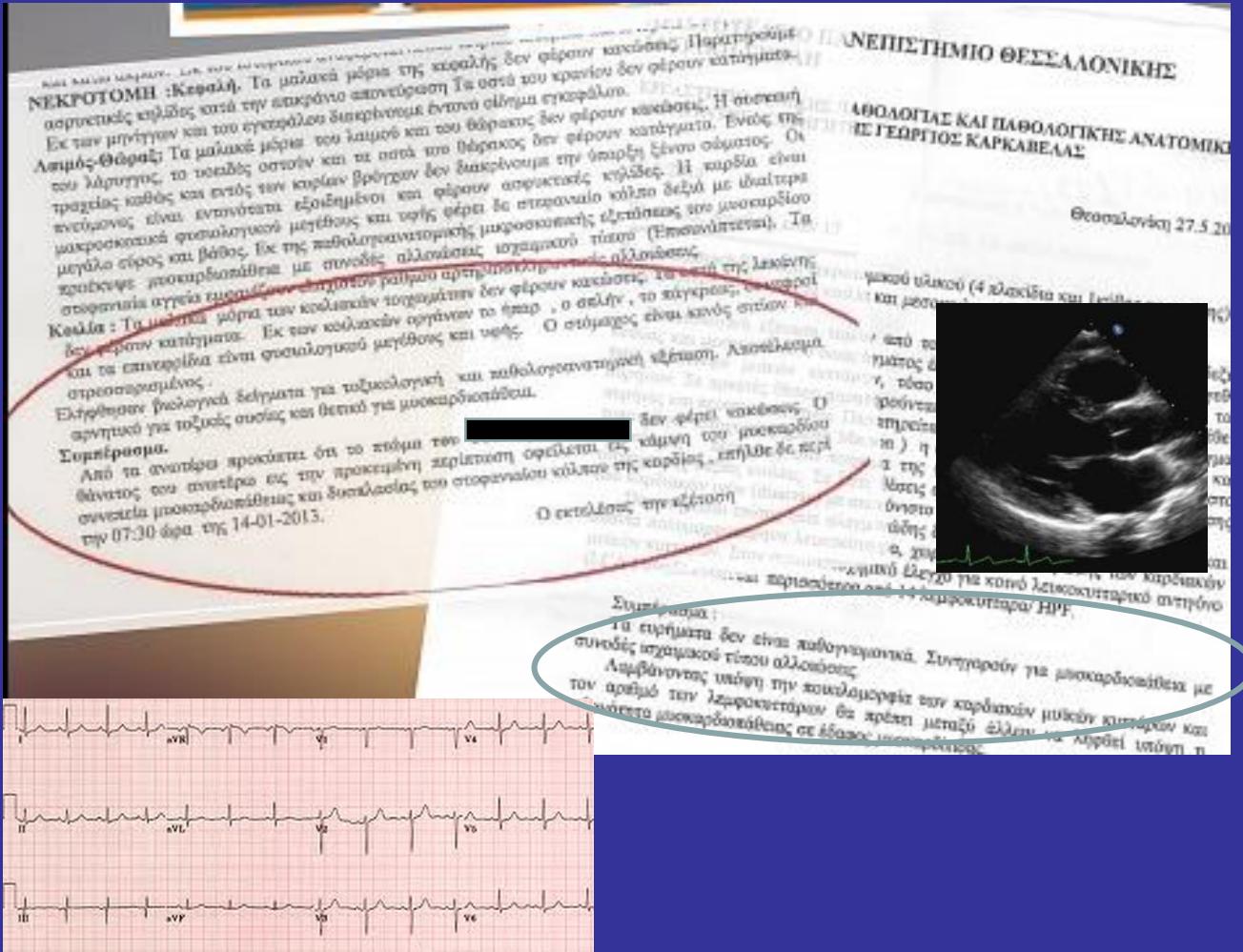
Sudden cardiac arrest in a marathon runner. A case report

F E Ghio,¹ M Pieri,² A Agracheva,² G Melisurgo,² A Ponti,^{✉1} and C Serini¹

► Author information ► Copyright and License information [Disclaimer](#)

- At the finishing line of a marathon (42 km and 195 m), a 37 y runner with no history of disease collapsed due to a cardiac arrest after 236 minutes of running. The cardiac arrest was witnessed by an advanced cardiac life support (ACLS) team that immediately started advanced cardiopulmonary resuscitation. During the treatment of the refractory cardiac arrest the patient developed an impressive pulmonary edema, his body temperature was 39°C. Further testing strategy included a coronary angiography that excluded coronary spasm, occlusion and anatomic anomalies, intra-aortic balloon pump positioning, transthoracic echocardiography revealing normal kinesis. After five days on veno arterial ECMO, brain death diagnosis was established and multi-organ donation was allowed (kidneys, bones, liver, femoral artery, cardiac valves, corneas). Autopsy revealed a diffuse cerebral edema, acute pulmonary stasis, a focal undermucosal colic hemorrhage and no definite cause of SCD.

Αιφνίδιος θάνατος εφηβου αθλητή



Electrical and Structural Adaptation in the Athlete's Heart

ECG

Bradycardia

AV block

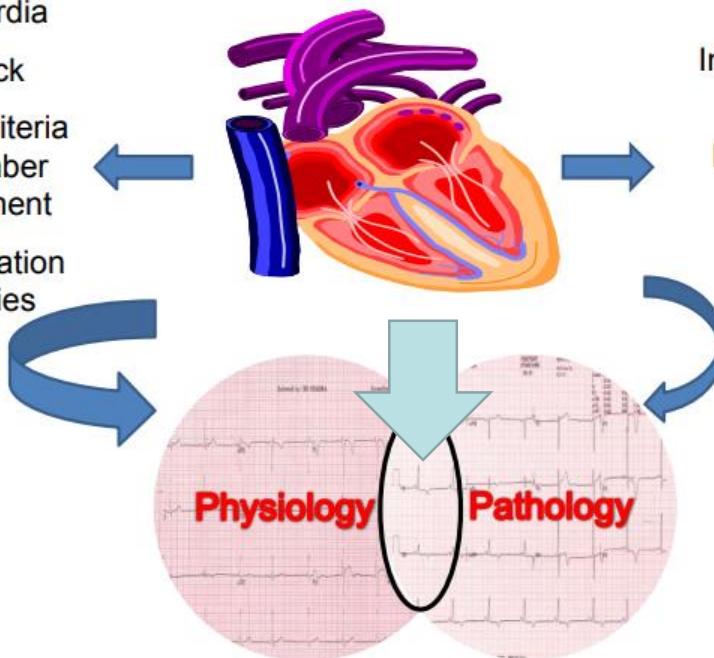
Voltage criteria
for chamber
enlargement

Repolarisation
anomalies

CARDIAC IMAGING

Increased cavity
size

Increased wall
thickness



INTENSE EXERCISE AND CARDIAC ARRHYTHMIAS

Heart block
PPM in 3% athletes vs. 0% non-athletes
*Balderesberger et al EHJ 2007
*Stein et al JACC 2002

Atrial flutter
• 31% vs. 8% are endurance athletes
*Claessen, La Gerche, Heidbuchel Heart 2011

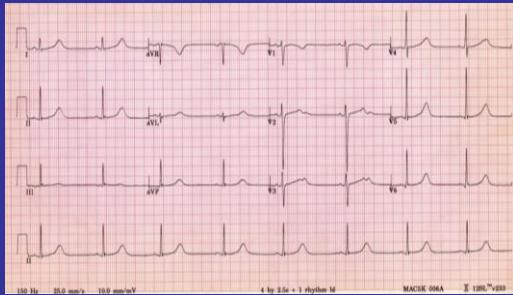
Atrial fibrillation
• 1% of community
• 3 – 10% athletes

Ventricular premature beats (ectopics)
Common in athletes
Usually completely safe
*Biffi JACC 2004

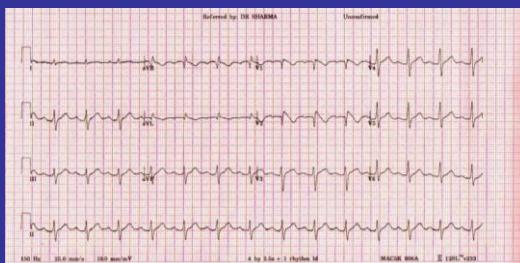
Ventricular tachycardia
Rare. Potentially serious
Most often of RV origin
??? More common in athletes
*Heidbuchel, Hoogsteen et al. EHJ 2003

LV Scar / arrhythmias
Schnell et al. BJSM 2015

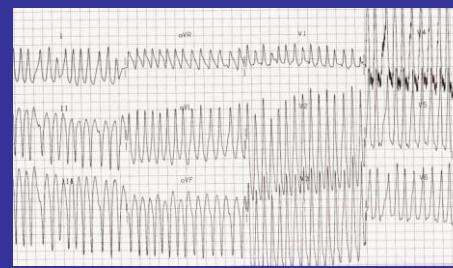
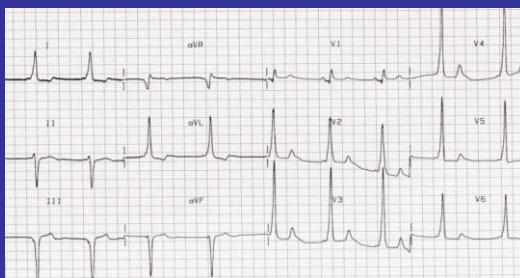
Sudden Cardiac Death with a Normal Heart



LQTS

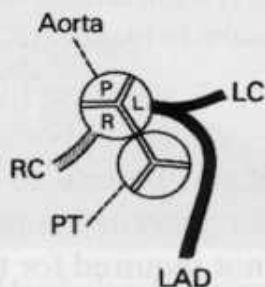


Brugada

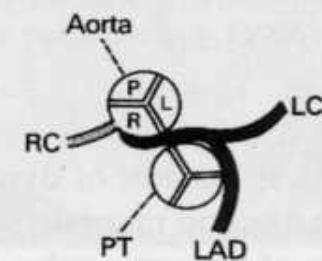


WPW

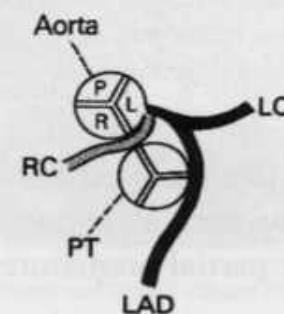
Congenital coronary artery anomalies



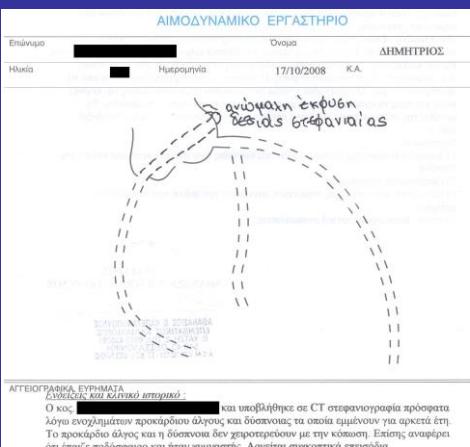
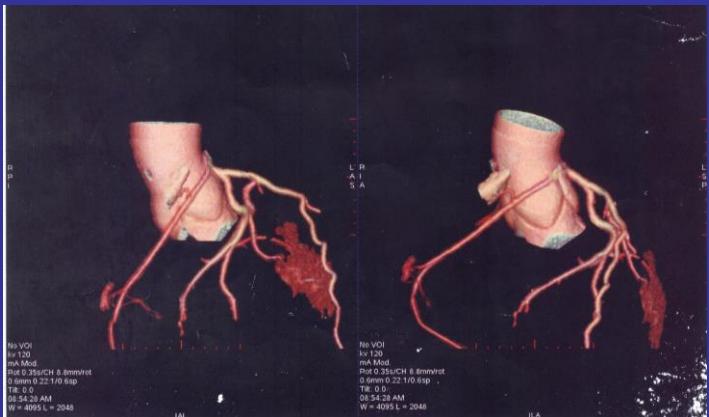
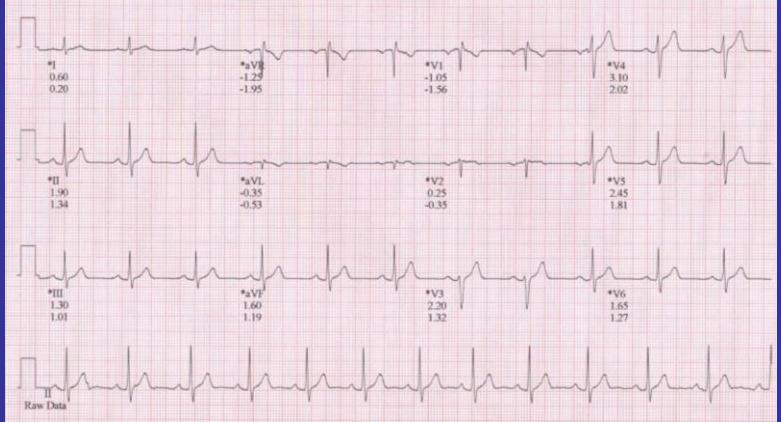
NORMAL



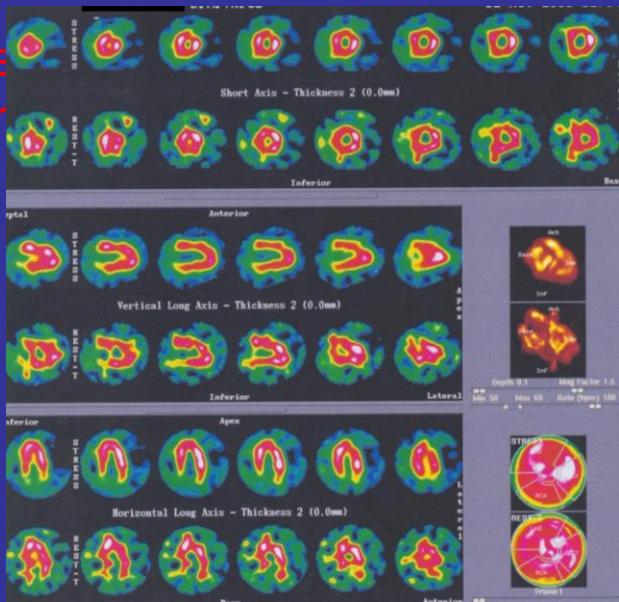
ORIGIN LEFT MAIN
FROM RIGHT (ANTERIOR)
SINUS OF VALSALVA



ORIGIN RIGHT
CORONARY FROM LEFT
SINUS OF VALSALVA



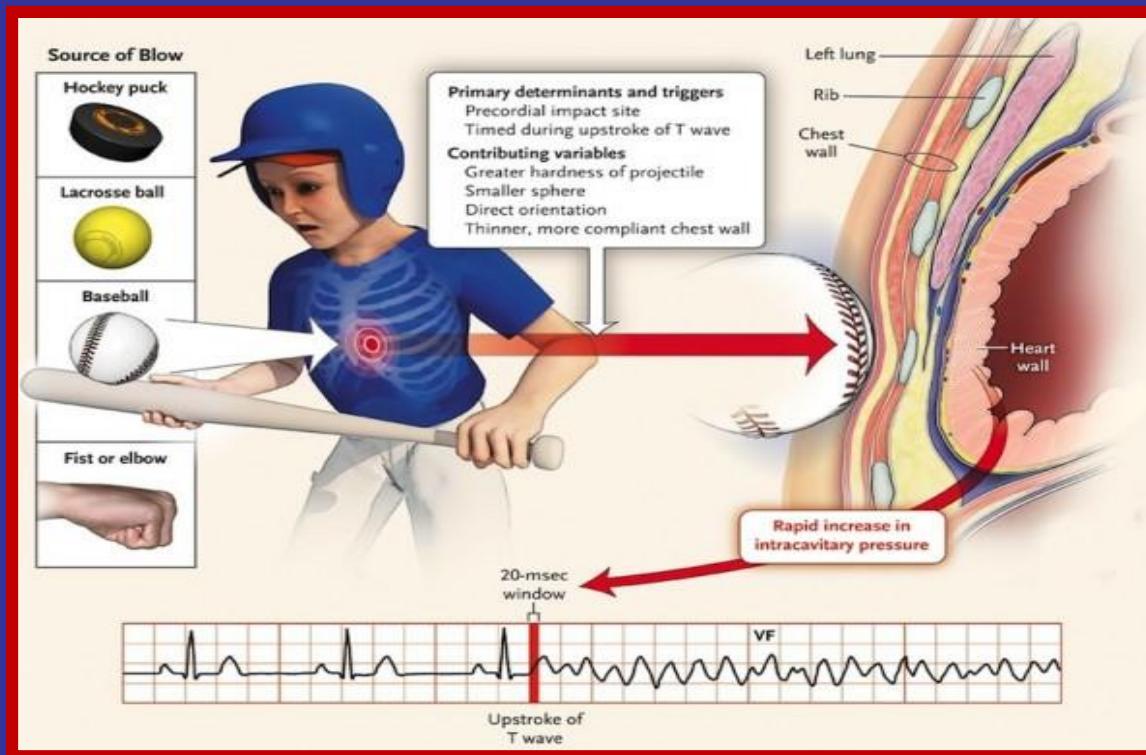
35 years old male soccer player with thoracic pain



Anomaly origin of right coronary artery

Cardiac Concussion

“Commotio Cordis”







**Dancing with the
Doping
...to Cardiac
Death !!!**

A.Deligiannis, Lisbon, 2014

Αυστρία: Κεραυνός «χτύπησε» σε ποδοσφαιρικό αγώνα – Οκτώ τραυματίες! (ΦΩΤΟ)

■ 8. Απριλίου, 2014 ■ Αθλητικά Εκπύπωση Μέγεθος Κειμένου: AAA



ΣΤΟ ΧΩΡΙΟ ΚΗΡΙΝΘΟΣ

Σοκ στην Εύβοια: Νεκρός από κεραυνό 28χρονος ποδοσφαιριστής μέσα στο γήπεδο!



Απίστευτη τραγωδία στην Εύβοια όταν ένας κεραυνός που έπεσε σε γήπεδο σκότωσε 28χρονο ερασιτέχνη ποδοσφαιριστή και τραυμάτισε άλλους 6 συμπαίκτες του.



- **BAD LUCK !**

Possible mechanisms of sudden cardiac death in top athletes: a basic cardiac electrophysiological point of view

András Varró • István Baczkó

Bad luck

ventricular tachycardia or ventricular fibrillation. On the level of the individual, however, as a contributor factor, misfortune should be emphasized as the most important factor, since in case the trigger extrasystole occurs even a fraction of a millisecond prior to or later than the vulnerability period, serious cardiac arrhythmia will not develop. In other words, even if all the objective prerequisites for arrhythmia development exist (substrate + trigger), the exact but random timing of the trigger extrasystoles will determine the induction of a lethal arrhythmic attack in a given individual. In the statistical sense, however, in competitive

QUESTION 3

Can sudden cardiac death in athletes be predicted or preventive



Cardiovascular Pathology xx (2010) xxx–xxx

CARDIOVASCULAR
PATHOLOGY

Review Article

Can sudden cardiac death be prevented?

Barry J. Maron*



Strategies for the prevention of sudden cardiac death during sports

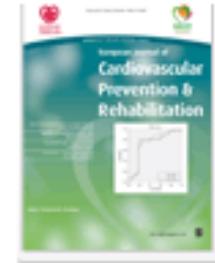
Domenico Corrado¹

Jonathan Drezner²

Cristina Bassi³

Antonio Pelliccia⁴

Gaetano Thiene³



European Journal of Cardiovascular
Prevention & Rehabilitation April 2011
vol. 18 no. 2 197-208

Pre-participation
Health Screening



Identification of
Target Groups
(High Risk Family)



Organization of
First Aids in
Arena



Int J Legal Med.

2016 Jan;130(1):59-66. doi: 10.1007/s00414-015-1237-8. Epub 2015 Jul 31.

Genetic screening in sudden cardiac death in the young can save future lives.

Stattin EL¹, Westin IM², Cederquist K², Jonasson J², Jonsson BA², Mörner S³, Norberg A², Krantz P⁴, Wisten A⁵

Using the landmark CASPER (Cardiac Arrest Survivors with Preserved Ejection Fraction) registry, 174 cardiac arrest survivors underwent genetic testing of 50 to 100 cardiac genes on average. The key finding was that 29 (17%) of cardiac arrest survivors had a pathogenic (disease-causing) mutation identified, of which 60% were in arrhythmia-related genes and 40% in cardiomyopathy-related genes..

Mellor G. Circ Cardiovasc Genet. 2017;10:e001686

**ΚΑΡΔΙΟΛΟΓΙΚΗ ΚΛΙΝΙΚΗ
ΠΑΝΕΠΙΣΤΗΜΙΟΥ
ΑΘΗΝΩΝ
ΕΛΙΚΑΡ**

**ΕΡΓΑΣΤΗΡΙΟ
ΑΘΛΗΤΙΑΤΡΙΚΗΣ ΤΕΦΑΑ ΑΠΘ
Α' ΚΑΡΔΙΟΛΟΓΙΚΗ ΚΛΙΝΙΚΗ
ΑΠΘ**

ΠΡΟΓΡΑΜΜΑ «ΦΕΙΔΙΠΠΙΔΗΣ»

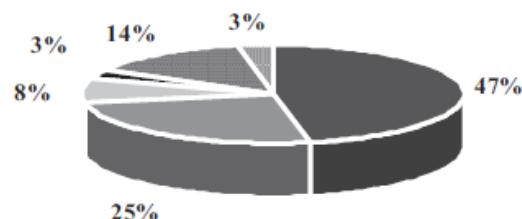
- Πρόγραμμα προληπτικού ιατρικού ελέγχου σε νέους αθλουμένους για τον αποκλεισμό επίκτητων και κληρονομικών καρδιαγγειακών παθήσεων**

FIRST AID IN ARENA IS LIFE-SAVE !



Effectiveness of Emergency Response Planning for Sudden Cardiac Arrest in United States High Schools With Automated External Defibrillators

Jonathan A. Drezner MD^{*}, Ashwin L. Rao MD, Justin Heistand MD, Megan K. Bloomingdale, and Kimberly G. Harmon MD



- At venue, accessible to the public
- At venue, accessible to ATC or medical personnel
- Nearby, brought to site from nearby building
- Nearby, brought to site from training room
- Brought by EMS
- Not reported

Figure 1. Location and access to AED. ATC indicates certified athletic trainer.

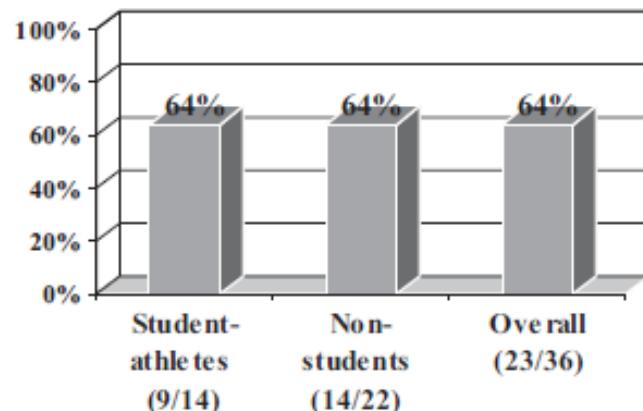


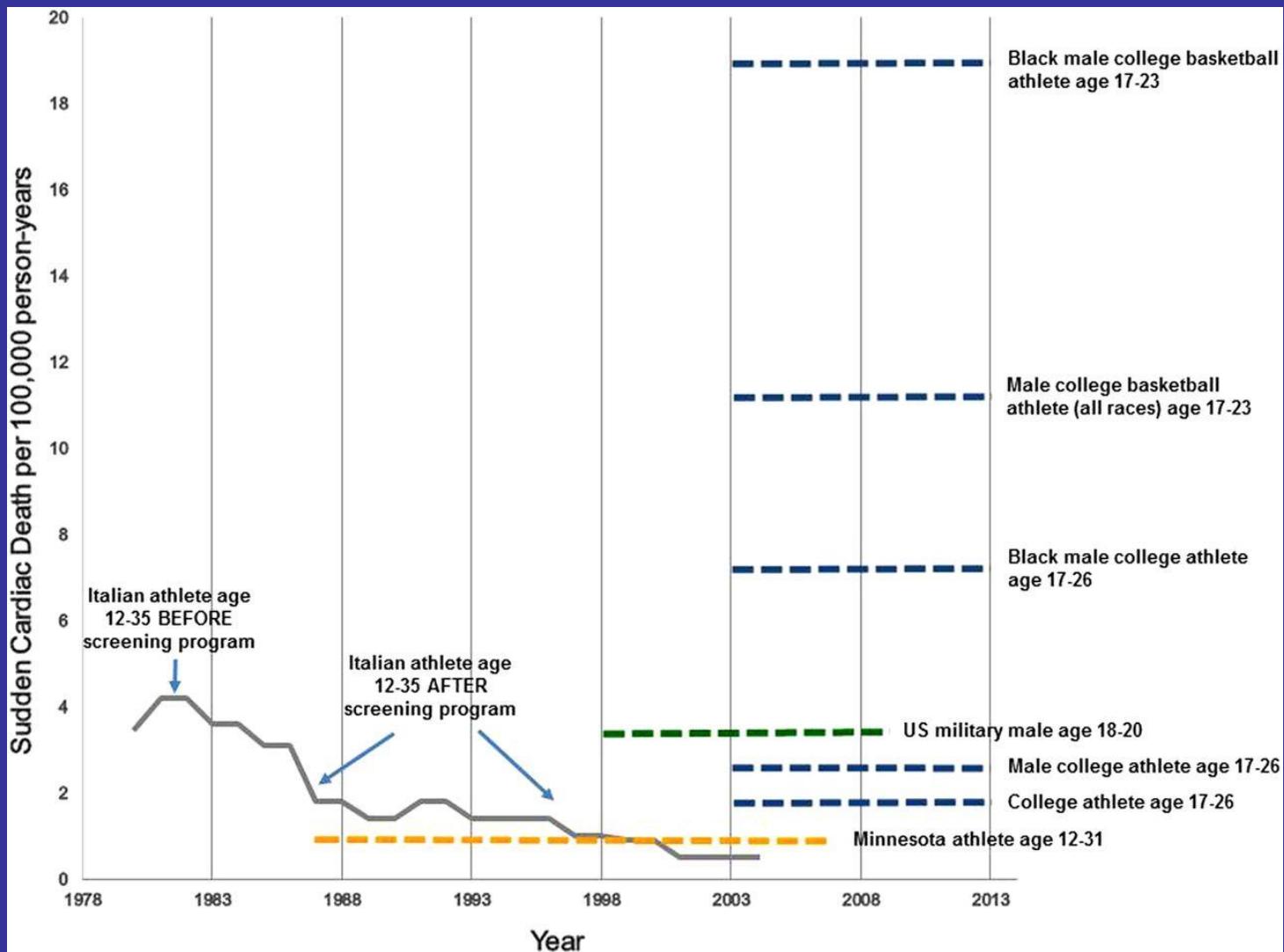
Figure 2. Survival to hospital discharge after SCA in high schools with AEDs.

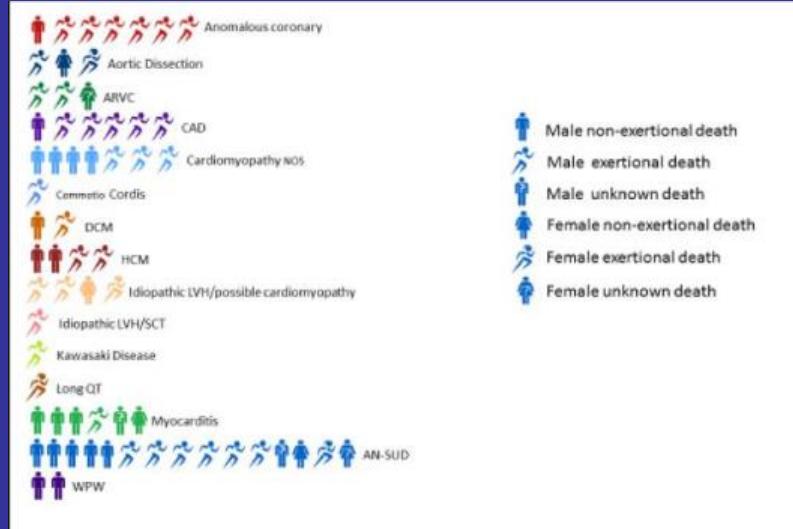
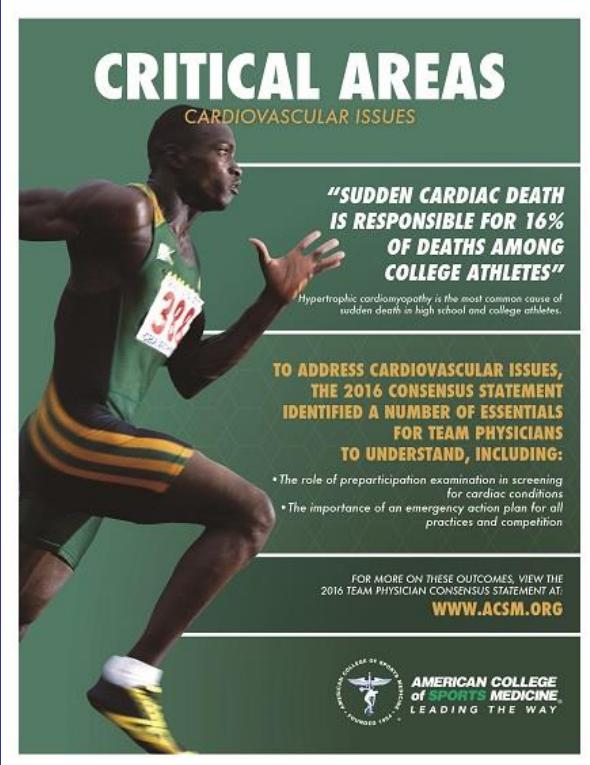
QUESTION 4

IS PRE-PARTICIPATION SCREENING OF ATHLETES NECESSARY?



PREPARTICIPATION SCREENING IS A LIFE-SAVING STRATEGY





A. Etiologies of sudden cardiac death in athletes.

B. Etiology and activity at time of death

Circulation. 2015 Jul 7; 132(1): 10–19.

The diagnosis of a cardiovascular disorder in a competitive athlete very frequently leads to the discontinuation of their sporting career due to concerns of disease progression and exercise-induced sudden cardiac death (SCD).

INTERRUPTION FREQUENCY OF SPORTS BECAUSE OF HEALTH DISORDERS

- 2.5% (125.408 athletes)

Zeppilli et al. 1990

- 1.8% (33.735 athletes)

Corrado et al. 1998

- ΙΑΤΡΙΚΟΣ ΕΛΕΓΧΟΣ
ΑΘΛΟΥΜΕΝΩΝ



ARISTOTLE UNIVERSITY OF THESSALONIKI
DEPARTMENT OF PHYSICAL EDUCATION & SPORTS SCIENCE
LABORATORY OF SPORTS MEDICINE
DIRECTOR: PROFESSOR A. DELIGIANNIS

CARDIOVASCULAR PRE-PARTICIPATION
SCREENING OF 32.205 ATHLETES:
A NORTHERN GREECE 20 YEARS EXPERIENCE



Deligiannis A. et al., HJC, 2013

SPORTS ACTIVITY DISQUALIFICATION

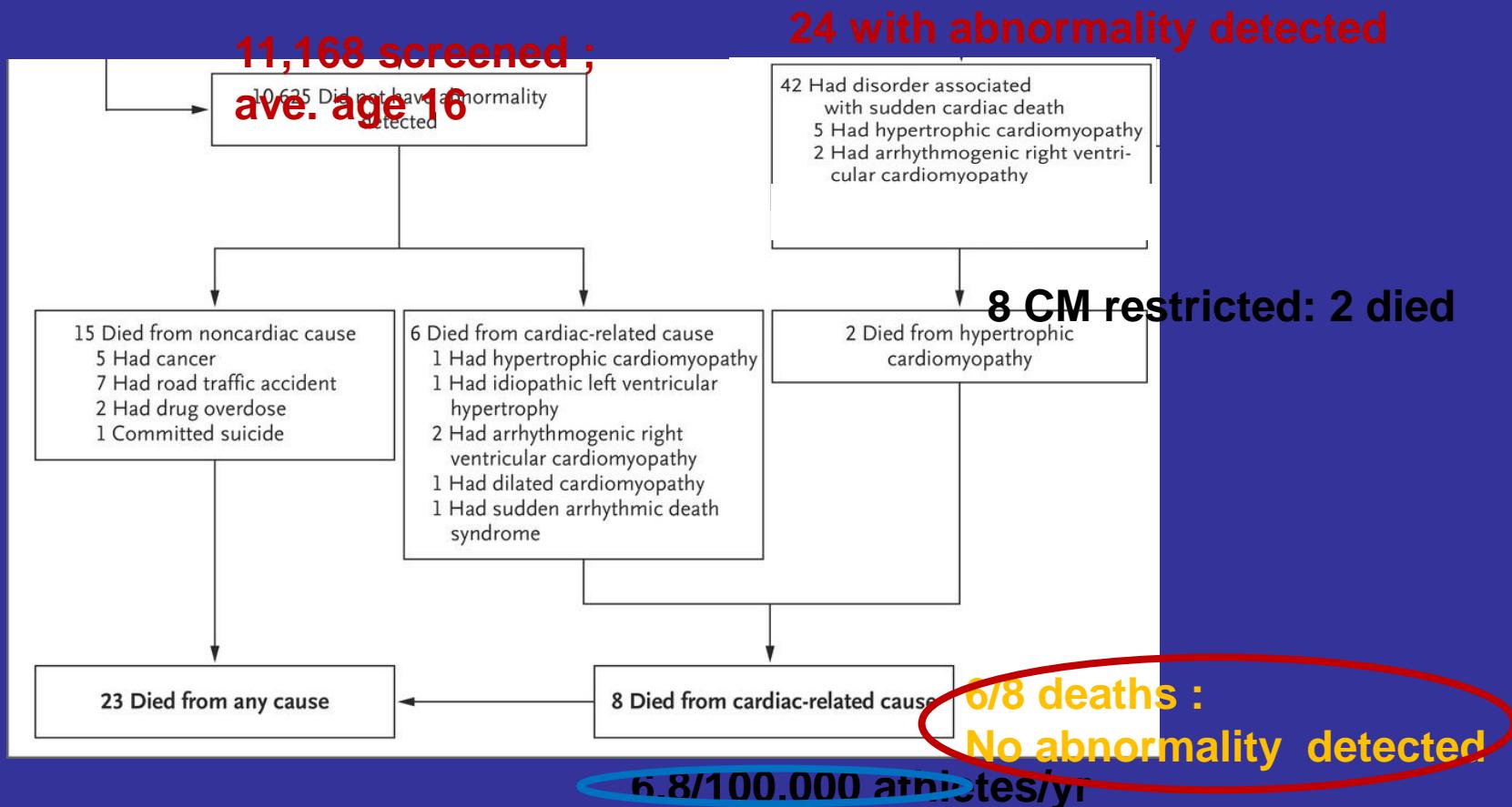
**DISQUALIFIED ATHLETES FROM ANY COMPETITIVE
SPORT ACTIVITY**

1 %

**✓ NO SUDDEN CARDIAC DEATH CASES
DURING 17 YEARS**

Evidence-based medicine does not support use of cardiovascular preparticipation screening in the USA. The heterogeneity of the US population, the lack of highly skilled screening practitioners, and the low prevalence of cardiovascular conditions lead to a high frequency of false-positive results.

Outcomes of Cardiac Screening in Adolescent Soccer Players Hx, ECG, Echo



Prevention: the highlight of ESC Congress 2009

Screening for all pre-sports children?

NO



'The time is definitely too early to recommend pre-participation screening,' says Asle Hirth from Haukeland University Hospital in Bergen, Norway.



YES



'The acceptance of this type of screening is gradually growing throughout the world,' says Erik Jan Meijboom from the University Hospital Vaudois in Lausanne, Switzerland.

Controversies relating to preparticipation cardiovascular screening in young athletes: time for a realistic solution?

M Papadakis,^{1,2} N Chandra,^{1,2} S Sharma^{1,2}

Curr Sports Med Rep. 2010 Mar-Apr;9(2):86-92. doi: 10.1249/JSR.0b013e3181d573d6.

Current controversies in the cardiovascular screening of athletes.

Drezner J¹, Berger S, Campbell R.

Editorials

SHOULD PREPARTICIPATION CARDIOVASCULAR SCREENING OF ATHLETES INCLUDE ECG?

Yes: Screening ECG Is Cost-Effective

PDF PRINT COMMENTS

SHARE

SANJAY SHARMA, MD, MBChB, BSc, FRCP, and LYNNE MILLAR, MB, BCh, BAO, St. George's University of London, London, United Kingdom

Am Fam Physician. 2015 Sep 1;92(5):338-339.

VS

NASCER E CRESCER - BIRTH AND GROWTH MEDICAL JOURNAL

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CARDIAC PREPARTICIPATION SCREENING FOR THE YOUNG ATHLETE: STILL A MATTER OF CONTROVERSY

Silvia Álvares

Cardiology Department of Centro Materno Infantil do Porto, Centro Hospitalar do Porto

NASCER E CRI

Birth and Growth Medical Journal

Editorials

SHOULD PREPARTICIPATION CARDIOVASCULAR SCREENING OF ATHLETES INCLUDE ECG?

No: There Is Not Enough Evidence to Support Including ECG in the Preparticipation Sports Evaluation

PDF PRINT COMMENTS

SHARE

RON WEXLER, MD, and N.A. MARK ESTES III, MD, Tufts Medical Center, Boston, Massachusetts

Am Fam Physician. 2015 Sep 1;92(5):343-344.

Prevention of SCD in athletes: The Needle in a Haystack?

Eur J Cardiovasc Prev Rehabil. 2011 Apr;18(2):194-6.

Preventing sudden cardiac death in athletes: finding the needle in the haystack or closing the barn door?

Mosterd A, Senden JP, Engelfriet P.

Department of Cardiology, Meander Medical Center, Amersfoort, The Netherlands.

PMID: 21450665 [PubMed - in process]

American Family Physician

PUBLISHED BY THE AMERICAN ACADEMY OF FAMILY PHYSICIANS

JUNE 1998

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Sudden Death in Young Athletes: Screening for the Needle in a Haystack

FRANCIS G. O'CONNOR, LTC, MC, USA,

QUESTION 5

ARE THERE COMMON RECOMMENDATIONS FOR
THE PRE-PARTICIPATION SCREENING OF
ATHLETES?

Europe vs. USA.
Who Wins?





Medical history*

Personal history

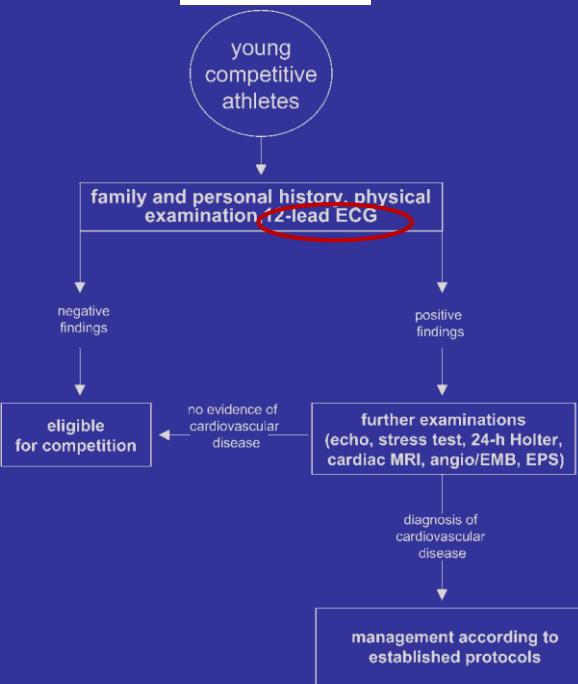
1. Exertional chest pain/discomfort
2. Unexplained syncope/near-syncope†
3. Excessive exertional and unexplained dyspnea/fatigue, associated with exercise
4. Prior recognition of a heart murmur
5. Elevated systemic blood pressure

Family history

6. Premature death (sudden and unexpected, or otherwise) before age 50 years due to heart disease, in ≥1 relative
7. Disability from heart disease in a close relative <50 years of age
8. Specific knowledge of certain cardiac conditions in family members: hypertrophic or dilated cardiomyopathy, long-QT syndrome or other ion channelopathies, Marfan syndrome, or clinically important arrhythmias

Physical examination

9. Heart murmur‡
10. Femoral pulses to exclude aortic coarctation
11. Physical stigmata of Marfan syndrome
12. Brachial artery blood pressure (sitting position)§





ESC Report

Cardiovascular pre-participation screening of young competitive athletes for prevention of sudden death: proposal for a common European protocol

Consensus Statement of the Study Group of Sport Cardiology of the Working Group of Cardiac Rehabilitation and Exercise Physiology and the Working Group of Myocardial and Pericardial Diseases of the European Society of Cardiology

Domenico Corrado^{1*}, Antonio Pelliccia², Hans Halvor Bjørnstad³, Luc Vanhees⁴, Alessandro Biffi², Mats Borjesson⁵, Nicole Panhuyzen-Goedkoop⁶, Asterios Deligiannis⁷, Erik Solberg⁸, Dorian Dugmore⁹, Klaus P. Mellwig¹⁰, Deodato Assanelli¹¹, Pietro Delise¹², Frank van-Buuren¹⁰, Aris Anastasakis¹³, Hein Heidbuchel⁴, Ellen Hoffmann¹⁴, Robert Fagard⁴, Silvia G. Priori¹⁵, Cristina Basso¹⁹, Eloisa Arbustini¹⁶, Carina Blomstrom-Lundqvist¹⁷, William J. McKenna¹⁸, and Gaetano Thiene¹⁹

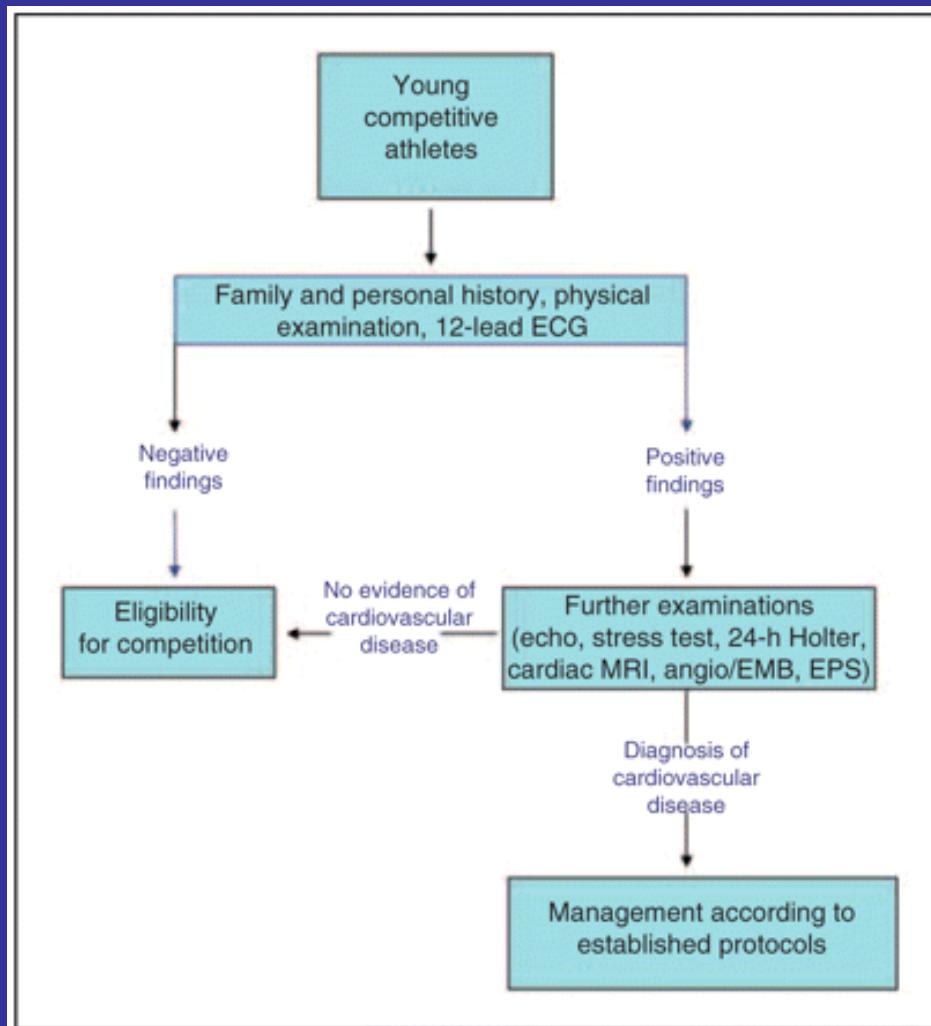
Review Article

Recommendations for the Cardiovascular Screening of Athletes

ASTERIOS DELIGIANNIS¹, ARIS ANASTASAKIS², LOIZOS ANTONIADES³, GEORGIOS BOBOTIS⁴, PARASCHOS GELERIS⁵, JOHN GOUDENOS⁶, GEORGIOS HAHALIS⁷, EVANGELIA KOUIDI¹, ATHANASIOS KRANIDIS⁸, DIMITRIOS KREMASTINOS⁹, JOHN LEKAKIS¹⁰, GEORGIOS PARCHARIDIS¹⁰, VLASSIS PYRGAKIS¹¹, GEORGIOS RONTOGIANNIS¹², CHRISTODOULOS STEFANADIS², IOANNIS STYLIADIS¹⁰, PANOS VARDAS¹³

¹Sports Medicine Laboratory, Aristotle University of Thessaloniki, ²First Department of Cardiology, Hippokration Hospital, University of Athens, Greece; ³Cardiology Department, Nicosia General Hospital, Cyprus; ⁴Second Cardiology Department, Papageorgiou Hospital, Thessaloniki, ⁵Second Propedeutic Department of Internal Medicine, Hippokration Hospital, Aristotle University of Thessaloniki, ⁶Department of Cardiology, University Hospital, Ioannina, ⁷Internal Medicine Department, Patras University Hospital, ⁸First Cardiac Department, Evangelismos Hospital, Athens, ⁹Second University Department of Cardiology, Attikon Hospital, Athens, ¹⁰First Cardiology Department, AHEPA Hospital, Aristotle University of Thessaloniki, ¹¹Cardiology Department, "G. Gennimatas" Hospital, Athens, ¹²Sports Medicine Laboratory, University of Thessaly, ¹³Cardiology Department, Heraklion University Hospital, Crete, Greece

ESC STUDY GROUP OF SPORTS CARDIOLOGY RECOMMENDATIONS FOR PREPARTICIPATION SCREENING OF YOUNG ATHLETES



The 12-Element AHA Recommendations for Preparticipation Cardiovascular Screening of Competitive Athletes

Medical history*

Personal history

1. Exertional chest pain/discomfort
2. Unexplained syncope/near syncope†
3. Excessive exertional and unexplained dyspnea/fatigue associated with exercise
4. Prior recognition of a heart murmur
5. Elevated systemic blood pressure

Family history

6. Premature death (sudden and unexpected or otherwise) before 50 y of age resulting from heart disease in ≥ 1 relative
7. Disability from heart disease in a close relative < 50 y of age
8. Specific knowledge of certain cardiac conditions in family members: hypertrophic or dilated cardiomyopathy, long-QT syndrome or other ion channelopathies, Marfan syndrome, or clinically important arrhythmias

Physical examination

9. Heart murmur‡
10. Femoral pulses to exclude aortic coarctation
11. Physical stigmata of Marfan syndrome
12. Brachial artery blood pressure (sitting position)§

- **History**
 - Screen for medications and drugs of abuse that can have potential cardiotoxic effects (Beta agonists, Theophylline, TCA's, Macrolides, Pseudoephedrine, Phenylpropanolamine, Tobacco, Alcohol, Cocaine, Amphetamines, Ephedrine, and Anabolic Steroids)
- **Questions to ask...**
 - Have you ever passed out during or after exercise?
 - Have you ever been dizzy during or after exercise?
 - Have you ever had chest pain during or after exercise?
 - Do you get tired more quickly than your friends do during exercise?
 - Have you ever had racing of your heart or skipped heart beats?

- Yes, more questions
 - Have you had high blood pressure or high cholesterol?
 - Have you ever been told you have a heart murmur?
 - Has any family member or relative died of heart problems or sudden death before age 50?
 - Have you had a severe viral infection within the last month (ie. Myocarditis or mononucleosis)
 - Has a physician ever denied or restricted your participation in sports for any heart problems?

- **Physical Exam**
 - **Vitals:**
 - **BP:** Elevated readings confirmed
 - Proper technique
 - **Pulse:** Rate of rise, Contour, Volume, consistency
 - Normal
 - Pulsus Bisferiens – Seen in AS, Aortic regurge, HCM
 - Coarctation of aorta – ie. HTN in arms, but weak femoral pulses AND/OR femoral pulse lags behind that of the radial artery

BLOOD PRESSURE IN YOUNG ATHLETES

- <<WHITE COAT>> PRESSURE 4.4 %
- TRUE PRESSURE 0.5%

Kouidi et al. Am J Hypertens, 1999

- **Indications for echo:**
 - All Diastolic Murmurs
 - Holosystolic murmurs
 - Murmurs Grade 3/6 and above
 - Any murmur that examiner isn't sure about...ie. CYA?
- **Features of “Innocent Murmurs”:**
 - Low in intensity and midsystolic in timing, normal splitting, normal DYNAMIC auscultation, absence of a specific pattern of radiation, asymptomatic.

Additional Testing

American Heart Assoc. Guidelines:

exercise ECG screening test

men > 40-45 years of age

women > 50-55 years of age (or postmenopausal)

with 1 independent coronary risk factor

hypercholesterolemia or dyslipidemia including low HDL

systemic hypertension

current or recent cigarette smoking

diabetes mellitus

A history of myocardial infarction or SCD in a first-degree relative aged < 60 years.

ΚΑΡΤΑ ΥΓΕΙΑΣ ΑΘΛΗΤΗ



Ελληνική Ποδοσφαιρική Ομοσπονδία
HELLENIC FOOTBALL FEDERATION

Η Κάρτα Υγείας Αθλητή αποτελεί προσωπικό έγγραφο του αθλητή, βρίσκεται στην κατοχή του και ισχύει για ένα (1) έτος από τη θεώρησή της.

The Athlete's Health Card is a personal document of the athlete, is in the possession of the athlete and is valid for one (1) year following the certification thereof.

Η Κάρτα Υγείας Αθλητή θεωρείται MONON από Ιατρούς όπως ορίζεται στην οικεία κοινή υπουργική απόφαση του Υπουργείου Υγείας και του Υφυπουργού Πολιτισμού και Αθλητισμού.

The Athlete's Health Card is certified SOLELY by cardiologists, as specified in the relevant joint ministerial decision of the Minister of Health and the Deputy Minister of Culture and Sports.

Η Κάρτα Υγείας Αθλητή συνιστά αυτοτέλες έγγραφο και δε συνδέεται με το Δελτίο Αθλητικής Ιδιότητας.

The Athlete's Health Card is a stand-alone document and is not linked to the Player's ID Card.

Η Κάρτα Υγείας Αθλητή προσκομίζεται υποχρεωτικά στον αρμόδιο Διαιτητή κάθε είδους αθλητικής εκδήλωσης αγωνιστικού χαρακτήρα ως βασική προϋπόθεση συμμετοχής στον αγώνα.

The Athlete's Health Card is submitted mandatorily to the competent Referee of any sports event as a basic



Ελληνική Ποδοσφαιρική Ομοσπονδία
HELLENIC FOOTBALL FEDERATION

ΑΡΜΗΤΡΟΥ ΕΠΟ:
HFF REGISTRATION NR



ΟΝΟΜΑ:
NAME
ΕΠΙΦΕΤΟ:
SURNAME
ΠΑΤΡΩΝΥΜΟ:
FATHER'S NAME
ΗΜΕΡΗΝΗΣΗΣ:
DATE OF BIRTH
ΑΜΚΑ:
SOCIAL SECURITY NR.

Οι κάτιωση ιατρός πιστοποιεί ότι οι οιν ανωτέρω επιτρέπεται να συμμετάσχει στο παραπάνω άθλημα (προετοιμασία και συγνώνες) και έχει υποβληθεί στις προβλεπόμενες Ιατρικές Εξετάσεις

The undersigned doctor certifies that the aforementioned may participate in the above sport (preparation and matches) and has been submitted to the foreseen medical examinations.

Ημερομηνία: / /
Date

Ονοματεπώνυμο και σφραγίδα Ιατρού
(Υποχρεωτικά και επάνω στη φωτογραφία)
Doctor's name and seal
(mandatory also on the photograph)



Κάρτα Υγείας Αθλητή

(ΦΕΚ Τεύχος Β 3254/08.08.2018)

Άρθρο 3 Έκδοση και Ισχύς:

1. Η Κάρτα Υγείας Αθλητή εκδίδεται και ανανεώνεται από τις Εθνικές Αθλητικές Ομοσπονδίες. Η έκδοση και ανανέωση της γίνεται ατελώς, χωρίς καμία οικονομική επιβάρυνση των αθλητικών σωματείων και των αθλητών και ισχύει για ένα (1) έτος από τη θεώρηση της.
2. Εκδίδεται μόνον κατόπιν των εξής υποχρεωτικών εξετάσεων:
 - α) Κλινική εξέταση
 - β) Ατομικό και οικογενειακό ιατρικό ιστορικό
 - γ) Ηλεκτροκαρδιογράφημα.
3. Αναλόγως των ευρημάτων των ως άνω υποχρεωτικών εξετάσεων και εφόσον οι ιατροί της παρ. 1 του άρθρου 4 κρίνουν σύμφωνα με την επιστημονική κρίση τους απαραίτητη την περαιτέρω διερεύνηση, δύνανται να παραπέμπουν τον αθλητή για περαιτέρω εξετάσεις.

Άρθρο 4 Θεώρηση

- 1. Η Κάρτα Υγείας του Αθλητή θεωρείται από ιατρούς μονάδων παροχής υπηρεσιών Πρωτοβάθμιας Φροντίδας Υγείας, Νομαρχιακών, Περιφερειακών ή Πανεπιστημιακών Νοσοκομείων, υγειονομικών στρατιωτικών μονάδων ή από ιατρούς έχοντες οποιαδήποτε σχέση με το Δημόσιο ή με Ν.Π.Δ.Δ., καθώς και από ιατρούς του ιδιωτικού τομέα, κατεχοντες την καρδιολογική ειδικότητα.**
- 2. Σε ιατρούς λοιπών ειδικοτήτων παρέχεται η δυνατότητα παρακολούθησης μετεκπαιδευτικών σεμιναρίων, τα οποία θα διοργανώνει το Ε.Κ.Α.Ε., σε θέματα προαγωνιστικού ελέγχου των αθλητών.**
- 3. Για την οργάνωση των μετεκπαιδευτικών σεμιναρίων το Ε.Κ.Α.Ε. δύναται να συμβληθεί με εθνικούς και διεθνείς ιατρικούς επιστημονικούς φορείς και εταιρείες.**
- 4. Το κόστος των μετεκπαιδευτικών σεμιναρίων δύναται να καλυφθεί από τίμημα που θα επιβαρύνει τους μετεκπαιδευόμενους ή/και από χορηγίες.**

QUESTION 6

IS ECG USEFUL?

Annals of Internal Medicine

ARTICLE

Cardiovascular Screening in College Athletes With and Without Electrocardiography

A Cross-sectional Study

Aaron L. Baggish, MD; Adolph M. Hutter Jr., MD; Francis Wang, MD; Kibar Yared, MD; Rory B. Welner, MD; Eli Kupperman, BA; Michael H. Picard, MD; and Malissa J. Wood, MD

Background: Although cardiovascular screening is recommended for athletes before participating in sports, the role of 12-lead electrocardiography (ECG) remains uncertain. To date, no prospective data that compare screening with and without ECG have been available.

Objective: To compare the performance of preparticipation screening limited to medical history and physical examination with a strategy that integrates these with ECG.

Design: Cross-sectional comparison of screening strategies.

Setting: University Health Services, Harvard University, Cambridge, Massachusetts.

Participants: 510 collegiate athletes who received cardiovascular screening before athletic participation.

Measurements: Each participant had routine history and examination-limited screening and ECG. They received transthoracic echocardiography (TTE) to detect or exclude cardiac findings with relevance to sports participation. The performance of screening with history and examination only was compared with that of screening that integrated history, examination, and ECG.

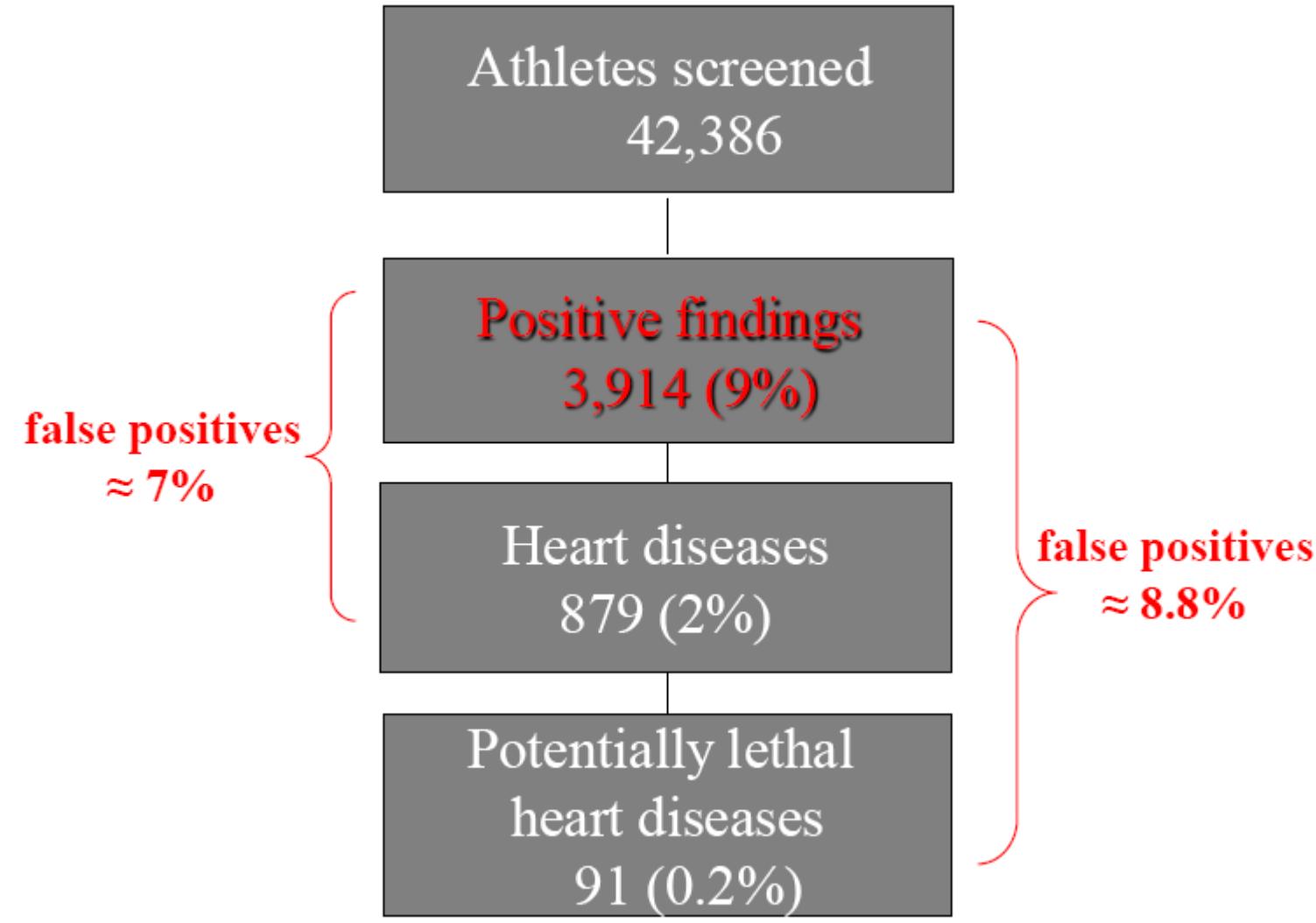
Results: Cardiac abnormalities with relevance to sports participation risk were observed on TTE in 11 of 510 participants (prevalence,

2.2%). Screening with history and examination alone detected abnormalities in 5 of these 11 athletes (sensitivity, 45.5% [95% CI, 16.8% to 76.2%]; specificity, 94.4% [CI, 92.0% to 96.2%]). Electrocardiography detected 5 additional participants with cardiac abnormalities (for a total of 10 of 11 participants), thereby improving the overall sensitivity of screening to 90.9% (CI, 58.7% to 99.8%). However, including ECG reduced the specificity of screening to 82.7% (CI, 79.1% to 86.0%) and was associated with a false-positive rate of 16.9% (vs. 5.5% for screening with history and examination only).

Limitation: Definitive conclusions regarding the effect of ECG inclusion on sudden death rates cannot be made.

Conclusion: Adding ECG to medical history and physical examination improves the overall sensitivity of preparticipation cardiovascular screening in athletes. However, this strategy is associated with an increased rate of false-positive results when current ECG interpretation criteria are used.

Primary Funding Source: None.



Corrado D, et al. EJCP 2010

The effectiveness of screening history, physical exam, and ECG to detect potentially lethal cardiac disorders in athletes:
A systematic review/meta-analysis

Kimberly G. Harmon, M.D.,^{a,b,*} Monica Zigman, M.P.H.,^a Jonathan A. Drezner, M.D.^a

^a Department of Family Medicine, University of Washington, Seattle, WA, USA

^b Department of Orthopaedics and Sports Medicine, University of Washington, Seattle, WA, USA

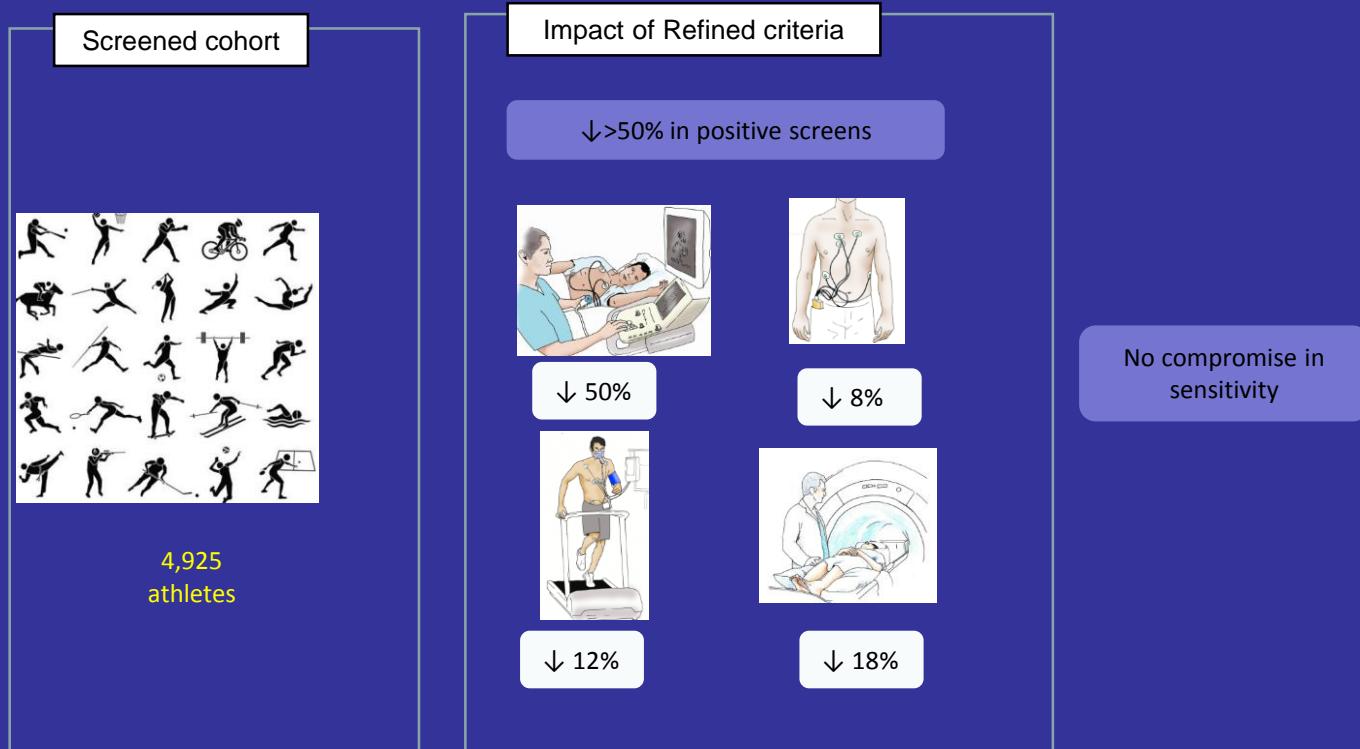
15 articles: 47,137 athletes

likelihood ratio	Sens	Spec	False positive	Positive
ECG	94%	93%	6%	14.8
History	20%	94%	8%	3.2
PE	9%	97%	10%	2.9



Cost Implications of Using Different ECG Criteria for Screening Young Athletes in the United Kingdom

Harshil Dhutia, MBBS, BSc,^a Aneil Malhotra, MBBCHIR, MA, MSc,^a Vincent Gabus, MD,^a Ahmed Merghani, MBBS, BMusSci,^a Gherardo Finocchiaro, MD,^a Lynne Millar, MBBS,^a Rajay Narain, MBBS,^a Michael Papadakis, MD, MBBS,^a Huseyin Naci, PhD,^b Maite Tome, MD, PhD,^a Sanjay Sharma, MD, MBClinB, BSc^a



Cost of Preparticipation Medical Screening

Parameters	AHA-Specific CV History and Physical	12-Lead ECG	2D Echo
Sensitivity	6%	70%	80%
Specificity	97.8%	84.3%	100%
Cost to screen 700,000 HSA annually	\$0	\$7 million	\$245 million
Cost to evaluate abnormal responses annually	\$7.7 million	\$40.2 million	\$0 dollars
Total cost to screen 700,000 HSA annually	\$7.7 million	\$47.2 million	\$245 million
Total amount of life gained from 700,000 HSA screened annually	92 yr	1080 yr	1232 yr
Cost per year of life saved	\$84,000	\$44,000	\$200,000

Fuller C. Med Sci Sports Exerc, 2000.

Recommendations for interpretation of 12-lead electrocardiogram in the athlete

Domenico Corrado^{1*}, Antonio Pelliccia², Hein Heidbuchel³, Sanjay Sharma⁴,
Mark Link⁵, Cristina Basso⁶, Alessandro Biffi², Gianfranco Buja¹, Pietro Delise⁷,
Ihor Gussac⁸, Aris Anastasakis⁹, Mats Borjesson¹⁰, Hans Halvor Bjørnstad¹¹,
François Carrè¹², Asterios Deligiannis¹³, Dorian Dugmore¹⁴, Robert Fagard³,
Jan Hoogsteen¹⁵, Klaus P. Mellwig¹⁶, Nicole Panhuyzen-Goedkoop¹⁷, Erik Solberg¹⁸,
Luc Vanhees³, Jonathan Drezner¹⁹, N.A. Mark Estes, III⁵, Sabino Iliceto¹,
Barry J. Maron²⁰, Roberto Peidro²¹, Peter J. Schwartz²², Ricardo Stein²³,
Gaetano Thiene⁶, Paolo Zeppilli²⁴, and William J. McKenna²⁵ on behalf of the
Sections of Sports Cardiology of the European Association of Cardiovascular
Prevention and Rehabilitation; and the Working Group of Myocardial and Pericardial
Disease of the European Society of Cardiology

Normal ECG Findings

- Increased QRS voltage for LVH or RVH
- Incomplete RBBB
- Early repolarization/ST segment elevation
- ST elevation followed by T wave inversion V1-V4 in black athletes
- T wave inversion V1-V3 ≤ age 16 years old
- Sinus bradycardia or arrhythmia
- Ectopic atrial or junctional rhythm
- 1° AV block
- Mobitz Type I 2° AV block

Abnormal ECG Findings

- T wave inversion
- ST segment depression
- Pathologic Q waves
- Complete LBBB
- QRS ≥ 140 ms duration
- Epsilon wave
- Ventricular pre-excitation
- Prolonged QT interval
- Brugada Type 1 pattern
- Profound sinus bradycardia < 30 bpm
- PR interval ≥ 400 ms
- Mobitz Type II 2° AV block
- 3° AV block
- ≥ 2 PVCs
- Atrial tachyarrhythmias
- Ventricular arrhythmias

Borderline ECG Findings

- Left axis deviation
- Left atrial enlargement
- Right axis deviation
- Right atrial enlargement
- Complete RBBB

No further evaluation required

in asymptomatic athletes with no family history of inherited cardiac disease or SCD

In isolation

2 or more

Further evaluation required

to investigate for pathologic cardiovascular disorders associated with SCD in athletes

QUESTION 7

ARE MORE TESTS NEED IN THE SCREENING ?

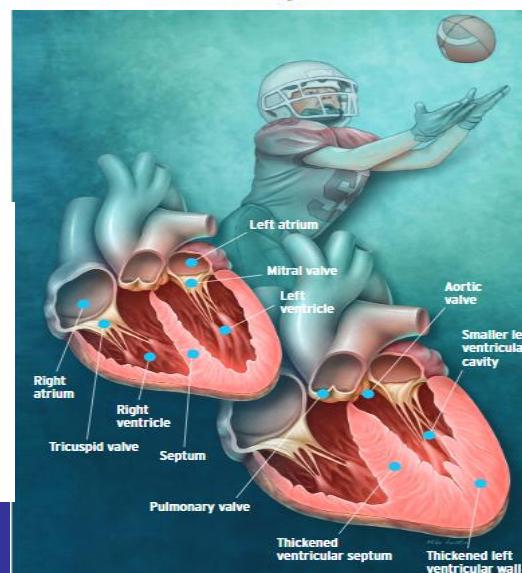
Prescreening of adolescent athletes: How much evaluation is enough?

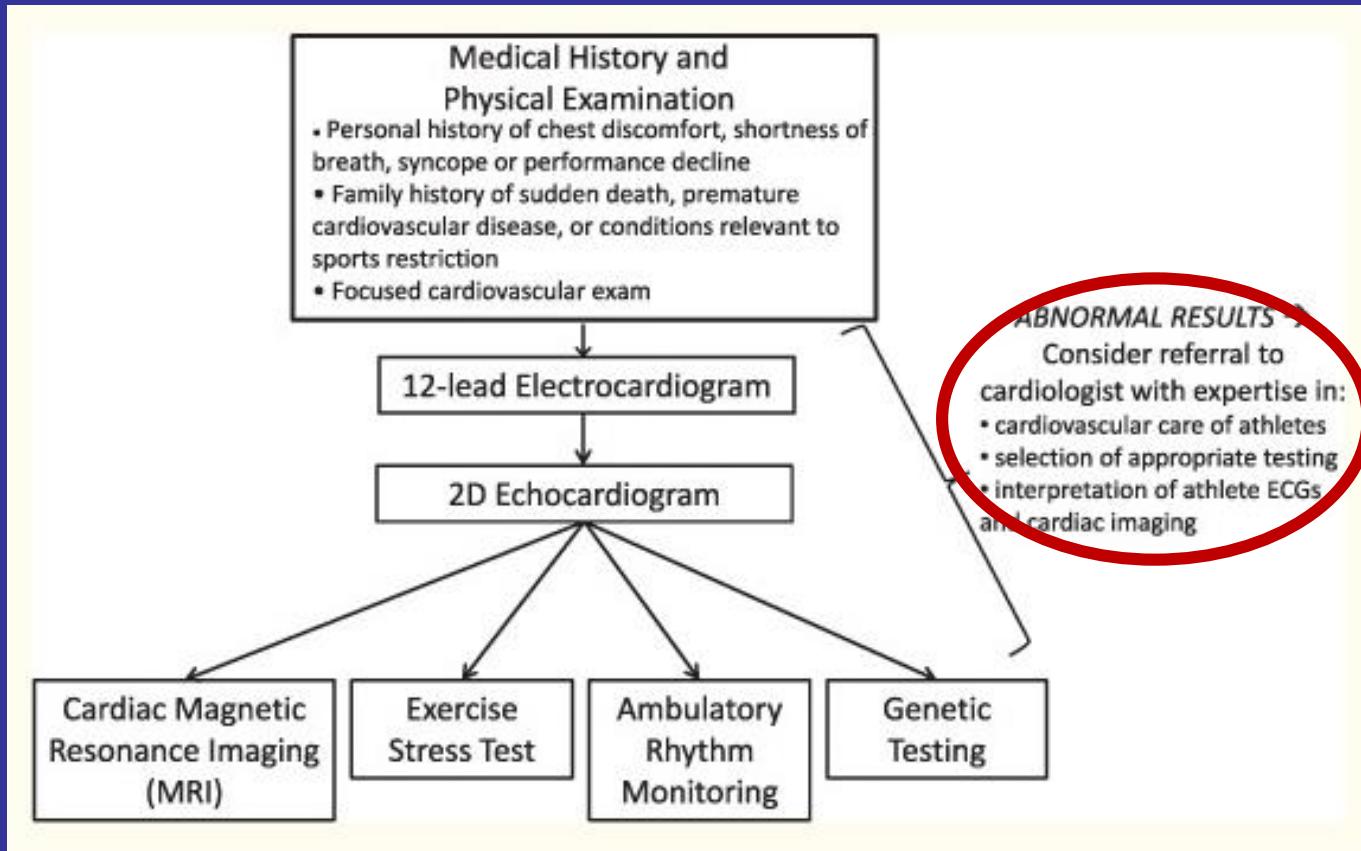
Fewer than 6% of providers may comply with recommendations for cardiovascular prescreening of young athletes, and only about half are aware that guidelines exist.

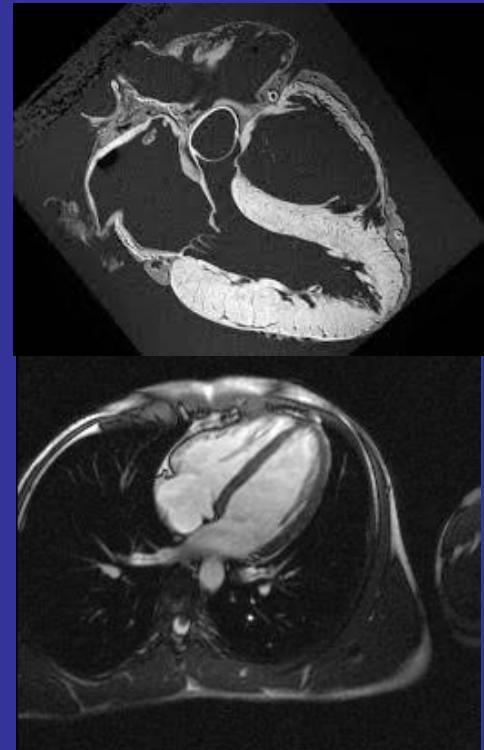
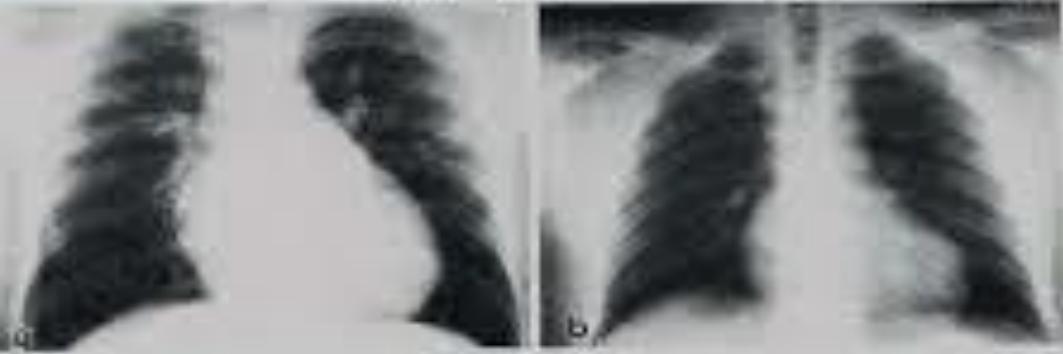
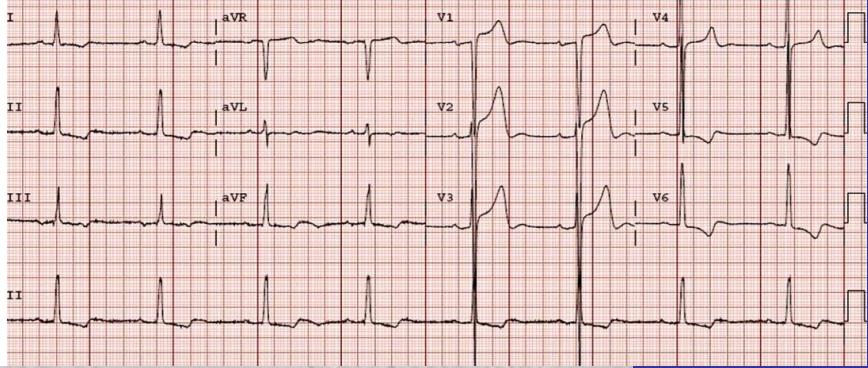
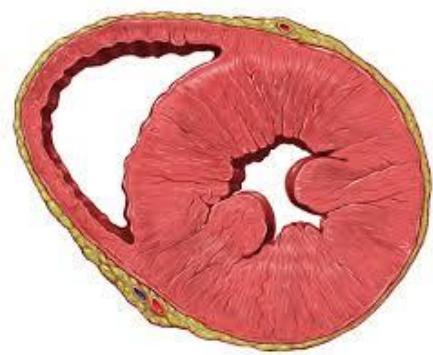
Dawn O'Reilly, PhD, PA-C; Laura Beth Enos, MMS, PA-C;
Laura Hedlund, MMS, PA-C; Kaylene Hood, MMS, PA-C;
Anna Kate Pruett, MMS, PA-C; Daryl Rosenbaum, MD;
Reamer L. Bushardt, PharmD, PA-C

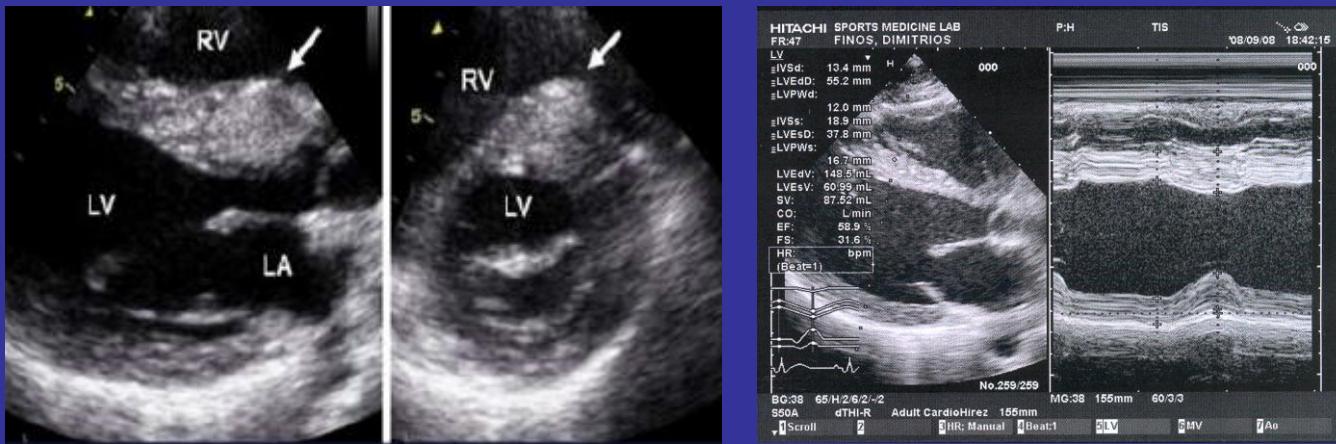
“If a syncopal event occurs in relation to any type of exertional activity, your suspicion of cardiac pathology should be high.”

JAAPA 2012; 25(11): 54-59



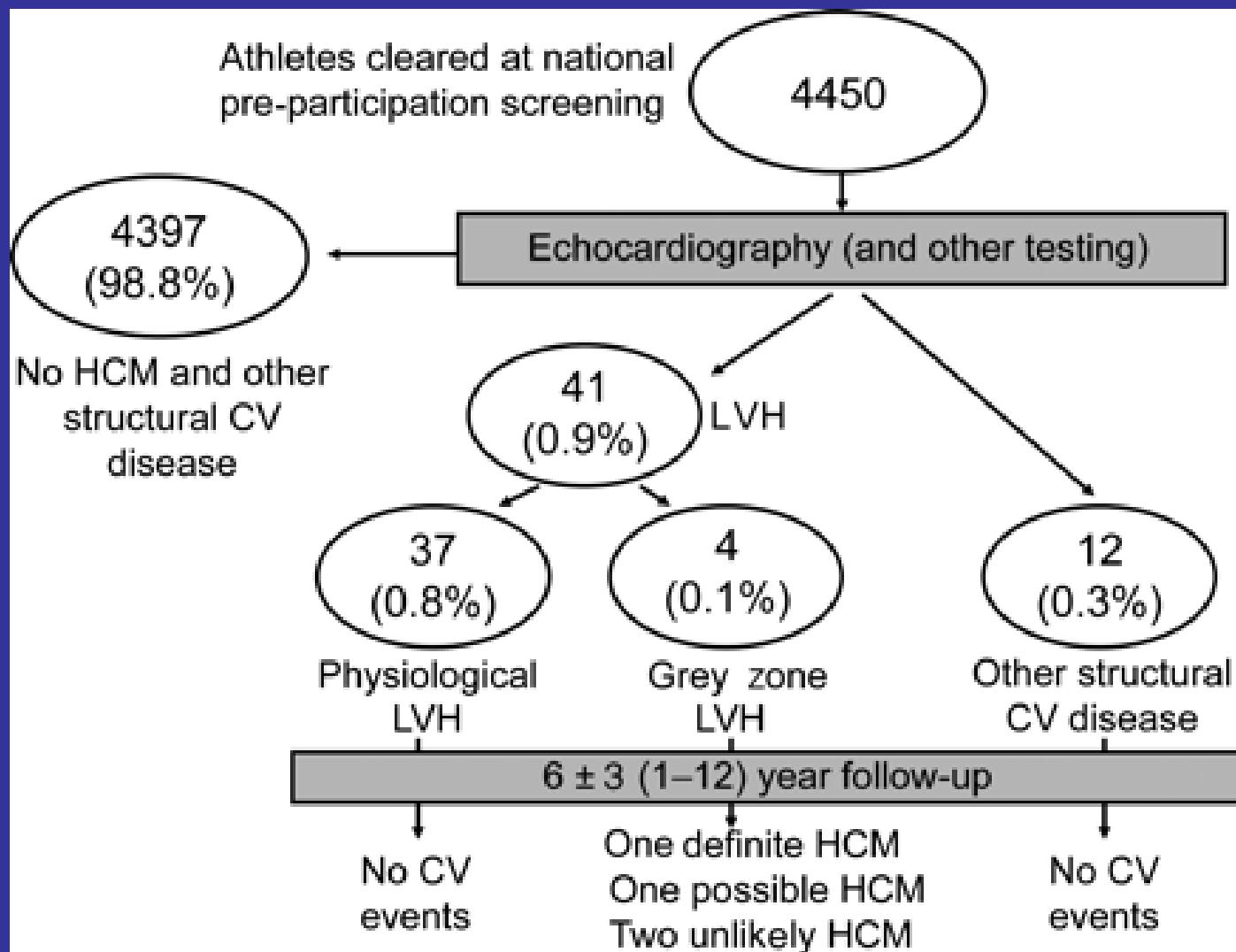




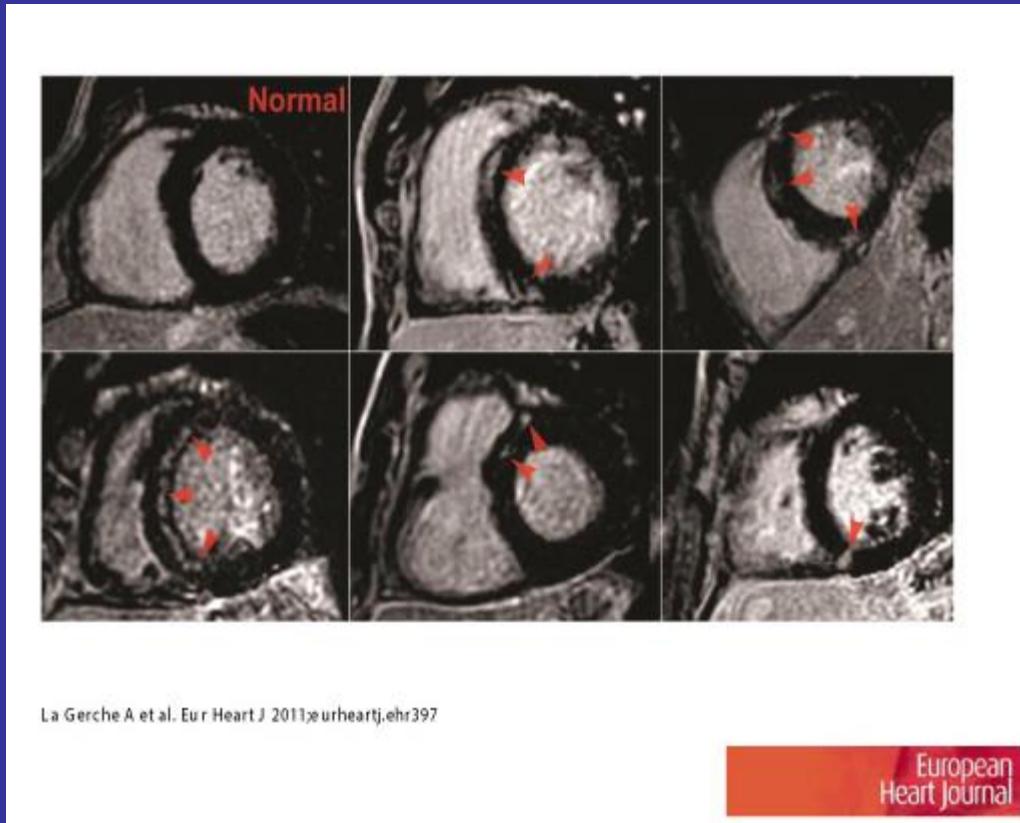


Additional testing, as echocardiography, requires enormous financial support and raises a number of criticisms, since it is considered to have limited diagnostic accuracy and efficiency in many cardiac disorders and, also they are time-consuming.

ITALIAN NATIONAL PREPARTICIPATION SCREENING PROGRAMME



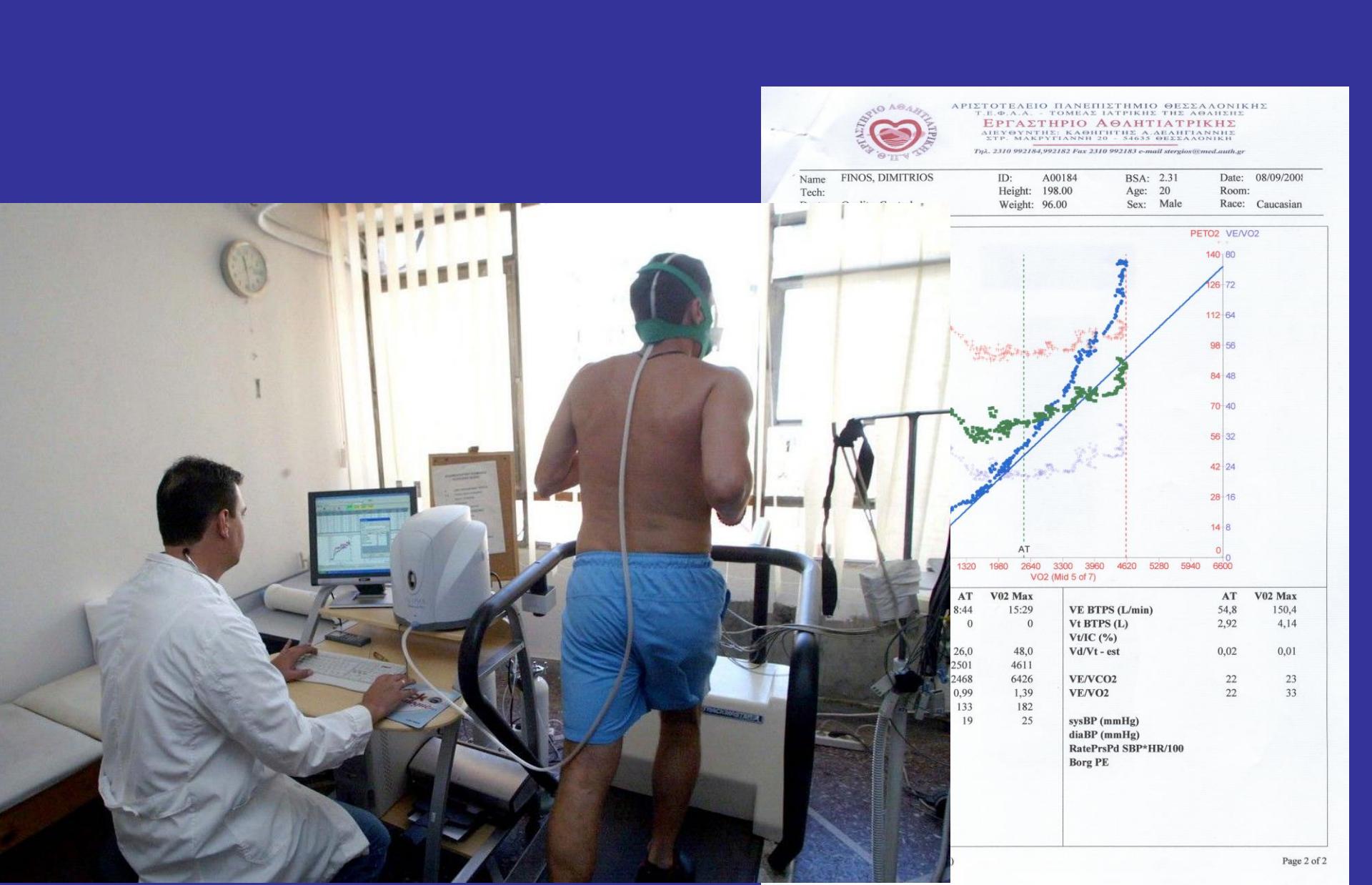
THE ROLE OF MRI IN SPORTS CARDIOLOGY



La Gerche A et al. Eur Heart J 2011;eurheartj;ehr397

European
Heart Journal

The delayed gadolinium enhancement
consist an important marker of
myocardial fibrosis.



QUESTION 8

PPS: When and Where?

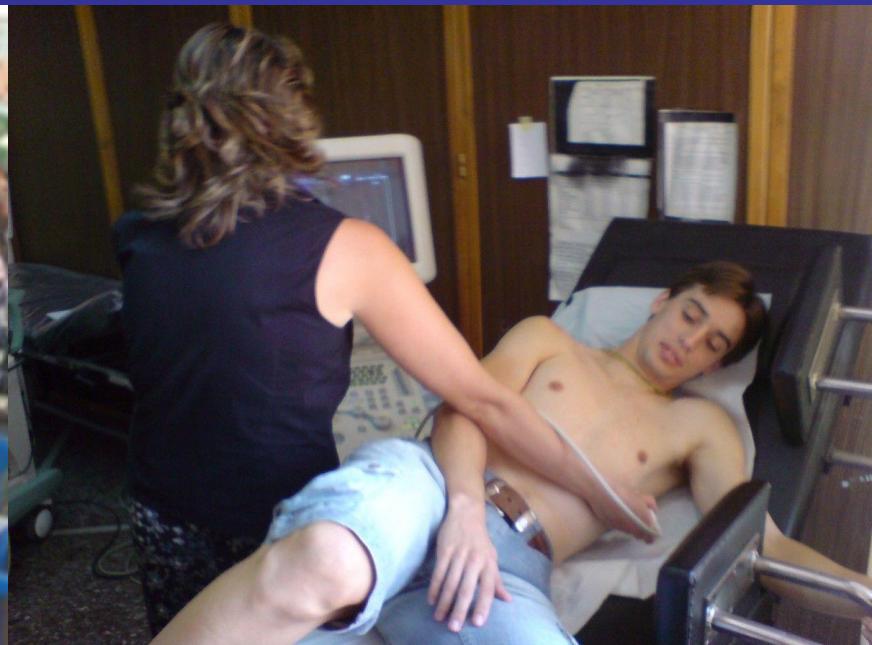
The PPE should be scheduled six weeks prior to the pre-season. This allows adequate time for correction and rehabilitation of any problems detected. In case of normal findings, it should be repeated after one year (?).

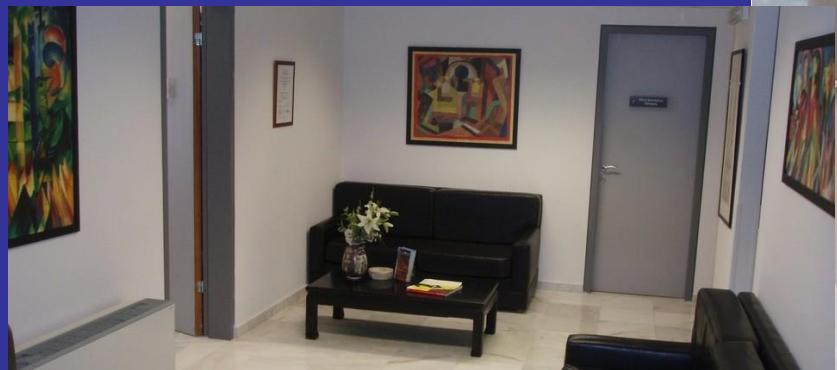
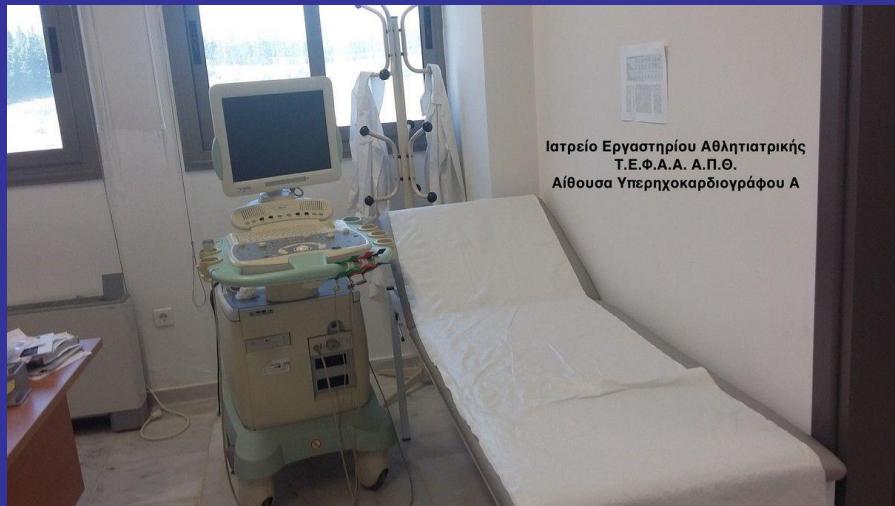


Where ?

Settings:

The two most common settings for performing PPEs are in a station-based environment or in the physician's office. Each setting has its own advantages and disadvantages in providing the best overall health screening to the athlete.





ΓΚΡΙΖΑ ΖΩΝΗ



Εργαστήριο Αθλητιατρικής

Άλλη μια χρονία το εργαστήριο Αθλητιατρικής του ΤΕΦΑΑ, υπό τη διεύθυνση του καθηγητή καρδιολόγου και προέδρου του τμήματος κ. Στέργιου Δεληγιάννη.

Ανέλθει τον πλήρη Ιατρικό - εργομετρικό - καρδιολογικό έλεγχο των παικτών του ΠΑΟΚ.

Η άριστη και υπεύθυνη δουλειά που γίνεται στο τμήμα, αποτελούν τη μεγαλύτερη εγγύηση για τον προληπτικό και πλήρη έλεγχο αθλητών.

Καθώς υπάρχει ο πλέον σύγχρονος εξοπλισμός, απόλυτη γνώση του αντικειμένου, εξειδίκευση και τεράπτια εμπειρία.

Αποτελούν την ιδανική λύση για τέτοιες εξετάσεις και φυσικά αυτός είναι ο λόγος που το εργαστήριο προτιμάται από όλοντα και περισσότερες ομάδες, αλλά και ομοσπονδίες.

Στις εξετάσεις των παικτών του ΠΑΟΚ, στην επεξεργασία και την ανάλυση των αποτελεσμάτων, συμμετείχε όλο το επιτελείο.

Με πρώτο τον καθηγητή κ. Δεληγιάννη συμμετείχαν ο επίκουρος Καθηγήτρια Ευαγγελία Κουΐδη, ο λέκτορας Νίκος Κουτλιάνος και ο καρδιολόγος Κατεφένια Τζορμπατζόγλου.



Μάλλον έχει και αυνέχει το σίριαλ Ηλιάδη

Περαστικοί

- Είναι λέσι επίορκοι αυτοί οι για τέτοια ψηλά γράμματα.

- Αφού έτσι και αλλιώς περα-

Ανακατατάξεις

- Τα πάνια - κάτια έισανε η εξέλιξη στο θέμα Ηλιάδη.



»
Ο Νίκος Νάτο πριν μετρήσει
δεξιό πλαϊνού
1,75. Δύοκόλα
πάνω να
άλλαξε το
ύψος του...»



»
Ο Σάκης Πρίτ-
τας θέντος,
περιμένει να
του πάρουν
την πίεσην

Καλωδιώματ-
νος ο Μιχάλης
Σπυρόπουλος
από πάνω
μέρι κάτω,
εξετάζεται
προσεκτικά

»

Το νέο
μεταγραφικό
απόκτημα
του Αρη, ο
Καρύμ Σάλονη,
περνεί τις
απαραίτητες
εξετάσεις

»

Αρκετά
αρχαίνενά
φαίνεται
στη φω-
τογραφία
ο Μισέλ
Γκαρμπίνι

»
Ακίνητος
και χωρίς
να παίρνει
ανάσα
ο Νίκος
Λαζαρίδης
για τις απα-
ραίτητες
εξετάσεις



Ξεκίνησαν οι ιατρικές εξετάσεις

Όπως ήταν προγραμματισμένο, χθες το πρωί το πρώτο γκρουπ των παικτών του Αρη πέρασε από τις απαραίτητες καρδιολογικές εξετάσεις στο Εργαστήριο Αθλητικής ΤΕΦΑΑ ΑΠΘ. Ο προληπτικός ιατρικός έλεγχος, των ποδοσφαιριτών πραγματοποιήθηκε κανονικά και θα συνεχιστεί αήμερα υπό τη διεύθυνση του Καθηγούτη Αθλητιστικής ΑΠΘ κ. Αστέριου Δεληγιάνην στις εγκαταστάσεις του Εργαστηρίου Αθλητιστικής στη Θέρμη (έναντι οικισμού Λίδα Μαρία). Αματολογικές εξετάσεις πέρασε το 70% των παικτών και το όλο 30% θα περάσει σήμερα. Οι εξετάσεις θα συνεχιστούν από το πρωί στην ΕΥΡΩΠΑΤΙΚΗ ΘΕΣΣΑΛΟΝΙΚΗ (Βασιλέως Γεωργίου 6-8, τηλ. 2310 861500).

Λιγες ώρες μετά τις οπηρινές εξετάσεις, οι ποδοσφαιριστές θα βρεθούν για πρώτη φορά στο γήπεδο μετά από ενόμιστο περίπου μήνα. Στις 18:00 οι παικτές θα βάλουν τις σφράξεις τους και θα ξεκίνησουν την προτομασία στο «Κλεδώνης Βικελόπη», στον οποίο τις κερκίδες θα βρίσκεται πλήθης κόσμου για να στείλει μνημόνια συμπαράστασης ενώπιο της νέας χρονιάς.





Research Article

Transtelephonic Electrocardiographic Transmission in the Preparticipation Screening of Athletes

Theodoros Samaras,¹ Savvato Karavasiliadou,² Evangelia Kouidi,² John N. Sahalos,¹ and Asterios Deligiannis²

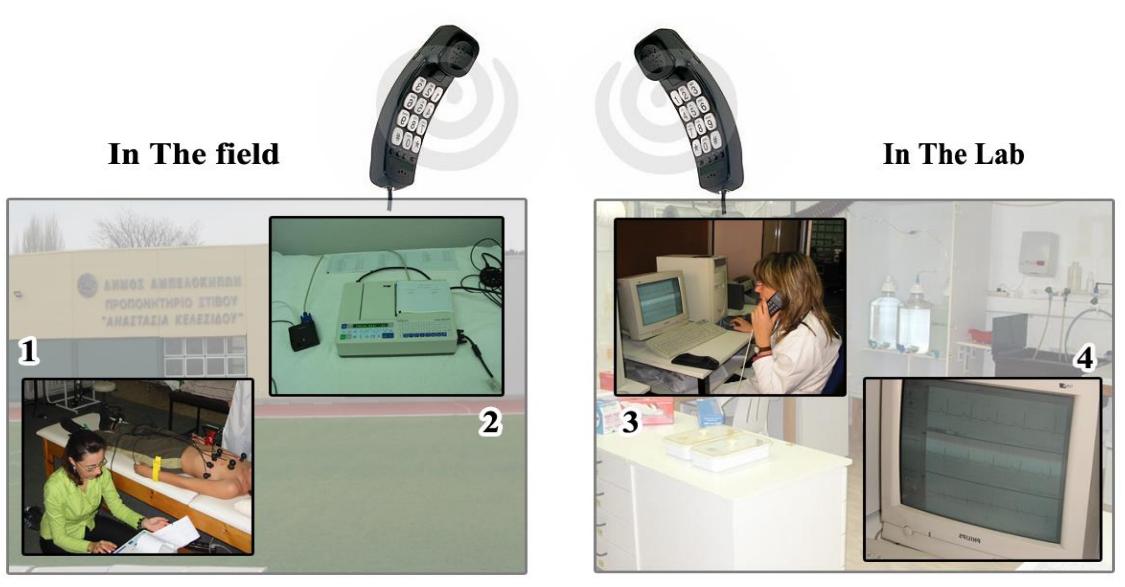
¹ Radiocommunications Laboratory, Department of Physics, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece

² Laboratory of Sports Medicine, Department of Physical Education and Sport Science, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece

ΕΥΦΟΡΕΣ ΣΥΣΤΗΜΑ ΤΗΛΕΜΑΤΙΚΗΣ ΚΑΤΑΓΡΑΦΗΣ

ΒΙΟΛΟΓΙΚΟΝ ΠΑΡΑΜΕΤΡΩΝ ΑΘΛΗΤΩΝ

ATHLETES' e-HEALTH



Accuracy of blinded clinician interpretation of single-lead smartphone electrocardiograms and a proposed clinical workflow

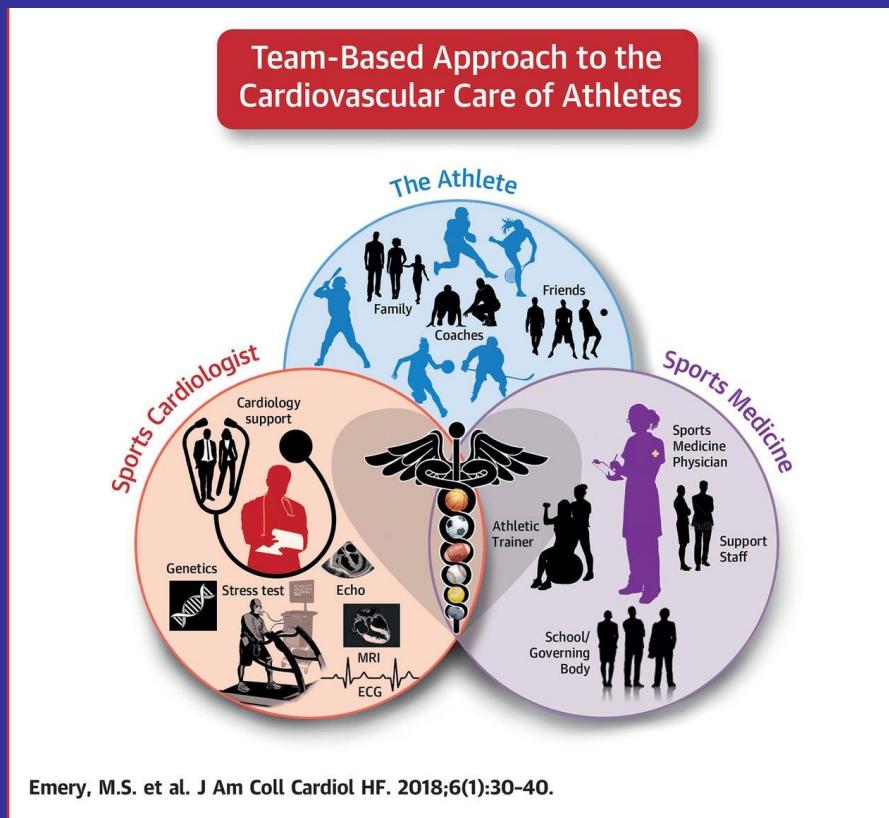
Anoop N Koshy; Jithin K Sajeev; Kazuaki Negishi; Michael C Wong; Christopher B Pham; Sumudu P Cooray; Yeganeh Khavar; Louise Roberts; Jennifer C Cooke; Andrew W Teh

Despite the appeal of smartphone-based electrocardiograms (ECGs) for arrhythmia screening, a paucity of data exists on the accuracy of primary care physicians' and cardiologists' interpretation of tracings compared with the device's automated diagnosis. Using 408 ECGs in 51 patients, we demonstrate a variable accuracy in clinician interpretation of smartphone-based ECGs, with only cardiologists demonstrating satisfactory agreement when referenced against a 12-lead ECG.



QUESTION 9

WHICH IS THE ROLE OF THE CARDIOLOGISTS?





Recommendations for competitive sports participation in athletes with cardiovascular disease

A consensus document from the Study Group of Sports Cardiology of the Working Group of Cardiac Rehabilitation and Exercise Physiology and the Working Group of Myocardial and Pericardial Diseases of the European Society of Cardiology

Antonio Pelliccia^{1*}, Robert Fagard², Hans Halvor Bjørnstad³, Aris Anastassakis⁴, Eloisa Arbustini⁵, Deodato Assanelli⁶, Alessandro Biffi¹, Mats Borjesson⁷, François Carré⁸, Domenico Corrado⁹, Pietro Delise¹⁰, Uwe Dorwarth¹¹, Asle Hirth³, Hein Heidbuchel¹², Ellen Hoffmann¹¹, Klaus P. Mellwig¹³, Nicole Panhuyzen-Goedkoop¹⁴, Angela Pisani⁵, Erik E. Solberg¹⁵, Frank van-Buuren¹³, and Luc Vanhees²

Experts who contributed to and revised parts of these recommendations:

Carina Blomstrom-Lundqvist¹⁶, Asterios Deligiannis¹⁷, Dorian Dugmore¹⁸, Michael Glikson¹⁹, Per Ivar Hoff³, Andreas Hoffmann²⁰, Erik Hoffmann²¹, Dieter Horstkotte¹⁴, Jan Erik Nordrehaug³, Jan Oudhof²², William J. McKenna²³, Maria Penco²⁴, Silvia Priori²⁵, Tony Reybrouck², Jeff Senden²⁶, Antonio Spataro¹, and Gaetano Thiene⁹

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36TH BETHESDA CONFERENCE

Introduction: Eligibility Recommendations for Competitive Athletes With Cardiovascular Abnormalities—General Considerations

Barry J. Maron, MD, FACC, *Co-Chair*
Douglas P. Zipes, MD, MACC, *Co-Chair*

ROLE OF CARDIOLOGIST IN PREPARTICIPATION HEALTH SCREENING

Cadet No.	Age/Sex	Fellow #1 Findings	Refer?	Fellow #2 Findings	Refer?	Cardiologist Findings	Refer?
#8	18y/o F	2-3/6 Early systolic murmur increased squat to stand	Yes	Normal	No	Normal	No
#19	19y/o M	Normal	No	3/6 SEM louder with standing from both seated and squatting	Yes	Normal	No
#21	18y/o F	Normal	No	3/6 SEM heard at LLSB and axilla	Yes	Normal	No
#23	19y/o F	Normal	No	3/6 SEM with midsystolic click	Yes	Normal	No
#30	19y/o M	Normal	No	2/6 SEM louder with standing from squatting	Yes	Normal	No
#46	18y/o M	2-3/6 SEM at the LLSB, harsh, low pitched, decreased sitting, slight augmentation squat to stand	Yes	2/6 Holosystolic murmur at the upper LSB	Yes	Normal	No
#51	18y/o F	Midsystolic click with late systolic 1/6 murmur, negative squat to stand	Yes	Normal	No	Normal	No
#54	18y/o M	2/6 Nearly holosystolic murmur at RUSB; no change squat to stand	Yes	Normal	No	Normal	No
#59	18y/o F	Normal	No	3/6 SEM heard at LLSB, radiates to axilla; louder with squatting	Yes	Normal	No
#89	18 y/o M	? Fixed split s2 vs. late systolic murmur at LLSB only; no change with inspiration; no change lying to sitting	Yes	Normal	No	Normal	No
#98	18 y/o M	2-3/6 SEM at RUSB without radiation; increases with squat, decreases with stand	Yes	Normal	No	Normal	No

LLSB, Left lower sternal border; RUSB, right upper sternal border; SEM, Systolic ejection fraction.

The Impact of Sports Cardiology on the Practice of Primary Care Sports Medicine

Where Were We, Where Are We, Where Are We Headed?

Siobhan Statuta, Dilaawar J. Mistry, MS, Robert Battle-(Sports Med 2015).

- 1.The cardiovascular care of competitive athletes is complex and demands a team effort between primary care team physicians and sports cardiologists.**
- 2.Training for competitive athletics induces several physiologic changes in the cardiovascular system that may mimic heart disease (HD) during cardiac testing (athlete's heart).**
- 3.Several cardiovascular pathologies can mimic athlete's heart, and primary care team physicians may not have the appropriate training necessary to fully understand the characteristics of this condition.**
- 4.The integration of sports cardiologists into sports medicine teams is beneficial to the practice of primary care sports medicine as well as the safety and well-being of athletes.**

QUESTION 10

Should the patient be involved in the decision?

In recent decades, patient empowerment has been gaining increasing recognition in clinical decision-making. Empowerment is a process through which people are involved over the decisions and actions that affect their own lives. In the context of a cardiac disorder, empowerment means giving an athlete the chance to participate in the decision about whether or not to remain active in competition.



THE FINAL DECISION: THE BIG DILEMMA



Three models of treatment decision-making are described, with progressive levels of empowerment: **the paternalistic model** (the athlete has a passive role), **the shared-decision making model** (both athlete and physician participate in the decision), and **the informed-decision making** (the decision is made by the athlete while the role of the physician is solely to provide information).



Empowerment of athletes with cardiac disorders: a new paradigm

Rui Providencia^{1,2}, Carina Teixeira³, Oliver R. Segal², Augustus Ullstein⁴,
Kim Mueser⁵, and Pier D. Lambiase^{2,3,6}

¹UCL Institute of Health Informatics, University College London, London, UK; ²Karen Heinz Center, Karen Heinz NRI Texas Wind Trust, Dallas, TX, USA; ³Centre for Paediatric Rehabilitation, Boston University, Boston, MA, USA; ⁴JP Lescure Chestnut, London, UK; and ⁵Institute of Cardiovascular Science, University College of London, London, UK



Benefits of empowerment

Respecting Athletes' Liberty as human being

Avoiding destroying athletes' professional lives and dreams

More transparent doctor–patient relationship, with better collaboration and truth.

Avoiding 'doctor-shopping'—athletes will seek experts in the area instead of more permissive physicians.

Acquiring more knowledge on 'grey zone areas' if athletes are allowed to compete in a safe environment.



Possible drawbacks

Concern that athlete's decision may not follow the Expert Consensus/Recommendations

Risk to reputation or personal feelings if the athlete has an arrhythmic event

Fear of liability

TAKE HOME MESSAGE....

In cases of athletes without symptoms and family history and normal ECG or with sport-related common ECG changes, we permit them to participate in competitive sports without additional investigation.

In cases of athletes with uncommon and not sports-related ECG changes further diagnostic evaluation is recommended.

ΑΣΤ. ΔΕΛΗΓΙΑΝΝΗΣ

«Απαραίτητος ο προαγωνιστικός έλεγχος»

Το 1992 το δ.σ. της ΕΠΣΜ προχώρησε στην επέκταση του προγράμματος. Υπέγραψε μνημόνιο συνεργασίας με τον καθηγητή Αθληταρικής ΑΠΘ, καρδιολόγο, Αστέριο Δεληγιάννη, για τον προαγωνιστικό έλεγχο υγείας των ερασιτεχνών ποδοσφαιριστών. «Ήταν μία καινοτομία για τη χώρα μας η καθίερωση ενός ολοκληρωμένου καρδιολογικού έλεγχου των νεαρών κυρίων ποδοσφαιριστών. Το 2000 για πρώτη φορά στη χώρα μας καθιερώθηκε η τηλεϊατρική στον αθλητισμό. Επιστημονικό προσωπικό του εργαστηρίου Αθληταρικής ζεκίνησε τον έλεγχο υγείας των ποδοσφαιριστών στο χώρο της άθλησής τους σε όλο το νομό Θεσσαλονίκης. Το ηλεκτροκαρδιογράφημα του αθλητή εξετάζεται άμεσα από ειδικούς καρδιολόγους στο κέντρο ελέγχου του εργαστηρίου και τηλεφωνικά αποστέλλονται οι κατάλληλες οδηγίες», λέει ο κ. Δεληγιάννης. «Καθιερώσαμε την τελευταία 5ετία το πρωτόκολλο έλεγχου που αποδεχήκαμε ως Ευρωπαϊκή Καρδιολογική Εταιρεία για δόλους τους αθλητές. Το πρωτόκολλο αυτό περιλαμβάνει τις απαραίτητες εξετάσεις για τη διασφάλιση της υγείας των αθλητών. Ο πρώτος ιατρικός έλεγχος των ποδοσφαιριστών γίνεται στις εγκαταστάσεις της ΕΠΣΜ στη Μίκρα υπό την ευθύνη της αναπληρωτριας καθηγήτριας του εργαστηρίου, καρδιολόγου Ευαγγελίας Κουδή. Στις εγκαταστάσεις του Εργαστηρίου Αθληταρικής στη Θέρμη ύχει αναπτυχθεί ένα σύγχρονο καρδιολογικό κέντρο, όπου εξετάζονται ενδελεχώς οι αθλητές, στους οποίους από τον πρωτογενή έλεγχο διαπιστώνεται κάποιο πρόβλημα. Επίσης, στα πλαίσια της γίνονται συχνά διαλέξεις, ώστε να ενημερώνονται οι αθλητές σε θέματα αγωγής υγείας και καταπολέμησης του ντό-



**Even with normal ECG findings,
complete physical examination and
careful evaluation of personal and
family history are required!!**



There are large variations in the incidence, registration methods and reported causes of sudden cardiac arrest/sudden cardiac death in competitive and recreational athletes.

