

Cardiac Disorders

See also Athletic Pre-Participation Evaluation

See also Sudden Death in Young Athletes

Background

1. Sudden cardiac death (SCD)
 - Relatively rare in athletic population
 - SCD events in sports are highly visible
 - Catastrophic for athletes, teams, fans, observers
 - Some SCD events may be preventable
 - Bethesda Guidelines
 - Physicians should be aware of these recommendations when determining eligibility to participate
2. PPE screening: thorough H&P
 - Most athletes in excellent physical condition
 - Still need a careful exam
 - Most sudden deaths in athletes are in previously asymptomatic pts
 - PPEs detect only a very small percentage of cardiac abnormalities among athletes who subsequently die suddenly
 - PPE may be only opportunity to detect potentially fatal condition
3. Automated External Defibrillators (AEDs)
 - Used for secondary prevention
 - PPE may not detect risk for SCD
 - Often first presentation of cardiac condition is SCD
 - Athletes of all ages have higher risk of sudden death
 - AED recommendation: available w/in 5 mins of cardiac arrest
4. Recommendations for athletes
 - The American Heart Association recommends cardiovascular screening every 2 yrs
 - AHA Cardiovascular Preparticipation Screening of Competitive Athletes
 - 36th Bethesda Conference of the American College of Cardiology, 2005
 - <http://www.acc.org/qualityandscience/clinical/bethesda/beth36/index.pdf>
 - The North American Society of Pacing and Electrophysiology (NASPE) Consensus Conference on Arrhythmias in the Athlete, 2001
 - http://www.csmfoundation.org/Report_of_the_NASPEPolicy_Conference_on_Arrhythmias_and_the_Athlete.pdf
5. Competitive and recreational athletes are at risk for cardiac disorders
 - Athletes <35 yo
 - Congenital leading to arrhythmias
 - Athletes >35 yo
 - Coronary artery disease 80%

Pathophysiology

1. Hypertrophic cardiomyopathy
 - Most common cause of sudden death in athletes (30%)
 - Autosomal dominant genetic disorder (1:500)

- Asymmetric ventricular hypertrophy leading to outflow obstruction and potentially fatal arrhythmias
- 90% have abnormal EKG
- 2. Anomalous coronary arteries
 - 14% of sudden death cases in athletes
 - Left coronary artery arises from right sinus, is constricted against aorta or pulmonary artery
 - Ventricular tachyarrhythmias w/exercise d/t ischemia
 - Present w/chest pain or syncope w/exercise
- 3. Myocarditis
 - 5% of sudden death cases in athletes
 - Inflammation of myocardium usually after upper respiratory infection
 - Enterovirus most common cause (Coxsackie B 50%)
- 4. Aortic stenosis
 - Bicuspid aortic valve
- 5. Marfan syndrome
 - Connective tissue dz
 - Autosomal dominant
 - Most often reported in basketball/volleyball athletes
 - Sudden death secondary to aortic dissection
 - Progressive dilation of aortic root
 - Stigmata of Marfan's synd
 - Arm span-to-height ratio >1.05
 - Tall stature
 - Arachnodactyly
 - Long, thin limbs
 - Hyperextensibility and ligamentous laxity
 - Scoliosis
 - Pectus excavatum or carinatum
 - Lens dislocation
 - Murmur
- 6. Arrhythmias
 - Wolff-Parkinson-White Syndrome (WPW)
 - Bypass tract between atria and ventricle leading to preexcitation
 - Risk of fatal ventricular fibrillation
 - Arrhythmogenic right ventricular dysplasia (ARVD)
 - Congenital malformation of right ventricle
 - Chamber dilation and aneurysm formation w/fibrofatty replacement of myocardium
 - At risk for fatal ventricular tachycardia and sudden death
 - Commonly present w/palpitations or syncope
 - EKG abnormalities incl: inverted T waves in V2, V3 w/o RBBB, prolonged QRS in V1-3, epsilon waves
 - >1000 extra ventricular beats/24 hrs on holter monitor
 - Long-QT syndrome
 - Genetic defect in cardiac repolarization
 - Can lead to torsades de pointes

- Brugada Syndrome
 - Congenital sudden death syndrome
 - Pseudo RBBB on EKG (V1-V3)
 - Coronary artery dz
 - Family hx of coronary artery dz or premature death
 - Exercise-induced chest pain
 - Syncope/ fatigue
 - Commotio Cordis
 - Blunt, non-penetrating blow to chest at peak of ventricular repolarization
 - Triggers ventricular fibrillation, sudden death
 - Illicit drugs
 - Cocaine, inhalants, performance enhancing drugs
 - Erythropoietin
 - Anabolic steroids
7. Incidence/ prevalence
- Occurs in 1:100,000-1:200,000 high school athletes per yr
 - Males 5x more likely than females
 - Mean age 17
 - Football and basketball most common
 - Specific numbers vary widely between studies
 - <300 sudden deaths annually
8. Risk factors
- Chest pain
 - Known or unknown congenital disorders
 - Family hx of heart dz or sudden death
 - Marfan's syndrome
 - Exertional syncope
9. Morbidity/ mortality
- Overall low resuscitation rate for ventricular fibrillation

Diagnostocs

1. Athlete's heart vs. cardiac dysfxn
- Well-trained athletes develop cardiovascular adaptations
 - Patterns vary by sport
 - May see
 - Incr wall thickness w/preserved systolic/diastolic fxn
 - Displaced PMI
 - Gallop
 - Bradycardia
 - AV block
 - Sinus pauses
 - Incomplete BBB
 - LVH criteria met in up to 80%
 - R in V5+ S in V1 >35 mm
 - Average HR: 52bpm
 - ST elevation in 50-90% of resting EKG's in athletes
 - Usually diffuse, upwardly concave, notched terminal QRS, concordant T waves represent benign early repolarization

2. Diagnostic testing

- AHA recommends every PPE screening should include
 - Family hx of
 - Premature sudden death (sudden or otherwise)
 - Heart dz in close relatives younger than 50 yrs
 - Specific family hx of HCM, Long QT, Marfan's or other clinically important arrhythmias
 - Personal hx
 - Heart murmur
 - HTN
 - Fatigue
 - Syncope/ near-syncope
 - Exertional dyspnea
 - Exertional chest pain
 - PE
 - Precordial auscultation in supine and standing position
 - Screen for heart murmur
 - Assess femoral artery pulses
 - Screen for coarctation of aorta
 - Stigmata of Marfan's synd
 - Brachial artery blood pressure in sitting position
- EKG as routine screening not recommended unless info in H&P raises suspicion of cardiac abnormality
- Echocardiography as routine screening tool also not recommended unless H&P raises suspicion of abnormalities
- Hypertrophic cardiomyopathy
 - Eval w/EKG, ECHO
 - Must have EKG abnormalities before sensitivity of ECHO is reliable
- Valvular disorders
- Marfan syndrome
 - If classic findings: ECHO to eval aortic root
 - Genetic markers: may be used clinically in future

3. Work up of specific arrhythmias

- Bradyarrhythmias
 - Asymptomatic sinus bradycardia: no workup needed
 - Symptomatic or extreme: H&P, EKG, Holter monitor, ETT
 - ECHO if suspect structural abnormality
- Supraventricular arrhythmias
 - PACs: H&P, EKG
 - Sustained SVT: H&P, invasive electrophysiologic study
 - WPW: H&P, EKG, Holter monitor, ETT, ECHO
 - Afib/ Aflutter: H&P, EKG, ECHO, TSH/T4, ETT, Holter monitor.
- Ventricular arrhythmias
 - PVCs: H&P, EKG, echo
 - Sustained V-Tach: H&P, EKG, ECHO, ETT, cardiac MRI, cardiac catheterization and electrophysiologic study

Therapeutics

1. On field response: 90% collapse during or immediately after exercise
 - Assess ABCs
 - Activate EMS
 - Apply AED
 - CPR
 - Immediate transfer to hospital
2. Ventricular fibrillation 40% on 1st rhythm analysis
3. Recommendations for eval and mgmt of athletes w/suspected or clinically documented arrhythmias are provided by NASPE consensus document
 - Used in conjunction w/athletic pre-participation evaluation and Bethesda Guidelines
4. Implantable cardiac defibrillators
 - All moderate and high intensity sports contraindicated
 - Low intensity sports
 - May consider on individual basis after 6 mos from either insertion or last therapeutic tx

Follow-Up

1. Return to play recommendations provided by
 - Bethesda Guidelines
 - NASPE statement
2. These two statements contain explicit recommendations regarding
 - Cardiac conditions in athletes
 - Eligibility to participate in sports
 - Should be used to guide decisions on athletes
3. Also recommend close follow-up w/cardiology

Prevention

1. AHA preparticipation guidelines
 - Screen for cardiac conditions
 - H&P
 - Focus on personal/family hx of cardiac symptoms/conditions
 - Perform bi-annually
 - Interval Hx yearly
2. No perfect objective screening tool available to screen 12 million athletes per yr in U.S.
3. Even careful PPE will miss some fatal cardiac disorders
 - EKGs: non specific, many false positives
 - Echocardiograms are expensive, time-consuming, operator dependent, not sensitive
 - Genetic markers may be available for future use
 - Automated External Defibrillators are important secondary prevention devices
 - May save some athletes w/cardiac disorders not identified on PPEs
 - Should be available in areas where competitive activity occurs
4. See NEJM Sudden Death in Young Athletes for more information
 - <http://content.nejm.org/cgi/reprint/349/11/1064.pdf>

Evidence-Based Inquiry

1. Do preparticipation clinical exams reduce morbidity and mortality for athletes?

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