



Centre universitaire de santé McGill
McGill University Health Centre

Murmurs in ▼ Children

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- 
- I have no financial disclosures

Objectives

General concepts pertaining to the cardiac examination of the child

Approach to the neonate, infant, toddler and child with a heart murmur

Murmurs heard at different ages

Murmurs: Benign vs Pathologic

Examples

Resources





Disclaimer

This workshop will not make you proficient in cardiac auscultation

Auscultation is a skill that is learned, through repetition and requires constant practice to maintain competence



Psychoacoustic facts

Must create an acoustic template for each sound and murmur

It takes about 500 repetition to acquire one template

It takes 15 minutes per sound/murmur

Training works very well but must be maintained

Return to baseline if no practice for 6 months



Why
attend a
murmur
workshop?

Screening of
murmurs

Change in
disease severity



Tools

History

Physical examination

Cardiac Auscultation

Ancillary investigations:
ECG, CXR





Facts

Auscultation remains an important skill as part of a comprehensive cardiac evaluation

Effective tool when done properly

Results are immediately available

Cost effective

Part of the patient-physician relationship



A systematic approach to cardiac examination in children

Plot

- Somatic growth
- Vitals, saturation

Look

- General appearance/dysmorphic features
- Central cyanosis, clubbing

Feel

- Palpation and apex assessment
- Pulses
- For organomegaly

Listen

- All auscultatory areas
- Bell and diaphragm

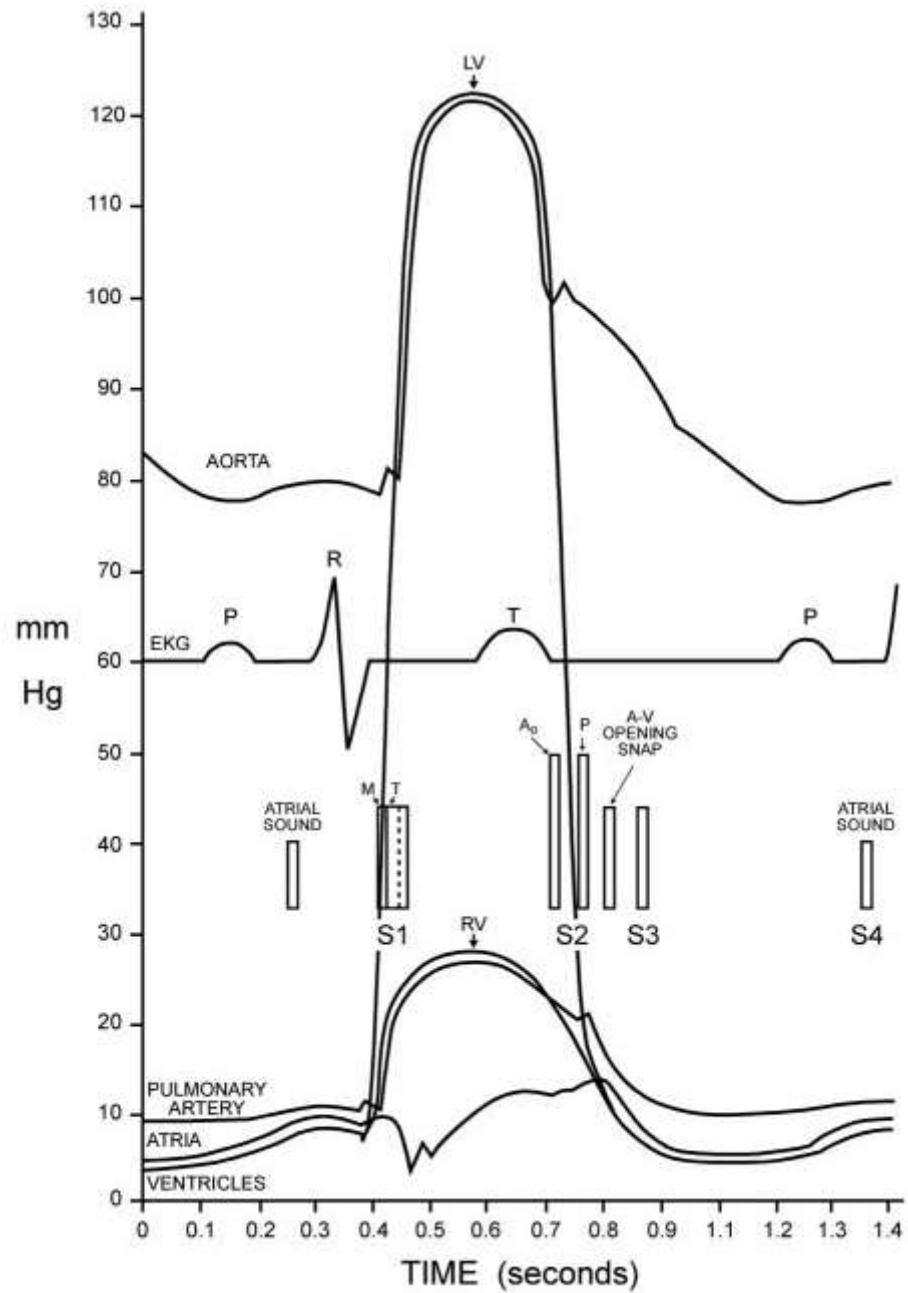




General concepts

- **Quiet room**
- **Quiet child**
 - Establish report
 - Distractions
 - Parent's lap for anxious toddlers
 - Warm hands
 - Warm stethoscope
- **Quiet parent**
- **Good tools**
 - Invest in a decent stethoscope
 - Shorter than 30" tubing
 - Comfortable earpiece
- **Be thorough but flexible**







History



Pregnancy and delivery history



Fetal ultrasounds (or fetal cardiac ultrasounds)



Exposure to possible teratogens or maternal diabetes?



Family history of congenital heart disease?



Are there other extra-cardiac congenital malformations present?



Examination

General appearance, dysmorphic features?

Heart rate, respiratory rate and effort, blood pressure, distal perfusion

Oximetry in right arm and one leg: oximetry screening

Palpation of the precordium

Hepatomegaly?

Peripheral pulses, femoral pulses

Auscultation



CPS statement

PRACTICE POINT



Pulse oximetry screening in newborns to enhance detection of critical congenital heart disease

Posted: Nov 27 2017



PEDIATRICS[®]

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

**Endorsement of Health and Human Services Recommendation for Pulse
Oximetry Screening for Critical Congenital Heart Disease**

SECTION ON CARDIOLOGY AND CARDIAC SURGERY EXECUTIVE
COMMITTEE, William T. Mahle, Gerard R. Martin, Robert H. Beekman III, W.
Robert Morrow, Geoffrey L. Rosenthal, Christopher S. Snyder, L. LuAnn Minich,
Seema Mital, Jeffrey A. Towbin and James S. Tweddell

Pediatrics 2012;129;190; originally published online December 26, 2011;

DOI: 10.1542/peds.2011-3211

ANY infant with **ABNORMAL*** or **FAILED**** result requires a **prompt** evaluation by NN pediatrician (daytime hours) or NICU team (afterhours)
ABNORMAL = ASAP
FAILED = within 30 minutes

Evaluation*** should include:
General physical exam
HR, RR, temperature
Palpation of femoral pulses
4-limb BP
Review of history

ABNORMAL: Transfer to NICU for ongoing evaluation
 Cardiology consultation if required

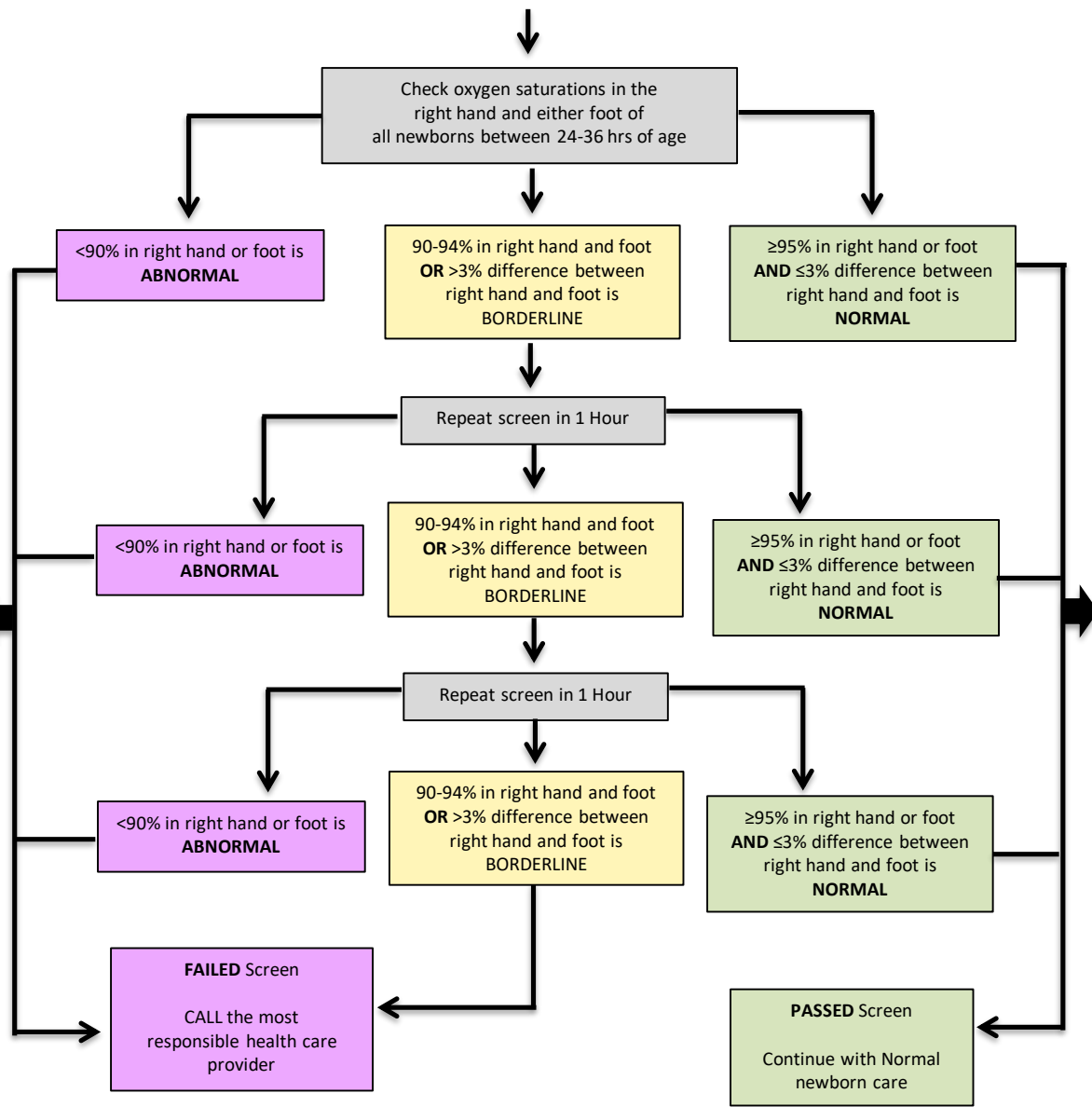
FAILED: Clinically abnormal/unstable at any time:
Transfer to NICU

Clinically stable: 08h-15h M-F for **failed but clinically stable**; NN to call cardiology directly for consult
 All other times: Consult NICU

*consider other causes of abnormal or borderline results (eg. sepsis)

**note that a FAILED screen may be EITHER of two components

***bodied items most predictive for sick/at risk neonate; 4 limb BP: greater than 20 mmHg difference considered abnormal but wide variability in measurement even in normal infants)



NORMAL** result at any time point = **PASS** of screening test

Document in infant's medical chart and in immunization record booklet

note that a **NORMAL result has two components; **BOTH** must be present for **PASS** screen



Murmurs in newborns younger than one month of age



Same general concepts as
for the immediate perinatal
period



Breast-feeding/bottle
feeding history



Weight gain (target 20-40
grams/day)



Vitals, respiratory, heart
rate over one minute

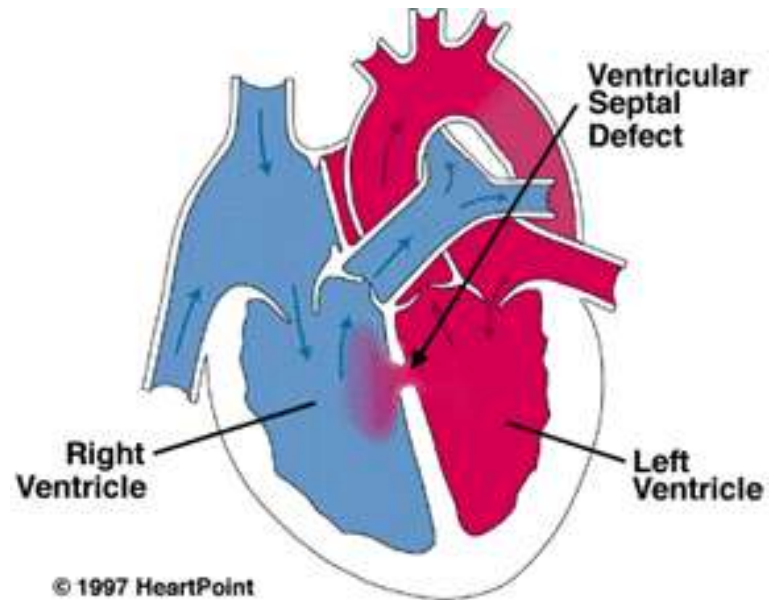


Peripheral pulmonary stenosis: Benign

- Flow acceleration originating in the pulmonary artery bifurcation
 - No real “stenosis”
 - Usually disappears by 6 months of age
 - Common in premies or ex-premies
-
- **Plot:** normal growth and vitals
 - **Look:** normal appearance
 - **Feel:** palpation, pulses normal
 - **Listen:** Systolic ejection murmur (SEM), 2/6 or less, best heard in the axillae and over the back
 - **ECG, CXR** normal

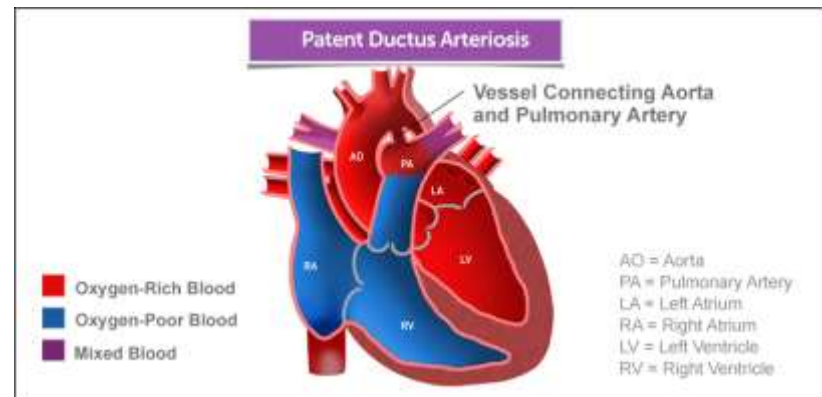
Small Muscular VSD

- **Plot:** Normal
- **Look:** Normal
- **Feel:** Normal palpation and pulses
- **Listen:** Rarely louder than a 2/6 systolic regurgitant, early to mid-systolic murmur at the LSB; “jet de vapeur” or “whistling” quality
- More than 50% close spontaneously by one year of age



Patent Ductus Arteriosus

- **Plot:** Moderate to large PDA's might have clinical signs of pulmonary overcirculation (FTT, tachypnea, tachycardia, dyspnea with feeds)
- **Look:** can be associated with syndromes or chromosomal abnormalities
- **Feel:** Moderate to large PDA's might have bounding (full) pulses and an active precordium
- **Listen:** Continuous murmur, with systolic accentuation at the LUSB; diastolic rumble at the apex; small PDA's or in babies under two weeks of age the diastolic component might not be audible



Can cardiologists distinguish between benign and pathologic murmurs in neonates?



201 neonates



Cardiac exam (blinded), ECG, echocardiogram



CHD in 56%



Clinical exam: sensitivity 80.5%, specificity 90.5%



ECG did not contribute



No patients requiring surgery or catheter intervention were missed



Murmurs in infants (under 1 yr of age)

Somatic growth?

Recurrent infections?

Precordial activity, RV impulse

Absence of a murmur does not
eliminate the possibility of
significant pathology



Moderate VSD/AVASD

- Smaller defects might not impact growth or cardio-respiratory status
 - Larger defects can cause FTT, tachypnea, dyspnea with feeds, tachycardia
 - Effective shunting will be influenced by size of defect as well as the relative difference between PVR and SVR
 - Abnormal ECG/CXR for large defects
- **Plot:** weight gain, respiratory rate, heart rate
 - **Look:** respiratory effort?, dysmorphic features?
 - **Feel:** precordial activity, is the RV palpable suggesting pulmonary hypertension?
 - **Listen:** Long systolic regurgitant murmur heard at the LMSB that radiates widely; the frequency of the murmur is determined by the LV-RV gradient



Murmurs in toddlers and young children

Very common, up to 70% depends on physiological state

Chest cavity very resonant, easily transmits normal flow sounds

Vast majority benign

A thriving, asymptomatic child is unlikely to have significant (congenital) heart pathology



Still's murmur: Benign

2-8 years of age

Plot: Normal growth and vitals

Look: Normal

Feel: Normal precordium, pulses and liver

Listen: Not louder than 3/6 SEM, vibratory in quality, best heard at the LLSB with local radiation; louder in supine position; suppressed or diminished with Valsalva maneuver



Venous hum: Benign

18 months-4 years

Plot: Normal

Look: Normal

Feel: Normal

Listen: Low frequency continuous murmur, diastolic accentuation, only in sitting position, suppressed with turning the neck or gently compressing the base of the neck



Subclavian bruit: Benign

2-8 years of age

Plot: Normal

Look: Normal

Feel: Normal

Listen: early to mid SEM best heard in the subclavicular area; attenuated or suppressed by pronation or supination of the ipsilateral forearm



Carotid
bruit:
Benign

2 years –adolescence

Plot: Normal

Look: Normal

Feel: can be associated with
thrill in neck

Listen: early to mid SEM, right
more than left



“Flow” murmurs: Benign

At any age

Related to hyperdynamic circulation:

- Fever
- Anemia
- Hyperdynamic circulation
- Pregnancy
- Hyperthyroidism

Plot/Look: depend on underlying cause

Feel: active precordium but no heave or thrill and PMI normal

Listen: 2-3/6 SEM at the left sternal border, can radiate to the base and occasionally to the neck.





Older Children and Adolescents

Most murmurs are benign in a healthy, asymptomatic children

Significant congenital pathology rarely presents at this age

Murmurs associated with a precordial thrill are always pathologic

Diastolic murmurs always pathologic

Additional sounds? (S3, S4, clicks, etc.)

Splitting of the second heart sound?



Pulmonary flow murmur: Benign

Older children and adolescents

Thin chest walled, girls more than boys

Plot: normal

Look: normal

Feel: normal

Listen: 2/6 (or less) SEM at the LUSB, some radiation to the base, S2 splits normally, no additional sounds



Atrial septal defect

Typical findings rarely obvious before 2 years of age

Plot: usually normal (rare FTT)

Look: usually normal

Feel: RV impulse palpable in the sub-xyphoid space?

Listen: 2-3/6 SEM, best heard at the LUSB, radiates to the base (and lung fields); wide, fixed splitting of S2; occasion diastolic tricuspid filling murmur at RLSB



Valvar pulmonary stenosis

After the neonatal period

Plot: Normal

Look: Normal (syndromes: Noonan, Allagile)

Feel: RV heave with severe PS, ?thrill

Listen: SEM at LUSB, radiates to the lungs, systolic ejection click at LUSB; P2 can be attenuated; the longer the murmur the more severe the PS



Valvar aortic stenosis

Plot: Normal

Look: Normal

Feel: ?Thrill at RUSB and/or neck

Listen: harsh SEM at RUSB and LMSB that radiates to the neck, systolic ejection click at the apex or at the RUSB; A2 can be attenuated, decrescendo diastolic murmur at RUSB and LMSB if significant aortic insufficiency (AI)



Mitral Valve Prolapse



Plot: normal



Look: dysmorphic features (?Marfan, connective tissue disorders)



Feel: Enlarged and displaced PMI



Listen: systolic ejection click at apex, followed by blowing, regurgitant murmur radiating to the left axilla (if associated MR)



Benign vs pathologic

Most murmurs are benign in a healthy, asymptomatic children

The louder and longer the murmur, the most likely it is pathologic

Murmurs associated with a precordial thrill are always pathologic

Diastolic murmurs always pathologic (except for the venous hum)

Additional sounds? (S3, S4, clicks, etc.)

Splitting of the second heart sound?

Abnormal ECG/CXR?



Go to this link to open up the examples

- https://www.dropbox.com/sh/nwqinbzw34adrt5/AACgYTez5UUbwc_h_KxMiO_Qa?dl=0



Take home points



In screening for congenital heart disease murmurs must be interpreted in the context of a complete cardiac evaluation



Practice makes perfect



Vast majority of murmurs in older children are benign



Severe congenital lesions present early in life



When in doubt consult



How to reach us

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Fax: 514-412-4273

MCH Sub-Specialty

Consultation: 514-412-
4242



Selected References and Resources

- “Teaching heart Auscultation to health professionals: methods for improving the practice of an ancient but critical skill”
Contributing Editor- John Finley, MD ISBN 978 0 9877400 0 7: endorsed by the Canadian Pediatric Cardiology Society
- <https://teachingheartauscultation.com>
- Pediatric cardiac auscultation. Altman CA & al Lippincott, Williams and Wilkins 2000.
- Pediatric Heart Sounds. McConnel ME. Springer 2008
- **Youtube:** “thinklabs, heart sounds”
- Mobile Applications: “emurmur university”, “emurmur primer”, “heart songs”, “heart murmurs pro”, “3M Littmann Learning”





Questions?

