Pediatric Heart Murmurs

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Disclosures

• I have no disclosures
Objectives

• Heart sounds
• Systolic murmurs
• Diastolic murmurs
• Innocent murmurs
• Exam maneuvers
• Additional testing
The physiology of cardiac auscultation

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• 1% of the population has congenital heart disease
• Up to 85% of the population has an innocent murmur during childhood
• Murmurs and heart sounds are the result of the relationship between blood volume, pressure, and flow
Heart Sounds

• S1
  – Closure of the AV valves

• S2
  – Closure of the semilunar valves
  – Physiologic splitting during inspiration
    • Increased right heart filling
    • Decreased left heart filling
Heart Sounds

• **S2**
  
  – Physiologic splitting during inspiration

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<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>( S_1 )</td>
<td>1st heart sound</td>
</tr>
<tr>
<td>( M_1 )</td>
<td>Mitral valve component</td>
</tr>
<tr>
<td>( T_1 )</td>
<td>Tricuspid valve component</td>
</tr>
<tr>
<td>( A_2 )</td>
<td>Aortic component</td>
</tr>
<tr>
<td>( P_2 )</td>
<td>Pulmonic component</td>
</tr>
</tbody>
</table>

Increased venous return during inhalation delays \( P_v \) closure.
Heart Sounds

- S2
  - Fixed splitting
Heart Sounds

• Ejection Click
  – Normal
  – Click
Murmurs

• Murmurs result from flow turbulence
• Intensity depends on size of vessel or orifice, amount of flow, and pressure differential
• Frequency of a murmur is proportional to the pressure differential only
Classification of Murmurs

• Timing
  – Systolic vs Diastolic vs Continuous
• Duration
• Intensity
  – Grade
• Location
• Frequency
Systolic Murmurs

• Holosystolic


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Systolic Murmurs

• Holosystolic Murmurs
  – Begin with S1 and continue through to S2.
  – Heard with atrioventricular valve regurgitation and most VSD’s
Systolic Murmurs

- Holosystolic

- Ejection
Systolic Murmurs

- Ejection
Systolic Murmurs

- Systolic Ejection Murmurs
  - Crescendo-decrescendo
  - Heard with narrowing of semilunar valves or outflow tracts
Systolic Murmurs

- Holosystolic
- Ejection
- Early systolic
Systolic Murmurs

- Early Systolic Murmurs
  - Begin with S1, but ends before S2
  - Heard with small VSDs
Systolic Murmurs

- Holosystolic
- Ejection
- Early systolic
- Late systolic
Systolic Murmurs

- Late Systolic Murmurs
  - Begin in mid systole and often associated with midsystolic clicks
  - Heard with mitral valve prolapse
Diastolic Murmurs

- Early Diastolic

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Diastolic Murmurs

• Early Diastolic Murmurs
  – Decrescendo
  – Heard with aortic or pulmonary insufficiency
Diastolic Murmurs

- Early Diastolic
- Mid Diastolic
Diastolic Murmurs

• Mid Diastolic Murmurs
  – From increased flow across normal AV valve or stenotic AV valve
Diastolic Murmurs

• Early Diastolic

• Mid Diastolic

• Late Diastolic
Diastolic Murmurs

- Late Diastolic Murmurs
  - From stenotic AV valves
Continuous Murmurs

• Begin in systole and continue past S2
• Often pathologic (except for venous hum)
Grading Murmurs

- Grade 1: Just audible under optimal conditions
- Grade 2: Easy to hear
- Grade 3: Moderately loud

- Grade 4: Markedly loud with a thrill
- Grade 5: Audible with stethoscope partly off chest with a thrill
- Grade 6: Audible without a stethoscope with a thrill
Location

- Aortic area
- Pulmonary area
- Mitral area
- Tricuspid area
Innocent Murmurs

- Up to 85% of children will have an innocent murmur
- Systolic or continuous
- Never solely diastolic
- Never greater than grade 3
- Usually no radiation
Innocent Murmurs

- Still’s murmur
  - Vibratory, “twanging sound”
  - Louder when supine
- Pulmonary flow murmur
  - Ejection systolic murmur
  - Louder when supine
  - No thrill or click, lower pitch than pulmonary stenosis
Innocent Murmurs

- Peripheral pulmonary stenosis
  - Common in newborns and infants
Innocent Murmurs

• Peripheral pulmonary stenosis
  – Best heard in axilla and back
  – Can be difficult to distinguish from pathologic branch pulmonary stenosis
    • Significant stenosis is usually higher pitch
    • Pathologic stenosis murmur persists
Innocent Murmurs

• Venous Hum
  – Continuous murmur
  – Heard on low anterior part of neck and infraclavicular area
  – Often louder on right
  – Louder when sitting vs supine
  – Murmur suppressed by turning head towards side of murmur or compression of jugular vein
Maneuvers

• Valsalva
• Exercise
• Postural Change
Maneuvers

- Valsalva
  - Straining increase intrathoracic pressure and decreases venous return to the heart
  - Results in heart rate increase and decrease intensity of most systolic murmurs
  - Murmur related to hypertrophic cardiomyopathy increases as obstruction worsens with lower stroke volume
Maneuvers

• Exercise
  – Handgrip-Isometric grip for 30 seconds
    • Increase both afterload and preload
      – Afterload increased to greater proportion
  • Aortic stenosis
    – Murmur decreases in intensity from increased afterload
  • Mitral regurgitation
    – Murmur increases in intensity from increased afterload
Maneuvers

• Postural Change
  – Sudden standing
    • Similar to valsalva
    • Decreases venous return and decreases stroke volume
    • Results in heart rate increase and decrease intensity of most systolic murmurs
    • Murmur related to hypertrophic cardiomyopathy increases as obstruction worsens with lower stroke volume
Maneuvers

• Postural Change
  – Squatting
    • Increases venous return to the heart
    • Both preload and afterload increase
    • Most systolic murmur will increase in intensity
Maneuvers

• Postural Change
  – Sitting forward and exhaling
    • Accentuates aortic insufficiency as heart rate decreases and stroke volume increases leading to more regurgitant volume
Timing of presentation

• Newborn period
• After 2 months of life
• Toddler
Testing

- Echocardiograms
  - Patient cooperation
  - Experience with pediatric echocardiograms
Summary

• Murmurs result from flow turbulence
• If all else is normal, consider referral/testing for
  – Murmurs louder than grade III
  – Diastolic murmurs
  – Newborn murmurs
• Echocardiogram is not a perfect test
Thank You!