

The Pre-Participation Exam

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Objectives

- Understand the purpose of a pre-participation exam
- Understand screening nature of the PPE
- Understand Sudden Cardiac Death (SCD) and screening
- Understand how to perform a PPE
- Understand concepts of clearance

Why do the PPE?

- To “screen for medical diseases or processes that may affect an athlete’s participation in physical activity” (American College of Sports Medicine)
- In particular:
 - To “reduce CV risks associated with physical activity and enhance the safety of athletic participation” (American Heart Association)
 - To detect “silent cardiovascular abnormalities that can lead to SCD” (The American College of Cardiology)
 - To meet legal requirements for sports participation

Why do the PPE?

- The additional benefit is to *screen* for *possible* medical conditions
- Too difficult to diagnose and manage a chronic pathology in the given construct of a PPE
- Depends on the ability of the screener to quickly and efficiently prioritize and recognize possible physical, mental, or other medical limitations and counsel the athlete appropriately

What are we doing?

- However, PPE is fairly controversial in itself
 - Have progressed from minimal PPE in past (or none!) to considering (multiple) medical tests
- Can the PPE prevent *injury*?
 - No evidence that an abnormal musculoskeletal exam screening itself predicts an increased risk for injury
 - Increased *risk* of injury does not always equal *incidence*
- Can we prevent *death*?
 - Most sport-related fatalities have been related to either head/neck injuries or sudden cardiac death
 - How to prevent these two?

Head/Neck Issues

- Injuries/fatalities related to head impact
 - Relative to gameplay and compounded by multiple factors
- Prevention is related to **multiple** factors:
 - Protective equipment, game situation and awareness, physical maturation, experience, history of prior injuries, etc
- PPE may suggest congenital or acquired structural defects that predispose to serious head/neck injuries
- Growing concern for identification of persons with a concussion history and potential pre-participation prevention
 - Difficult and complex concept of concussion prevention

The Pre-Participation Exam

- Medical history
 - Standardized questionnaire forms (PPE, 4th Ed) exist
 - Forms useful due to breadth of screening information
 - Should be completed with help of parents/family
- Divided into major sections of:
 - Past medical history
 - Cardiovascular:
 - Musculoskeletal
 - General medical conditions
 - Females Only (if applicable)

The Pre-Participation Exam

- Highlights of Medical History:
 - Known past medical history
 - Including surgical, current medications, allergies
 - Cardiovascular:
 - Personal history of chest pain, syncope, palpitations, fatigue, cardiac testing
 - Family history of cardiac-related deaths, known congenital cardiac abnormalities, suggestive symptoms
 - Musculoskeletal
 - Prior and current history of injuries and their status

The Pre-Participation Exam

- Highlights of Medical History:
 - General medical conditions
 - Asthma, or similar symptoms, and current status
 - History of concussions and head injuries
 - History of seizures
 - Screen for nutrition and body image issues and misconceptions
 - Females Only (if applicable)
 - Menstrual cycle abnormalities (suggestive for female triad)

The Pre-Participation Exam

- Examination
 - Broad-spectrum physical exam
- History and Exam are *independent* of each other
 - Unlike “normal” patient encounters where history leads to the focus of the exam
 - Emphasizes the *screening* concept that an “abnormal” finding warrants an additional detailed evaluation

The Physical Exam

- Often best to consider a station-based format
- Includes:
 - Vital signs and visual acuity
 - Head, Ears, Eyes, Nose, and Throat
 - Cardiovascular
 - Pulmonary
 - Abdominal
 - Musculoskeletal

The Physical Exam

- Personal preference will determine format of the exam
- Key inclusions:
 - Repeat blood pressures, if necessary
 - Notable undiagnosed reactive airways disease
 - Auscultation of the heart in the standing and supine positions
 - Simultaneous femoral and radial pulse palpation
 - Notable organomegaly or abdominal bruits
 - Musculoskeletal screening for joint mobility, strength (ie. Garrick Ortho Screen)

Garrick Ortho Screen



Marfan's Screening

- Include screening for Marfan's stigmata:
 - Kyphoscoliosis
 - High-arched palate
 - Pectus excavatum
 - Arachnodactyly (Walker, Steinberg signs)
 - Arm span greater than height
 - Joint hyperlaxity
 - Myopia
 - Mitral valve prolapse
 - Aortic insufficiency

PPE Clearance

- **Any positive response or concerning finding should require further, directed interview and exam**
- Any restriction -- full or qualified -- needs to be clearly explained to the athlete, parents, coaches, athletic training staff
- PPE should be repeated and reviewed on a predetermined frequency
 - AHA recommends reviewing cardiac history and physical at least every two years

PPE Clearance

- AAP has outlined relative restriction guidelines for numerous conditions in: Medical Conditions Affecting Sports Participation. Committee on Sports and Fitness. *Pediatrics*. Vol. 107 No. 5 May 1, 2001 pp. 1205 -1209
- Restriction of participation is a complex decision
 - Factors include: further evaluation for undiagnosed or uncontrolled issues, surgical clearance, desired sport and competition level, stabilization of chronic medical diseases, need for fitness level testing, nutrition counseling, etc
 - Orthopedic issues may require re-evaluation or rehabilitation prior to full clearance

“Qualified Yes”

- Hypertension
- Congenital Heart Disease
- Irregular heart rhythms
- Marfans' Syndrome
- Vasculitis
- Diabetes Mellitus
- Malabsorption/Short-gut
- Hepatitis C/HIV
- Single kidney
- Neoplasm
- Myopathies
- Seizure disorder
- Obesity
- Pregnancy
- Cystic Fibrosis
- Rheumatologic disease
- Sickle Cell Trait
- Splenomegaly

Participation Restrictions

- Absolute Disqualification:
 - Carditis
 - Fever of any source
- “Qualified No”
 - Hypertrophic cardiomyopathy
 - Coronary artery anomalies
 - Arrhythmogenic right ventricular cardiomyopathy
 - Acute rheumatic fever
 - Ehlers-Danlos syndrome
 - Infectious Diarrhea
 - Infectious conjunctivitis

Physical Demands of Sports

		INCREASING DYNAMIC COMPONENT		
		A. Low (<40% Max O ₂)	B. Moderate (40-70% Max O ₂)	C. High (> 70% Max O ₂)
INCREASING STATIC COMPONENT	III. High (>30% MVC)	IIA (Moderate) Basketball/Upper Field events (throwing) Gymnastics Martial arts Soccer Football Weight lifting Wrestling	IIIB (High/Moderate) American football Baseball/softball Basketball Soccer Wrestling	IIIC (High) Boxing Canoeing/kayaking Cycling Rowing Soccer Snow-skiing Triathlon
	II. Moderate (20-30% MVC)	IIA (Low/Moderate) Aerobic Drifting Football Motorcycling	IIIB (Moderate) American football Field events (jumping) Figure skating Hockey Running (long) Skiing Synchronized swimming	IIIC (High/Moderate) Baseball Ice hockey Cross-country skiing (skiing technique) Lacrosse Running (middle distance) Swimming Team handball
	I. Low (<20% MVC)	IA (Low) Golf Shooting Curling Badminton Volleyball	IIB (Low/Moderate) Basketball Figure skating Ice hockey Volleyball	IIC (Moderate) Badminton Cross-country skiing (skiing technique) Field hockey Ice skating Ice hockey Paralympic sports Running (long distance) Soccer Tennis

Sudden Cardiac Death

- Most common cause of *sudden death* in young persons (<35 y/o) during exercise
- Hypertrophic cardiomyopathy and congenital coronary artery anomalies account for 1/3 of all SCD cases
 - “Others” account for less than 5%
 - ARVCM, Long QT, other arrhythmias, early CAD
- Approximately 1 in 300-500 persons may have an occult CV condition that places them *at risk* for SCD.
 - Incidence of SCD estimated at 1/40,000 – 1/200,000
- Can we identify these on a PPE (to prevent death)?
 - *With limited ability, yes*

Electrocardiogram?

- Used to detect cardiac electrical abnormalities that signify cardiac arrhythmias and structural disorders
- For detection of cardiac abnormalities
 - Classic PPE history alone has 31% false-positive rate
 - PE alone has a 9% false-positive rate
 - History, PE, & ECG has a 3-6% false-positive rate

Athlete's Heart

- ECG interpretations for "athlete's heart" allows for these as normal adaptations to exercise:
 - Sinus bradycardia or sinus arrhythmia
 - First degree AV block
 - Incomplete Right Bundle Branch Block
 - Early repolarization
 - Isolated QRS voltage criteria for left ventricular hypertrophy

ECG Usefulness

- Particularly sensitive for HCM, Long/short QT syndrome, and Arrhythmogenic Right Ventricular Cardiomyopathy, pre-excitation syndromes, Brugada syndrome
 - *Unable to detect certain structural abnormalities, such as abnormal coronary artery anomalies, and early coronary artery disease*
- ECG manifestations of cardiomyopathy may occur before the physiologic changes occur

At This Time

- Despite international movements towards ECG screening, AHA continues to not recommend a mandated ECG-screening process for athletes
 - Cost-effectiveness, feasibility, and physician access
- At this time, the decision to ECG an athlete should be made on an individual basis, as part of a workup or on a personal pre-determined basis

Mass ECG Screening

- August Heart Foundation (San Antonio)
 - www.augustheart.org
- Championship Hearts Foundation (Austin)
 - www.champhearts.org
- Cody Stephens Go Big or Go Home Foundation (Houston)
 - www.codystephensfoundation.org
- Cypress Creek ECG Project (Cypress)
 - www.cypressecegproject.org
- Living for Zachary (Plano, Denton, McKinney)
 - www.living4zachary.org
- Hearts (Houston)
 - www.memorialhermann.org/hearts/
- The Brandon Goyne Foundation (Waskom, Elysian Fields, Marshall)
 - www.thebrandongoynefoundation.com

Electrocardiogram Screening?

- Since 2007, AHA unable to recommend a national ECG-based screening process based on cost-effectiveness and feasibility
 - 8+ million potential athletes needing screening ECGs, at a cost of \$2+ billion per year
 - Physician and resource shortages, and lack of national standard of PPE
- Multiple studies cite need for improved SCD statistics nationally
- At this time, decision to ECG an athlete should be made on an individual basis, as part of a workup or a predetermined decision

Summary

- The purpose of a PPE is to prevent injury and death related to sports participation, and to meet potential legal requirements.
- The PPE is intended, not to diagnose or manage medical conditions, but to identify potential medical limitations to sports participation.
- Sudden Cardiac Death is a leading cause of sports-related deaths and can be effectively screened for during a PPE, with an appropriate history and physical.
- The use of an electrocardiogram in a PPE has proven benefits but there remain logistical barriers to its full implementation.
- A proper PPE utilizes a standard medical history questionnaire and comprehensive screening examination.
- Clearance for sports participation can be a complex decision requiring detailed evaluations and/or testing.

Thank you very much....

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