What’s That Sound?
Pediatric Murmur Evaluation

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Objectives:
1. Describe the components of a thorough cardiac physical examination and define the prevalence of murmurs in the pediatric population.
2. Using concepts of music, define the five qualities by which a murmur is described.
3. List the defining qualities and characteristics of the four common “innocent” murmurs heard in children.
4. Employ reasoning skills to distinguish characteristics of murmurs that would differentiate an innocent from a pathologic murmur.

Definitions
• Describe qualities and characteristics of “innocent” murmurs
• Using reasoning skills, distinguish innocent from pathologic murmurs
Obligatory Disclaimer

- The cardiac exam DOES NOT start with listening for murmurs...
  - Inspection
  - Palpation
  - Auscultation
    - Heart sounds (S1, S2; possibly S3, S4)
    - Clicks
    - Murmurs

- Be systematic, develop a routine, and stick with it!

What is a Murmur?

- Latin: *murmurare*
  - “A hum, muttering, rushing”
- Dorland’s Medical Dictionary
  - “An auscultatory sound, benign or pathologic, particularly a periodic sound of short duration of cardiac or vascular origin”

How prevalent are murmurs in children?

A. 0-20%
B. 21-40%
C. 41-60%
D. 61-80%*
E. 81-100%
What is the incidence of congenital heart disease in the US?

A. 0.1%
B. 1%
C. 5%
D. 10%
E. 20%

How Common Are Murmurs?

- Murmur prevalence as high as 77% of children
- ~1% of the general population is born with a CHD

Characteristics of Sound

1. Volume
2. Pitch
3. Quality
4. Timing
5. Location and Transmission
What Causes an Innocent Murmur?

- Nobody knows!
  - Smaller vessel caliber (increased velocity)?
  - Left ventricular false tendons?
  - Exaggerated vibrations with ventricular contraction?

Characteristics of “Innocent” Murmurs

1. Soft (≤ grade 3)
2. Often vary with postural changes
3. Always systolic (with 1 exception . . .)
   - Diastolic = pathologic
4. Occur in otherwise normal children

Innocent Murmurs

- 4 common innocent murmurs:
  1. Still’s Murmur
  2. Peripheral Pulmonic Stenosis (PPS)
  3. Venous Hum
  4. Pulmonary Flow Murmur
1. Still’s Murmur

- Most common innocent murmur in children
- Peak age: 3-8 years
  - Occasionally heard in infants
- Many names:
  - Vibratory
  - Musical
  - Groaning
  - Twanging String

Still’s Murmur

- Mid-systolic
- Low-mid pitch
- LLSB, with slight radiation to base and apex
  - “Hockey stick” radiation
- Best heard when supine

Still’s Murmur

- Sir George Frederic Still
  - “Father of British paediatrics”
- Credited with:
  - Still’s murmur
  - Still’s disease (systemic JRA)
  - Initially describing ADHD
- “Hobby” was reading classic literature in their original languages
  - Fluent in Greek, Latin, Hebrew, Arabic
Still’s Murmur DDx

- Differentiate:
  1. Small VSD

Ventricular Septal Defect

- “Holosystolic” murmur
  - Aka “Regurgitant” murmur
  - ONLY implies isovolumic contraction

- No significant positional change
Still’s Murmur DDx

- Differentiate:
  1. Small VSD
     - Both heard at LLSB
     -Isovolumic contraction, no postural changes
  2. Subaortic Stenosis
     - Subaortic Membrane
     - Hypertrophic Obstructive Cardiomyopathy

Subaortic Stenosis

1. Subaortic Membrane
   - “Harsh” quality
   - Loudest at URSB, radiates to neck
   - Often associated with aortic regurgitation (diastolic murmur)
   - ECG: may show LVH

Subaortic Stenosis

2. Hypertrophic Obstructive Cardiomyopathy
   - “Harsh” quality
   - Louder at URSB
   - Louder with standing
   - Softer with squatting
   - ECG: May show LVH
Still’s Murmur

- Differentiate:
  1. Small VSD
     - Both heard at LLSB
     - Isovolumic contraction, no postural changes
  2. Subaortic Stenosis (subaortic membrane vs. HOCM)
     - “Harsh” quality
     - Louder at URSB
     - May have LVH on ECG

2. Peripheral Pulmonic Stenosis (PPS)

- Most common innocent murmur in infants
- “Pulmonary flow murmur of newborn”
- Systolic ejection murmur at ULSB, radiates to axillae/back
- Resolves by 6 months

Peripheral Pulmonic Stenosis DDx

- Differentiate:
  1. Valvar Pulmonic Stenosis
Valvar Pulmonic Stenosis
• Systolic ejection murmur at ULSB
• Ejection click after S1
• Palpable right ventricular impulse
• ECG: may show RVH

Peripheral Pulmonic Stenosis DDx
• Differentiate:
  1. Valvar Pulmonic Stenosis
     • Presence of click, right ventricular impulse
  2. Small PDA

Patent Ductus Arteriosus
• Continuous murmur, subclavicular area
• Diastolic “spilling” of blood from aorta to PA
  – Drops diastolic pressure in aorta
  – “Bounding” pulses
• Small PDA: diastolic component may be very quiet
Peripheral Pulmonic Stenosis DDx

- Differentiate:
  1. Valvar Pulmonic Stenosis
     - Presence of click, right ventricular impulse
  2. Small PDA
     - Louder in subclavicular region
     - Listen for diastolic component

3. Venous Hum

- Continuous murmur, louder in diastole, vary with respiration
- Peak age: 3-6 years
- Low pitch
- Lf or Rt supra/subclavicular area
- "Manipulate-able"

Venous Hum

- "Breezy" sound
- "Manipulate-able"
  - Heard sitting up
  - Murmur disappears when:
    - Lie down
    - Turn head away from murmur
    - Compress ipsilateral jugular vein
What congenital heart defect causes a continuous murmur on exam?

A. VSD  
B. ASD  
C. TOF  
D. PDA*

Venous Hum DDx

- Differentiate:
  1. PDA

Patent Ductus Arteriosus

- Continuous murmur, subclavicular area
- Diastolic “spilling” of blood from aorta to PA
  - Drops diastolic pressure in aorta
  - “Bounding” pulses
Venous Hum DDx

• Differentiate:
  1. PDA
     • High pitch, no changes with postural changes
     • Accentuated pulses

4. Pulmonary Flow Murmur

• Commonly heard in thin-chested adolescents
  – Peak age: 8-14 years
• Early-mid systolic ejection murmur
• ULSB: flow across RVOT

Pulmonary Flow Murmur DDx

• Differentiate:
  1. Valvar Pulmonic Stenosis
     • Presence of click, right ventricular impulse
  2. ASD
Atrial Septal Defect

- Early-mid systolic ejection murmur at LUSB
  - = pulmonary flow murmur
- “Fixed split S2”
- Right ventricular impulse
- ECG: right-sided enlargement
- CXR: cardiomegaly, increased PVM’s

Pulmonary Flow Murmur

- Differentiate:
  1. Valvar Pulmonic Stenosis
     - Presence of click, right ventricular impulse
  2. ASD
     - Abnormal S2, right ventricular impulse

Conclusions

- Murmurs are music
- Approach murmurs in a stepwise fashion, as if you were evaluating music
- “Innocent” murmurs are common
- Rely on murmur characteristics (+/- ECG, CXR) to differentiate innocent vs. pathologic murmurs