Evaluation of Cardiac Child

(Formerly: History & Physical Exam)

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Patients do not come with labels.
Key Messages

1. History: sometimes critical, sometimes not
2. More to a physical exam than murmurs
3. Pearls in physical diagnosis
4. Endocarditis is not lab or echo diagnosis
5. Echo is great but stethoscope still works
6. Three phases of differential diagnosis
Elements in Evaluation

- History
- Physical exam
- Labs
- Imaging
- Review of literature (evidence)
- Differential diagnosis
History

From whom?

- Parents; care-giver(s)
- Patient
- Teachers; Coaches;
- Other professionals

Elements

- Appearance
- Feeding & growth hx
- Trend lines
- Family History
- Medication history
Patterns of Failure to Thrive

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History: Pt with Failure to Thrive

There are only two cardiac reasons for FTT:

- **Profound cyanosis**
- **Very** large LØ>R shunt +/- CHF.

Look for other reasons an unrecognized syndrome, endocrine, or environmental causes an in a child with FTT and a murmur, or PAH.
Physical Exam: O. T. L.

Start by making friends with the child.

- Observe
- Touch
- Listen
Physical Exam: Observation

- Color: general, specific areas
- Breathing pattern: rhythm, rate, depth, noise
- Skin: perfusion, rash, petechiae, Janeway spots
- Jugular venous distention & head circumference
- Precordium: where, activity, PMI.
- Somatic features, viz., syndrome, asymmetry.
- Cyanosis? Where?
Physical Exam: Touch (Feel)

- Chest & Precordium
- Warmth. Capillary refill
- Taps, Heaves, Thrills
- Pulses: Volume, Character
  - Simultaneous rt arm & leg (? Prior cath, shunt?)
  - ALL pulses in Kawasaki patients

What is the most sensitive part of the hand?
Physical Exam: Listen

- Lungs
- Heart
- Abdomen
- *Head and Liver* for bruits
Evaluating a Heart Murmurm
Using The *Focal Plane Shutter*
With intact atrial septum, 
$S_2$ widens during inhalation.
Exhale → ↑ Intrathoracic Pressure

↓ Syst Ven Ret  ↑ Pulm Ven Ret

↓ Rt Hrt Vol  ↑ Left Hrt Vol

Quicker RV emptying  Slower LV emptying

With intact atrial septum, $S_2$ width varies with respiration.

With large ASD, $S_2$ stays widely split regardless of breathing.
What does ‘holosystolic mean? P.S. Isn’t ‘systolic ejection~ murmurm redundant?
The Shapes of Murmurs

Continuous

To-&-Fro

PDA

PS/PR
Stenotic Murmurs

- Early Peak
- Late Peak
The Peripheral Pulses

- Quality/Volume
- Feel ALL
- Differences & lag
- Changes over time or with Rx

Consider AS-V versus Coa
Other Physical Signs

- Hepatomegaly
- Splenomegaly*
- Edema: pedal, peri-orbital, generalized
- Jugular Venous distention
  (NB in Fontan pts, including head circ.)
Pearls in Physical Diagnosis

• Inside-Out (in RF) *versus* Outside-In (in JRA)

• Endocarditis is a clinical, repeat *clinical*, diagnosis

• Vitiligo `H` Tub. Scler. `H` Rhabdomyomas

• Beware No murmur. Beware Grade V murmur.
1. Blood count
2. Blood gases
3. Blood culture
4. ESR vs CRP
5. ESR, platelet count \( \text{in Kawasaki} \)
6. BNP
7. Troponins in chest pain
8. Genetic studies
9. Others: CPK, metabolites,
Imaging

- Chest x-ray

Use *focal plane shutter* technique
Chest X-ray

Bones  Airways  Qp  Heart & pedicle
Imaging

- Chest x-ray
- Barium swallow & bronchoscopy
- Echo, the **Queen** of cardiac studies
- Vascular studies, especially color
- MRI, esp. with contrast
- CT
- Angios (by cath)
Physical Exam <ãã> Echo Correlation

Leg of Normal, OR
Arm of Coa Pt

Femoral Pulse in Coa Pt

Note Upstroke Or Lack thereof.

Normal Celiac Flow

Celiac artery flow—coarctation pt
Three Phases of Diff Dx

I. Med Student  What is possible (list)?

II. Resident/Fellow  What is probable?

III. Sr. Attending  What is treatable?

Put in order of probability

? Two stories

Most dangerous?
A Physical Exam

Story

With A Happy Ending.

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Physical Exam: Listening

- Stethoscope: bell versus diaphragm (pediatric)

- Lungs
  - Stridor, egophony
  - Different sounds: rales, rhonchi, breath sounds
  - Symmetry

- Heart / C-V sounds: valve sounds, murmurs, bruits, clicks, rubs, etc.
S₂ â The Most Important Sound

• S₂ is your window on physiology.

• A₂ & P₂: What determines intensities?
  • S₂: in a large VSD
    in Tetralogy of Fallot
    in aortic stenosis

• What makes S₂ split?
  • Pressures?
  • Resistances?
  • Volumes?
  • Contractility?
Physical Exam: *Cyanosis*

**Defined as:**
PERCEPTION of bluish discoloration in skin, nail beds, sclerae, mucous membr

**Caused by:**
> 4.5gms desaturated Hb in Systemic arterial circulation

**Differentiate cyanosis from hypoxemia**

**Differential vs reverse differential cyanosis**
S₂ in large VSD

1. What determines split?  

2. What determines intensity?  

3. What if there is a large VSD???  
Clinical Histories:


4 yo referred to Pulmonary for lung disease. Exercise tolerance ’ normal. ~ Saturation in room air=78%. No abnormal lung sounds. No murmur. Died 18 mon later, in San Diego.

What was dx? What would have saved them?
Analysis of Murmurs

1. Timing: systolic v. diastolic; length
2. Character, including shape
3. Frequency means \( \text{H} \)
4. Peak: when; height
5. Location, viz., mitral area
6. Radiation

A warm stethoscope makes for easy listening.
# Pitch: Window on Physiology

<table>
<thead>
<tr>
<th>Condition</th>
<th>LV_p &gt;&gt; AAO_p</th>
<th>LV_p ( \uparrow ) AAO_p</th>
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<tbody>
<tr>
<td>Ventricular septal defect</td>
<td></td>
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<tr>
<td>Aortic stenosis</td>
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<tr>
<td>Mitral regurgitation</td>
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</tbody>
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Nl PAP \( \uparrow \) RV_p, LV_p

Severe MR

Implies

High?       Low?

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How to Listen to Heart Sounds: The Focal Plane Shutter
Causes

1. Bileaflet Valve
2. Prolapse-A-V valve
3. Aneurysm of membr. septum
Pitch: Window on Physiology

<table>
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<th>Low?</th>
</tr>
</thead>
<tbody>
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<td>Ventricular septal defect</td>
<td>NL PAP</td>
<td>RV&lt;sub&gt;p&lt;/sub&gt; f LV&lt;sub&gt;p&lt;/sub&gt;</td>
</tr>
<tr>
<td>Aortic stenosis</td>
<td>LV&lt;sub&gt;p&lt;/sub&gt; &gt;&gt; AAO&lt;sub&gt;p&lt;/sub&gt;</td>
<td>LV&lt;sub&gt;p&lt;/sub&gt; f AAO&lt;sub&gt;p&lt;/sub&gt;</td>
</tr>
<tr>
<td>Mitral regurgitation</td>
<td>NL LA&lt;sub&gt;p&lt;/sub&gt;</td>
<td>Severe MR</td>
</tr>
<tr>
<td>Aortic regurgitation</td>
<td>Mild AR</td>
<td>Sev AR, but’H</td>
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Murmur Shapes: La maladie de Roget
More Murmurs

Continuous Murmur

PDA

PS/PR

To-&-Fro Murmur

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