Dynamic Auscultation of Heart Sounds and Murmurs

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Acknowledgement
The sounds you hear today are compliments of "Listening to the Heart" by Daniel Mason, MD., Professor of Medicine, Drexel University College of Medicine, Hahnemann University Hospital, Philadelphia, Pa.
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W. Lane Edwards, Jr., MSN, ARNP, ANP

- Recipient of Grant/Research Support
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- Major Stock/Shareholder
  - None
Where are we?

- Differentiate Mitral Regurgitation from Aortic Stenosis?
- Differentiate Systolic from Diastolic Murmurs?
- Differentiate S3 from S4?
- Recognize a stethoscope 4 out of 5 trys?

Physiologic Approach

- Key to Understanding the creation of "noise" within the cardiovascular system is based on
  - What causes that noise
  - S4 – atrial contraction
- Significant aid in retention of sounds.

I repeat myself........

- Some say it is a sign of aging.
- Some say that I just ramble.
- Some attribute it to SDAT in my family

- My excuse is a learning theory that says repetition strengthens learning, that's my story, and I am sticking with it.
Heart Sounds and Murmurs

Objectives

- Describe a murmur by timing, radiation, characteristics, and point of intensity
- Grade a murmur by its auscultatory characteristics
- Differentiate systolic from diastolic murmurs by clinical presentation

Objectives

- Distinguish split heart sounds from S3 & S4 by characteristics and timing
- Differentiate first and second heart sounds by characteristics and location of sounds
- Provide the physiologic rationale for creation of the 3rd & 4th heart sounds.

Objectives

- Identify the clinical presentation of selected lesions of the aortic and mitral valves
- Discuss the medical and surgical treatment for each valve lesion.
Today's Agenda
- Anatomy
- Circulation
- Creation of Heart Sounds
- The Cardiac Cycle
- Anticipation!
- Auscultatory Positions
- First Heart Sound
- Second Heart Sound
- Split Sounds
- Third Heart Sound
- Fourth Heart Sound
- Summation Gallop

Part II - The Murmurs
- Description of Murmurs
- Characteristics
  - Holosystolic
  - Decrescendo
  - Crescendo
- Grading of Murmurs
- Aortic Stenosis
- Aortic Insufficiency
- Mitral Insufficiency
- Mitral Stenosis
- Prosthetic Valves

Circulation Review
Types of Valves

- Pressure
  - Aortic & Pulmonic
  - Dependent on pressure gradients

- Structural Support Mechanisms
  - Mitral & Tricuspid
  - Cordae and papillary muscles

Right Atrium and Tricuspid Valve

- Unidirectional blood flow from RA to RV
- Rt. Atria Expansion
- Rt. Atrial Mixing
  - different O² sats
- Tricuspid Valve
  - low pressure
  - small support structures
  - Low pressure gradient

Tricuspid Valve
**Pulmonic Valve**

- Unidirectional blood flow from RV to Pulmonary circuit
- Pressure valve
- No structural support
- Moderate pressure gradient

**Left Atrium and Mitral Valve**

- Lt Atria Fixed Size
- Mitral Valve
  - more cordae
  - stronger papillary muscles
  - part of inferior wall
  - Inferior MI issues
  - Pressure issues
  - No Valves to Lungs
Mitral Valve

Mitral Valve Open and Closed

Aortic Valve
The Cardiac Cycle

Rapid LV Filling
- Mitral Valve Opens
- Blood stored in prior cycle rushes into left ventricle.
- If Preload high
  - S3
Diastosis

- As the Mitral Valve is open, blood continues to fill from the LA to the LV increasing pressure and wall tension

Atrial Contraction

- Following the P wave of the EKG, the atria contract augmenting another 20-30% volume increase in LV
  - If large preload
    - S4

Both Doors Closed ....

- When pressure in Lt Ventricle exceeds that of the LA, the mitral valve closes
  - Aortic Valve is closed
  - Room get smaller!
  - Pressure goes up
Aortic Ejection

- With the Mitral valve prevented from opening by chordae and papillary muscles
- Aortic valve set by pressure above the valve
- Pressure in LV increases

Aortic Valve Opens

- With pressure below the valve higher than above the valve, the aortic valve opens
- When ventricle empties and the pressure is less in LV, aortic valve cusps fill with blood and close

What if....

- Mitral valve can’t open adequately
- Mitral Valve can’t close during systole
- Aortic valve can’t open well
- Aortic valve can’t close well
Anticipation of Abnormals

- History of Hypertension
  - Mitral Regurgitation
  - S3
  - S4
Anticipation of Abnormals

- Congestive Heart Failure
  - Mitral Regurgitation
  - S3
  - S4

Anticipation of Abnormals

- Volume / Pressure Overloads
  - Splitting of Heart Sounds
  - S3
  - S4

Anticipation of Abnormals

- Valvular Abnormalities
  - Ejection Sounds, Clicks
  - Opening Snaps
  - Knocks, plopps
Pulmonic

Anatomical Auscultation Points

- Left Lateral Sternal Border
  Rt. Heart and tricuspid valve
  4th ICS, Left Sternal Border
- Apex
  Lt. Heart or Mitral area
  5th intercostal space, mid clavicular line

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Anatomical Auscultation Points

- Base Left
  Pulmonic Area
  2nd ICS, Left of Sternum
  Mitral & Aortic Sounds also heard
- Base Right
  Aortic Area
  2nd ICS, Right of Sternum

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Normal First Heart Sound

- Closure Mitral - Tricuspid Valves
- Occurs with onset of the apical pulse and carotid pulsation
- Heard loudest at the apex and LSB with diaphragm (high)

Normal S2

- Closure of Aortic & Pulmonic Valves
- S1 longer & lower
- S2 is shorter & sharper
- Aortic 1st; A2P2
- Base Of Heart with diaphragm (high)

Listen
Splitting of $S^2$

Normal Split
Physiological Split
Paradoxical Split

Closing Order
Left Ventricle

- Normal (physiological)
  - Aortic – Pulmonic
    - A2-P2
  - Abnormal (paradoxical)
    - Pulmonic Aortic
    - P2 A2

Normal Split $S^2$

- Splitting during inspiration is normal
- Expiration the splitting will do away
- Increased blood intake into Rt. Heart during inspiration
Listen

Paradoxical Split S 2
Abnormally Wide Split S 2

- Heard split in inspiration and expiration
- Best heard base Lt. with diaphragm
- RBBB, LBBB
- Pulmonary Stenosis
S 3

- Opening of Mitral Valve - rush in
- Ventricular Overload
- Myocarditis
- CHF, Tachy's
- Bell over Apex - Lt. Lateral Recumbent
- Physiologic in young <30 (!)
Listen

Fourth Heart Sound S4
- Caused by Atrial Contraction
- Increased LV Stiffness
  - Primary Myo Dz
  - Htn
  - CAD
  - Aortic Pulmonary Stenosis
- Bell at Apex

S4

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Listen

Summation Gallop

Listen
Normal vs Bicuspid Aortic Valve

Listen

Murmurs
Describing a Murmur

- Timing - Systolic Vs Diastolic
- Identify area heard loudest
- Identify radiation of sound
- Identify Duration and Characteristics

Grading of Murmurs

- Grade I
  - very faint - takes several cycles to hear
- Grade II
  - quiet, but heard immediately, first cycle

Grading of Murmurs

- Grade III
  - Moderately loud, but without thrill
- Grade IV
  - loud, may be associated with a thrill
Grading of Murmurs

- Grade V
  very loud, may be heard with a stethoscope partly off the chest, usually associated with a thrill

- Grade VI
  Heard with stethoscope off the chest has a thrill

Listen

Systolic

Early Systolic Murmurs
Holosystolic Murmurs
Mid-systolic Murmurs
Late Systolic Murmurs
Diastolic

- Early Diastolic Murmurs
- Mid-diastolic and Presystolic Murmurs
- S3 Rumbles
- Austin Flint Murmurs

The Misconception

The Electrocardiogram

- Mitral Regurgitation
- Mitral Stenosis
- Aortic Stenosis
- Aortic Insufficiency
When Do I get an echo?

- New discovery of murmur
- Change in clinical presentation
- Annually for grade 3 or above murmurs
- Change in LV function

Aortic Stenosis

Listening for Aortic Stenosis
Aortic Stenosis

Aortic Valve Vegetations

Aortic Stenosis
Pathophysiology AS

Clinical – low output state

Aortic Stenosis

Blood is unable to flow freely from the left ventricle to the aorta during aortic stenosis

Aortic Stenosis

- Low forward flow
- Dizziness
- Fatigue
- LV geometry changes
- Fibrillation possible
- LA pressure up
- Pulmonary back pressure
Listen

Treatment of AS
- Afterload reduction
- Preload reduction
- PVR
- Increased Intravascular Volume
- Anti platelet

Aortic Insufficiency
Aortic Insufficiency

- Compromised diastolic filling of coronary arteries
- IABP contraindicated
- Enhanced preload - LV
- LVH as compensation

Aortic Insufficiency

- Aorta
- Aortic valve
- Left ventricle
- Aortic valve regurgitation
- Aortic valve does not close
- Blood leaks backward
Aortic Insufficiency

Failure of the aortic valve to close tightly causes back flow of blood into the left ventricle.

Listen

Treatment of AI

- Afterload reduction
- Preload reduction
- PVR
- Increased Intravascular Volume
- Anti platelet
Mitral Insufficiency

Listening

Mitral Insufficiency
Mitral Insufficiency

<table>
<thead>
<tr>
<th>Acute</th>
<th>Chronic</th>
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</thead>
<tbody>
<tr>
<td>- Cordal Rupture</td>
<td>- Increasing LV geometry changes</td>
</tr>
<tr>
<td>- Inferior wall MI</td>
<td>- Increasing MR</td>
</tr>
<tr>
<td>- Papillary Muscle Rupture</td>
<td></td>
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<tr>
<td>- Vegetations on leaflet</td>
<td></td>
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Mitral Insufficiency

- Large LA
- High Pulmonary Pressure
- Reflection to Lungs
- LVH
- Rt. Heart Failure

- Primary clinical - Respiratory complaints
Listen

Treatment of MI
- Afterload reduction
- Preload reduction
- PVR
- Increased Intravascular Volume
- Anti platelet

Mitral Stenosis
Listening to MS

Normal Mitral Valves

Mitral Stenosis
Mitral Stenosis
- Huge Left Atria
- Mural Thrombus
- Arrhythmia control
- Low forward flow
  - Right heart failure
- Minimal LV geometry changes
- Mostly Pulmonary with some decreased flow

Listen

Treatment of MS
- Afterload reduction
- Preload reduction
- PVR
- Increased Intravascular Volume
- Anti platelet
Left Atrial Mixoma

Listen

Prosthetic Valves
Tissue Valves

Starr-Edwards Caged Ball

Ball Cage Valves

Ball Cage Valve
St Jude Valve

Just wanted to say it formally!

Thank You

For Listening

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