



Cardiopulmonary Evaluation In Athletes

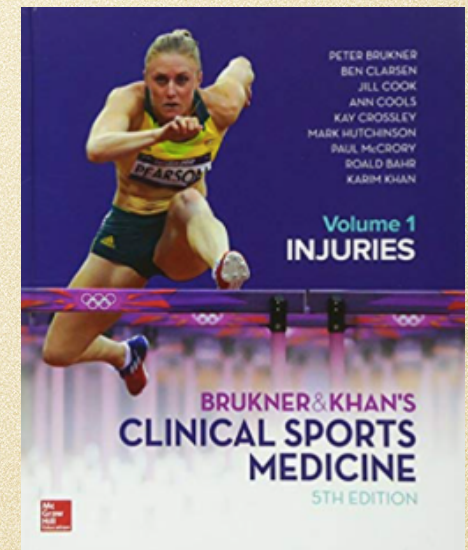
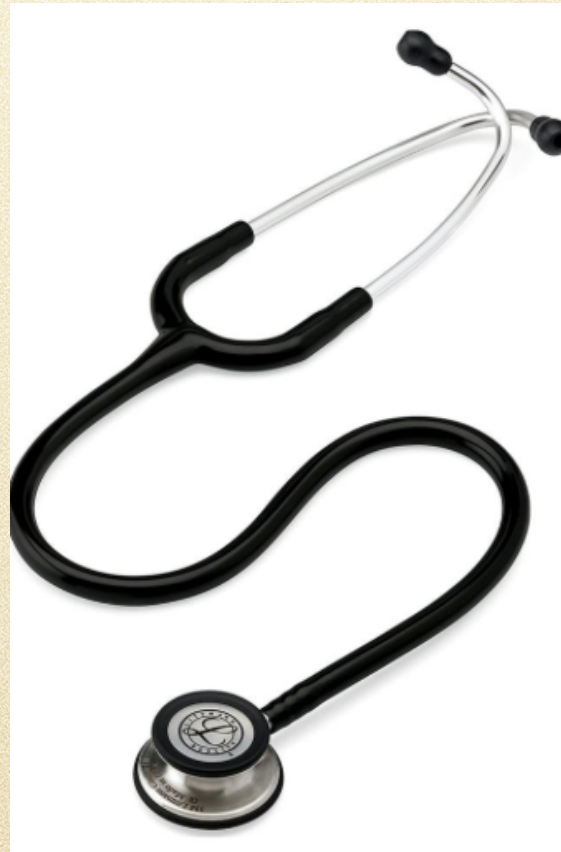
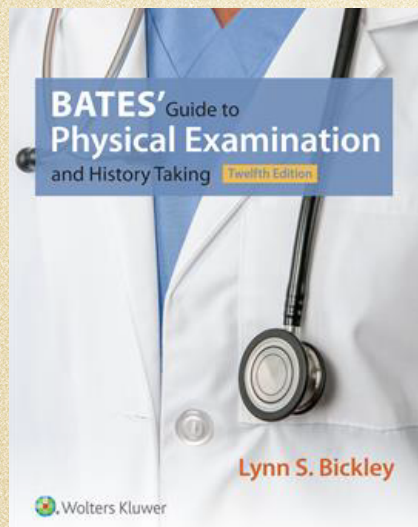
Cody B. Clinton D.O.
Primary Care Sports Medicine
Cooper Bone and Joint



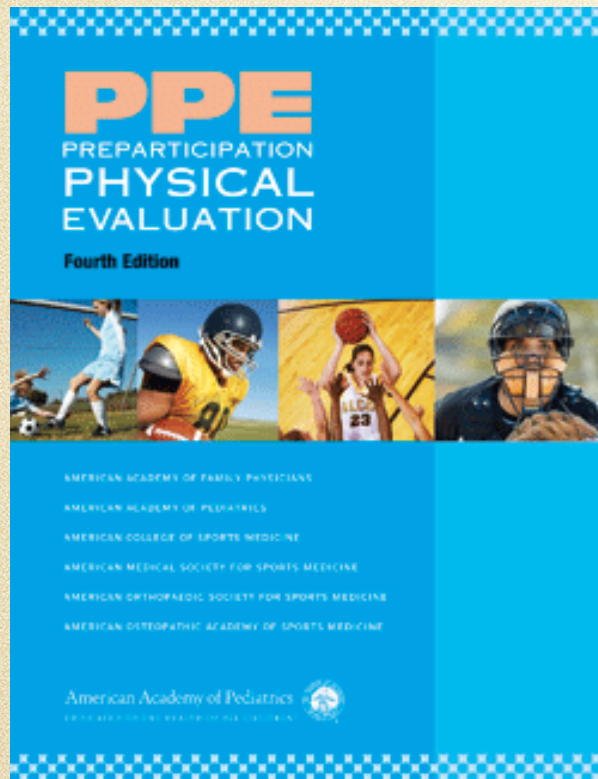
Objectives

- increase athletic trainer recognition of common cardiopulmonary pathologies
- review important cardiopulmonary questions to ask when taking a detailed history in student athletes
- review key components of the physical exam of the cardiac and pulmonary systems

Suggested Resources



Additional Resources



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National Athletic Trainers' Association Position Statement: Preparticipation Physical Examinations and Disqualifying Conditions

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Table 7.
Online Resources for Pediatric Cardiac Auscultation

The Auscultation Assistant

Web site: <http://www.wilkes.med.ucla.edu/inex.htm>

Blaufuss Medical Multimedia Laboratories

Web site: <http://www.blaufuss.org>

Heart Sounds and Murmurs

Web site: <http://www.dundee.ac.uk/medther/Cardiology/hsmur.html>

Johns Hopkins University Cardiac Auscultatory Recording Database

Web site: <http://www.murmurlab.com/card6/> (registrationrequired)

Texas Heart Institute

Web site: http://www.texasheart.org/education/cme/explore/events/eventdetail_5469.cfm

University of Michigan Heart Sound and Murmur Library

Web site: <http://www.med.umich.edu/lrc/psb/heartsounds/index.htm>

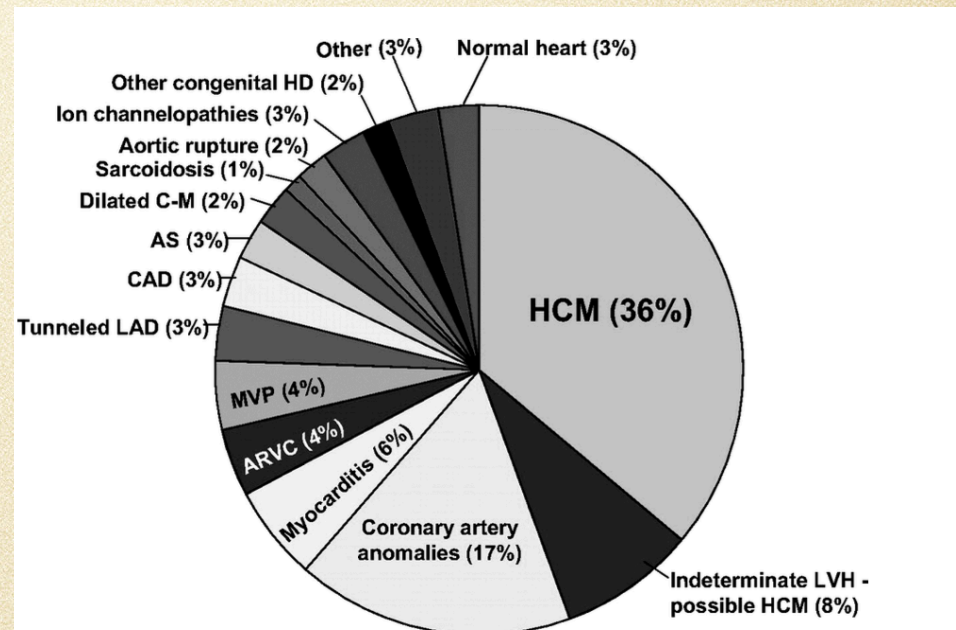
University of Washington Department of Medicine

Demonstrations: Heart Sounds and Murmurs

Web site: <http://depts.washington.edu/physdx/heart/demo.html>

Why is this important?

- **You could save a life!**
 - most sudden death in athletes has been related to cardiac congenital anomalies and acquired cardiac disorders (HCM, myocarditis, aortic rupture)
- **High prevalence:** 15-25% of athletes have symptoms of asthma and EIB
- **As a health care provider you are always on call**



2007 update. Circulation.
2007;115(12):1643-1655.4

Cardiopulmonary Pathology You Will See

- Asthma (Reactive Airway Disease)
- Exercise Induced Bronchoconstriction / Asthma
- Infectious Disorders: Pneumonia / Mono / URIs
- Costochondritis
- Heart Murmurs
- Arrhythmia's
- Hypertension / Hypotension
- Vocal Cord Dysfunction

Cadiopulmonary Pathology You Don't Want to See

- Hypertrophic Cardiomyopathy
- Commotio Cordis
- Aortic Regurgitation / Rupture
- Myocardial Infarction
- Pneumothorax
- Pulmonary Contusion / Hemorrhage

Presenting Symptoms

- Shortness of Breath
- Chest Pain
- Cough
- Hemoptysis
- Dyspnea
- Dizziness
- Headache
- Insomnia
- Blurry Vision
- Anxiety
- Arm Pain / Jaw Pain
- Fatigue

Cardiac Personal History

- | | | | |
|-----|---|--------------------------|--|
| 5. | Have you ever passed out or nearly passed out DURING exercise? | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. | Have you ever passed out or nearly passed out AFTER exercise? | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. | Have you ever had discomfort, pain, or pressure in your chest during exercise? | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. | Does your heart race or skip beats during exercise? | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. | Has a doctor ever told you that you have (check all that apply): | | |
| | <input type="checkbox"/> High blood pressure | <input type="checkbox"/> | <input type="checkbox"/> Heart murmur |
| | <input type="checkbox"/> High cholesterol | <input type="checkbox"/> | <input type="checkbox"/> Heart infection |
| 10. | Has a doctor ever ordered a test for your heart? (for example ECG, echocardiogram) | <input type="checkbox"/> | <input type="checkbox"/> |
| 11. | Has anyone in your family died for no apparent reason? | <input type="checkbox"/> | <input type="checkbox"/> |
| 12. | Does anyone in your family have a heart problem? | <input type="checkbox"/> | <input type="checkbox"/> |
| 13. | Has any family member or relative been disabled from heart disease or died of heart problems or sudden death before age 50? | <input type="checkbox"/> | <input type="checkbox"/> |
| 14. | Does anyone in your family have Marfan syndrome? | <input type="checkbox"/> | <input type="checkbox"/> |

Additional Cardiac Questions

- increasing SOB?
- swelling of your legs?
- increasing fatigue?
- have you had increasing anxiety?
- weight changes?
- numbness and tingling of legs / arms?

Pulmonary Personal History

- hx of Asthma at any time in life?
- ever used an inhaler or taken asthma medication?
- been hospitalized for breathing issues?
- lightheaded or short of breath more than expected with exercise?
- more tired or SOB than friends during exercise?
- cough during the day or at night?
- do you suffer from insomnia?
- do you smoke or are exposed to smoke?
- allergies?
- headaches?

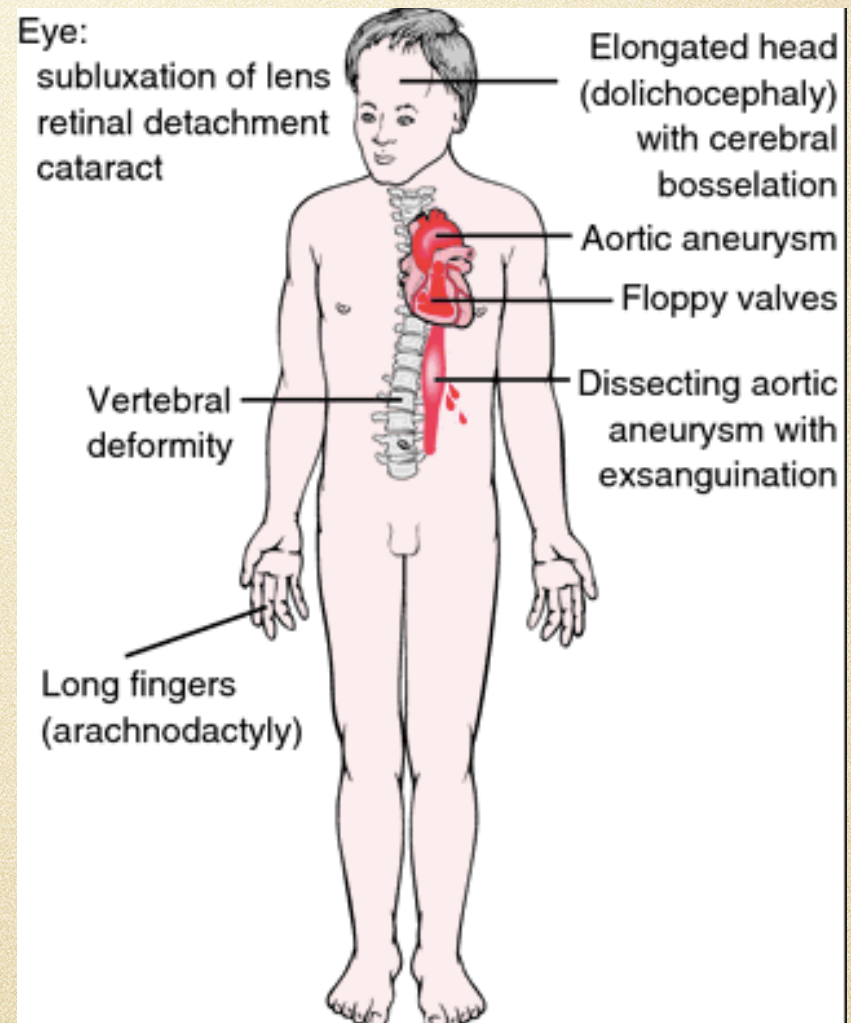
Family Hx

AHA recommends additional cardiac eval for people:

- with sudden death <50 yo in 1 or more relatives
- disability from heart dz in a close relative young than 50
- specific knowledge of cardiac disorders like HCM, Marfan, ARVC, LQTS, Brugada syndrome, lipid abnormalities
- also ask about unexplained syncope, near-drowning or drowning, unexplained seizure, SIDS (can be a sign of ion channel disorder)
- family hx of kawasaki's, rheumatic fever, ehlers-danlos
- family hx of asthma, sickle-cell

CARDIOPULMONARY PHYSICAL EXAM

- AHA recommends:
 - brachial artery pressure taken in seated or supine position
 - auscultation for heart murmurs
 - **Supine and Standing**
 - palpation of femoral pulses to exclude coarctation of aorta
 - examination for stigmata of Marfans
- Additional Recommendations:
 - pulse oximeter, peak flow meter / spirometer
 - inspection / palpation / auscultation of pulmonary system



Blood Pressure Key Points

- ideally should be seated for 5 minutes prior to taking BP
- should take BP in both arms if elevated (use higher reading)
- ask about stimulants, caffeine use, steroids, and exercise (>30 minutes before reading)
- appropriate sized cuff important
- need 3 separate readings for diagnosis of HTN

Manual or Automated BP Monitors?

- automatic devices tend to:
 - overestimate systolic and diastolic pressures in adults
 - underestimate systolic and diastolic pressures in kids 5-17

Heinemann M, Sellick K, Rickard C, Reynolds P, McGrail M
Int J Nurs Pract. 2008 Aug; 14(4):296-302.

JNC 7 Adults (13+)

Table 1

Classification of Hypertension^{3,4}

Classification	Systolic Blood Pressure (mm Hg)	Diastolic Blood Pressure (mm Hg)
Normal	<120	<80
Prehypertension	120–139	80–89
Stage 1 hypertension	140–159	90–99
Stage 2 hypertension	≥160	≥100

Modified from Chobanian et al³ Pickering et al⁴

PEDS HYPERTENSION

- most common cardiovascular disease encountered in athletic population
- HTN usually due to **secondary** factors causes in kids
- in kids, screen BP by using right arm (coarctation of aorta causes low left arm BP- could give false negative)

PEDS HYPERTENSION

Table 1.

NHBPEP Classification of Prehypertension and Hypertension in Children and Adolescents

CLASSIFICATION	SYSTOLIC OR DIASTOLIC BLOOD PRESSURE*
Normal	< 90th percentile
Prehypertension	90th to < 95th percentile or $\geq 120/80$ mm Hg†
Stage 1 hypertension	95th to < 99th percentile plus 5 mm Hg
Stage 2 hypertension	> 99th percentile plus 5 mm Hg

NHBPEP = National High Blood Pressure Education Program.

**—Based on sex, age, and height; measured on at least three separate occasions.*

†—Blood pressure of 120/80 mm Hg or greater is prehypertension regardless of whether it is less than the 90th percentile. If 120/80 mm Hg is in the 95th percentile or greater, then the patient has hypertension.

Information from reference [9](#).

Screening blood pressure requiring further evaluation

Age (years)	BP (mmHg)			
	Boys		Girls	
	Systolic BP	Diastolic BP	Systolic BP	Diastolic BP
1	98	52	98	54
2	100	55	101	58
3	101	58	102	60
4	102	60	103	62
5	103	63	104	64
6	105	66	105	67
7	106	68	106	68
8	107	69	107	69
9	107	70	108	71
10	108	72	109	72
11	110	74	111	74
12	113	75	114	75
≥13	120	80	120	80

PEDS HYPERTENSION

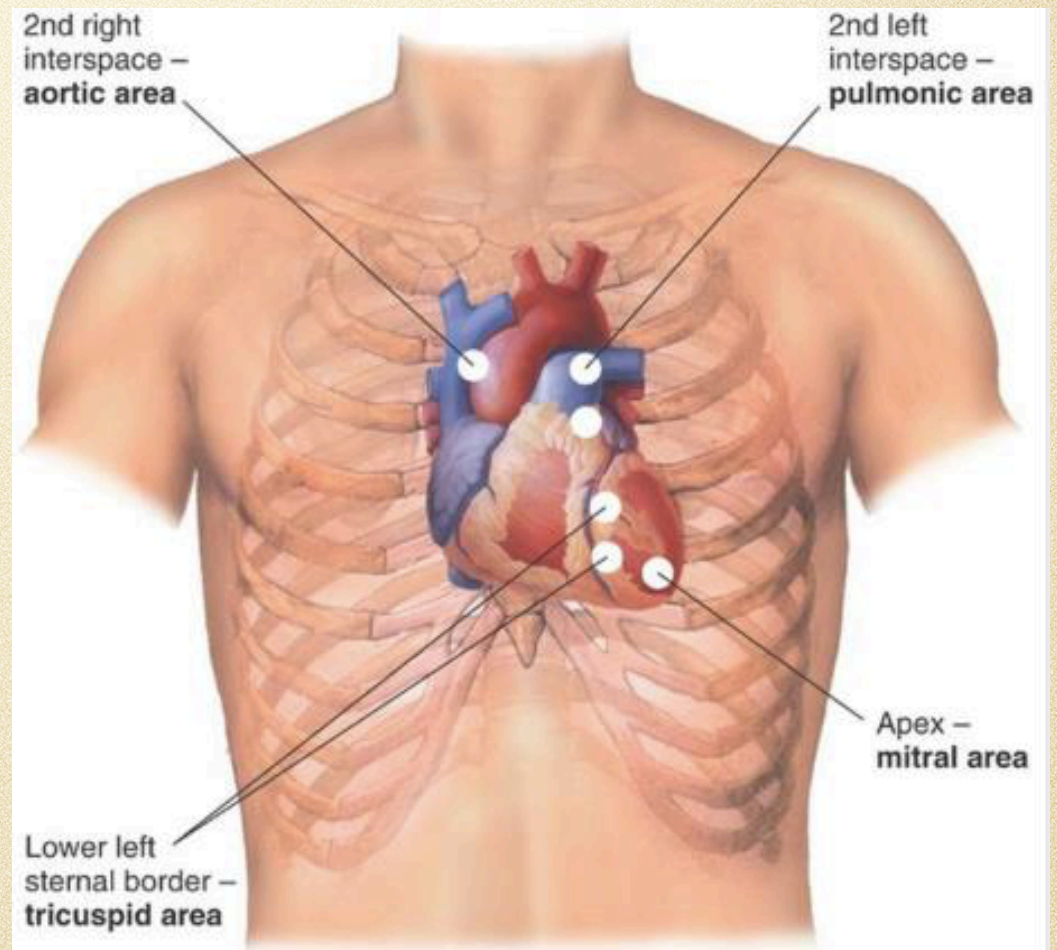
- PreHTN & Stage I HTN can participate while undergoing further work-up
 - 36th Bethesda Conference – Stage I = Echo
- Stage II HTN needs further work-up and better BP control prior to participation in sports

Arrhythmias

- Mostly will see tachyarrhythmias (afibb, idiopathic ventricular tachycardia, SVT, atrial flutter, etc.) causing sx's
- Bradycardia 40-60 bpm is normal in athletes, less than 40 bpm is likely abnormal
- PVCs are seen commonly in athletes and can be a sign of underlying structural disease
- If concerned, refer and consider Holter monitor

Cardiac Exam

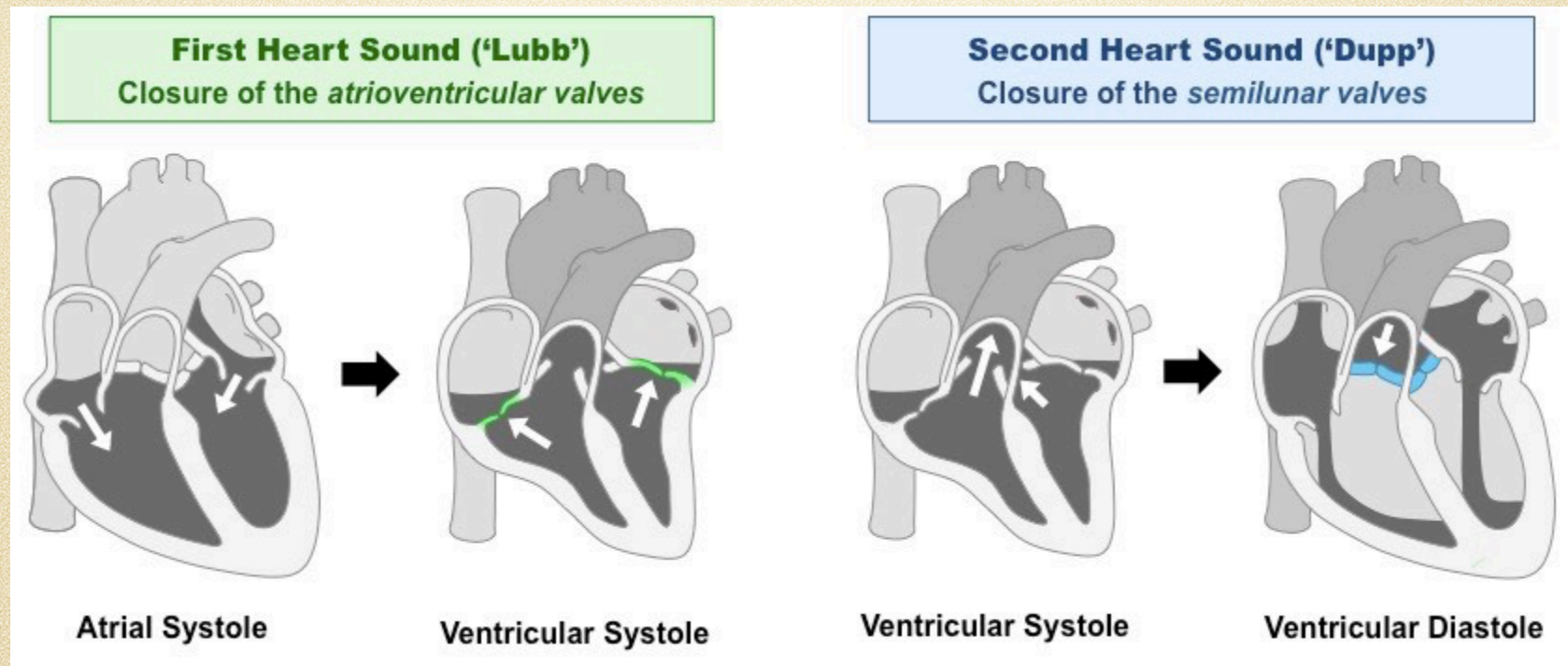
- observation
- palpation
- auscultation



The Diaphragm and the Bell

Copyright © 2007 Lippincott Williams & Wilkins. Instructor's Resource CD-ROM to Accompany Bidley's Bates' Guide to Physical Examination and History Taking, ninth edition.

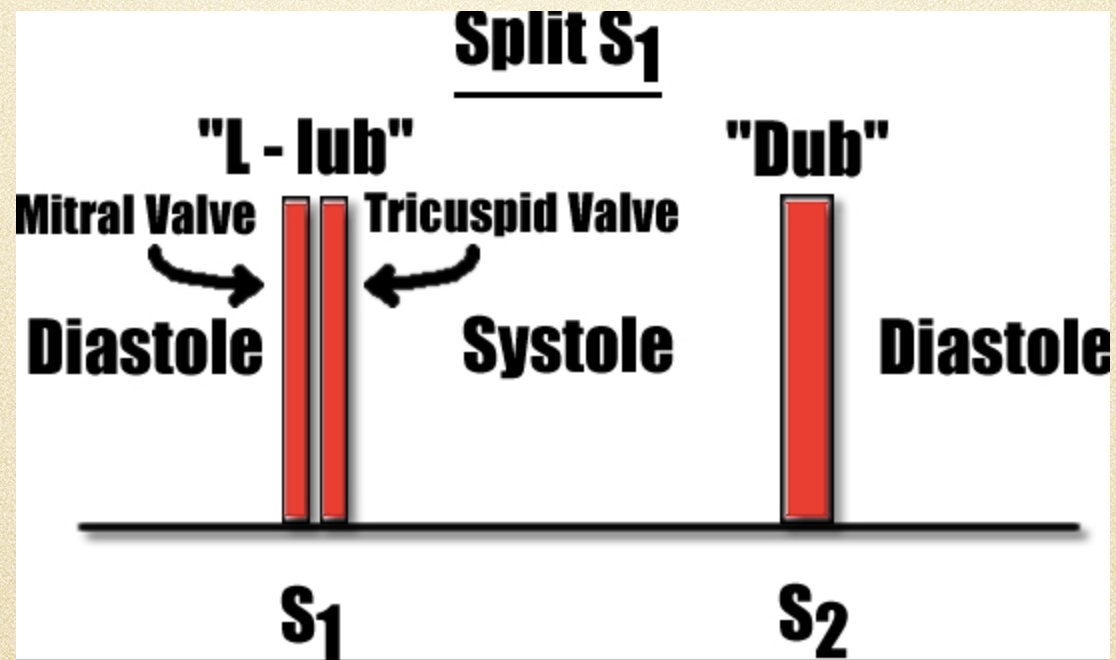
Review on Heart Sounds



Murmur Classification

Table 1	GRADING HEART MURMURS
Grade	Description
1	Soft murmur heard only under quiet conditions
2	Soft murmur heard under even noisy conditions
3	Easily heard prominent murmurs
4*	Loud murmur associated with a thrill
5	Loud murmur with the edge of the stethoscope tilted against the chest plus a thrill
6	Very loud murmur that can be heard 5 mm to 10 mm from the chest plus a thrill
<i>*Note: Diastolic murmurs are only graded to grade 4</i>	

Cardiac Cycle



Common Murmurs

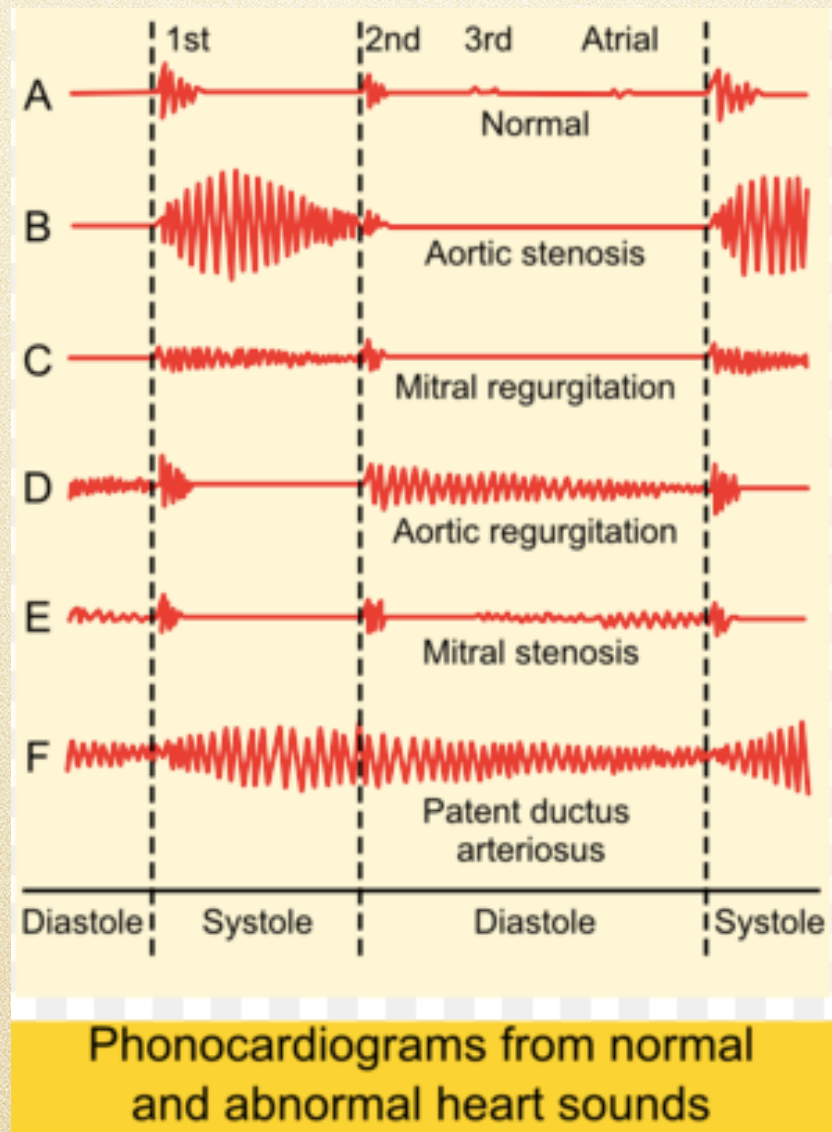


Table 6. The Seven S's: Key Features of Innocent Murmurs

Sensitive (changes with child's position or with respiration)

Short duration (not holosystolic)

Single (no associated clicks or gallops)

Small (murmur limited to a small area and nonradiating)

Soft (low amplitude)

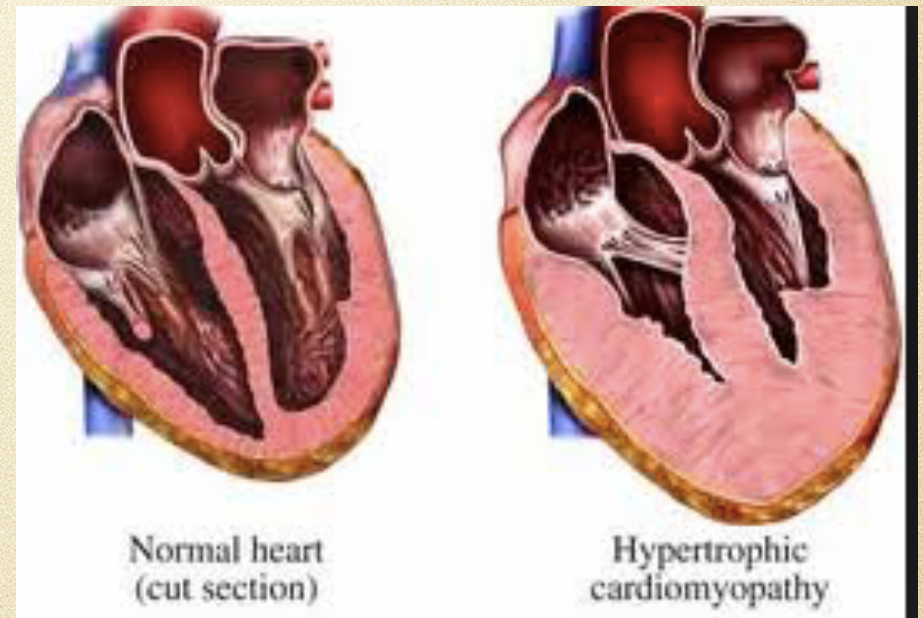
Sweet (not harsh sounding)

Systolic (occurs during and is limited to systole)

Information from reference 27.

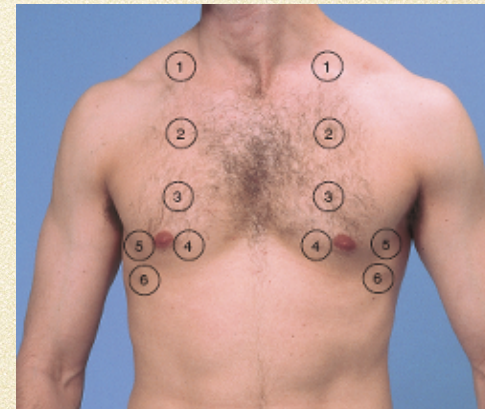
HCM Murmur

- harsh mid-systolic murmur
- heard at left lower sternal border, 4th intercostal space
- **increases with valsalva**
- increases with standing and **decreases with squatting** (decreased venous return)



Pulmonary Exam

- Observation (pallor/ cyanosis/ accessory muscle use/ retractions/ clubbing)
- Palpation
- Auscultation
- Pulse ox/ peak flow/ spirometry



Pulmonary Exam Pathology

- **rhonchi** in bronchi, typically URI, congestion
- **wheezes**: asthma or EIB
- **rales**: infection / fluid / mass

Crackles (or Rales)	Wheezes and Rhonchi
Discontinuous	Continuous
Intermittent, nonmusical, and brief	≥250 msec, musical, prolonged (but not necessarily persisting throughout the respiratory cycle)
Like dots in time	Like dashes in time
<i>Fine crackles</i> : soft, high-pitched, very brief (5–10 msec)	<i>Wheezes</i> : relatively high-pitched (≥400 Hz) with hissing or shrill quality
<i>Coarse crackles</i> : somewhat louder, lower in pitch, brief (20–30 msec)	<i>Rhonchi</i> : relatively low-pitched (≤200 Hz) with snoring quality

From Bickley, Bates' Guide to Physical Examination and History-Taking 11E. Reprinted with permission of Wolters Kluwer Health.


Asthma/EIB

- Chronic Inflammatory Disease of Airways (abnormal PFTs)
- EIB is bronchospasm which usually occurs **after** exercise (normal PFTs at rest)
- EIB seen in 10% population and 90% of asthmatics
- Can make diagnosis of EIB with exercise challenge test where FEV1 decreases >10% on spirometry



Asthma Prevention

- important to know how well your athletes have control over their asthma
- encourage use of peak flow meter at baseline and during periods of SOB to know severity
- may need controller meds if SABAs are not working
- think about **vocal cord dysfunction** if asthma is ruled out and still with symptoms

ASTHMA ACTION PLAN  Asthma and Allergy Foundation of America
aafa.org

The colors of a traffic light will help you use your asthma medicines.

GREEN means Go Zone!
Use preventive medicine.

YELLOW means Caution Zone!
Add quick-relief medicine.

RED means Danger Zone!
Get help from a doctor.

Name: _____ Date: _____

Doctor: _____ Medical Record #: _____

Doctor's Phone #: Day _____ Night/Weekend _____

Emergency Contact: _____

Doctor's Signature: _____

Personal Best Peak Flow: _____

GO Use these daily controller medicines:

You have **all** of these:

- Breathing is good
- No cough or wheeze
- Sleep through the night
- Can work & play

Peak flow: from _____ to _____

MEDICINE	HOW MUCH	HOW OFTEN/WHEN

For asthma with exercise, take: _____

CAUTION Continue with green zone medicine and add:

You have **any** of these:

- First signs of a cold
- Exposure to known trigger
- Cough
- Mild wheeze
- Tight chest
- Coughing at night

Peak flow: from _____ to _____

MEDICINE	HOW MUCH	HOW OFTEN/WHEN

CALL YOUR ASTHMA CARE PROVIDER.

DANGER Take these medicines and call your doctor now.

Your asthma is **getting worse fast**:

- Medicine is not helping
- Breathing is hard & fast
- Nose opens wide
- Trouble speaking
- Ribs show (in children)

Peak flow: reading below _____

MEDICINE	HOW MUCH	HOW OFTEN/WHEN

GET HELP FROM A DOCTOR NOW! Your doctor will want to see you right away. It's important! If you cannot contact your doctor, go directly to the emergency room. **DO NOT WAIT.** Make an appointment with your asthma care provider within two days of an ER visit or hospitalization.

Take Home Points/Personal Advice

- Heart and lung disease commonly presents with atypical signs in athletes (dizziness, fatigue, anxiety, decreased athletic performance, paresthesias)
- Marfanoid habitus can be a clue to underlying cardiac pathology (cystic medial necrosis and aortic rupture)
- Bradycardia is normal in athletes, tachycardia and PVCs can be sign of more severe structural cardiac disease
- Hypertension is diagnosed differently in kids than adults
- Not all murmurs are pathologic
- Hypertrophic cardiomyopathy sometimes can only be diagnosed with murmur that increases with valsalva or standing from squatted position
- Rhonchi are mostly harmless, rales and wheezing usually asthma or infection
- Have your significant others or ADs buy you peak flow meters/spirometers, pulse ox, and a good stethoscope- they can be useful additions to your tool chest!

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