

# Adult Heart Murmurs: I Heard It Through the Grapevine

David Schneider, MD, FAAFP



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## David Schneider, MD, FAAFP

Faculty Physician/Team Leader/Didactics Director/Procedures Director Santa Rosa Family Medicine Residency; Professor of Family and Community Medicine, University of California-San Francisco, School of Medicine

Dr. Schneider cares for the underserved in Santa Rosa, CA, serving Latino, Southeast Asian, and Eritrean populations. His professional interests include the doctor-patient relationship, clinical skills, and teaching the breadth and depth of family medicine for over 20 years. Cardiovascular system conditions are one of his specialty topics, and he points to "the growing body of evidence suggesting that lifestyle is as effective as, or more effective than, pharmacologic interventions in primary prevention." He also focuses on conditions of the endocrine system (especially thyroid), skin and dermatology, primary prevention focusing on lifestyle, and procedures. Dr. Schneider is board certified not only in Family Medicine, but also in Integrative Holistic Medicine. He produces Dr. Dave's To Your Health segments for Wine Country Radio and BlogTalkRadio.com.



## Learning Objectives

1. Distinguish innocent and abnormal heart murmurs in patients and classify them as systolic, diastolic or continuous.
2. Formulate a differential diagnosis of specific cardiac sounds and explain the pathology of heart murmurs to patients.
3. Evaluate diagnostic factors in patients with suspected heart murmurs using cost-effective cardiac testing.
4. Coordinate referral and follow-up to a cardiologist for patients with a pathologic cardiac examination, or who has cardiac symptoms and questionable findings on the cardiac examination.



## Audience Engagement System

The image shows three sequential screenshots of a mobile application interface:

- Step 1:** The home screen of the app, featuring a grid of icons for various services and a search bar at the top.
- Step 2:** A list of available courses, each with a star icon and a title. A red arrow points to the first course, "CME011 Acute Coronary Syndromes: Unchain My Heart".
- Step 3:** The detailed view of the selected course, showing the title, a description, and a "View Details" button. A red arrow points to the "View Details" button.



## The Stethoscope

- The quintessential physician's tool.
- When people think of doctors, they often get a mental picture of a stethoscope.
- How do you use one?



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## Auscultation: A Lost Skill?

- Numerous studies suggest that both experienced and novice physicians are inaccurate at auscultative diagnosis.
- Training in auscultation may or may not help.

GJM 2000;93:685-8; BrJCardiol 2010;17:8-10; Am Heart J 2006;152:85.e1-85; BMC Medical Education 2004, 4:5

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## What is the Purpose of the Physician?

- "The role of the physician is to entertain his [sic] patient while nature takes its course."  
–Voltaire



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## My Core Belief

You may not be perfect, but you can describe and sometimes diagnose murmurs by routine auscultation with a standard stethoscope.

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## Step 1: Listen

- **Listen on the skin!!**
  - Auscultation through clothing is for show, not for examining a pt.
- It is generally agreed that you should listen from the patient's right side.
  - I can't find any evidence—only consistent recommendations.

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## Step 1a

- Don't forget the history:
  - Valve replacement.
  - Heart surgery, incl during infancy/childhood.

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## What Do You Listen For During Cardiac Auscultation?



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## Step 2: Know the Lingo

- **Timing:**
  - Systolic = murmur occurs during ventricular systole.
    - Starts w/or after S1, ends by/at S2.
  - Diastolic = murmur occurs during ventricular diastole.
    - Starts w/or after S2, ends by/at S1.
  - Continuous = both.
    - Begins in systole, includes S2, continues in diastole.

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## Lingo Continued

- **Pitch:**
  - High
  - Low
- **Timbre**—how harsh:
  - Harsh
  - Blowing/soft.
  - Diastolic rumbling
  - Musical.
- I tend to put these together, though they are different.

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## More Lingo

- **Shape/pattern** – how does it fill the phase of the cycle (i.e., systolic or diastolic)?
  - Crescendo-decrescendo (diamond-shaped).
  - Decrescendo.
  - Fairly consistent through systole (holosystolic).
- **Pearl:** stenosis murmurs tend to have discrete start & end points within the phase, whereas regurgitant murmurs tend to fill the entire phase (generalization).

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## Location

- Where do you hear it best/loudest?
  - I dislike “aortic area,” “mitral area,” etc.
    - Not necessarily location of pathologic sounds.
  - Describe the location.
    - LUSB – L 2<sup>nd</sup> intercostal space is even better.
    - Apex
    - LLSB
    - Etc.

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## The “Forgotten Location”

- Does the murmur **radiate** to another location?
  - L axilla
  - Carotid arteries
  - Other

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## Intensity

- 1/6: can barely be heard by experienced listener in a quiet room.
- 2/6: easily audible w/scope.
- 3/6: louder, easily heard by anybody.
- 4/6: palpable thrill.
- 5/6: loud, w/thrill, heard w/scope only partly on chest.
- 6/6: audible w/scope not touching chest.

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## Mnemonic for Describing Murmur

- S
- T
- R
- I
- P

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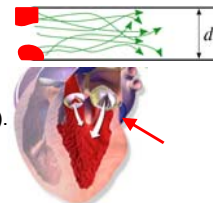
## Mnemonic for Describing Murmur

- Shape (= Pattern)
- Timing
- Radiation/Location
- Intensity
- Pitch/Timbre

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## Background Info

- Heart murmurs are caused by:
  - Turbulent flow across a valve that does not open properly (**stenosis**).
  - Inappropriate flow across a valve that is **leaky** instead of staying closed (**regurgitation/ insufficiency**).
  - Other—to be discussed later.

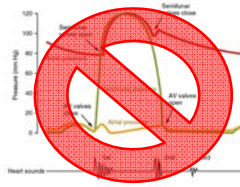


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## Review of the Cardiac Cycle

- If you understand what is supposed to happen during the cardiac cycle, you can understand most murmurs.



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## Poll Question

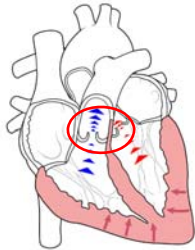
Which of the following produces a diastolic murmur?

- Aortic stenosis
- Aortic sclerosis
- Aortic regurgitation
- Mitral regurgitation
- Pulmonic stenosis

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## Ventricular Systole

- Ventricles **contract**.
- Blood should flow through **outflow** tracts (aortic & pulmonic valves), which should be **OPEN**.
- Atrioventricular (AV) valves **CLOSED**.

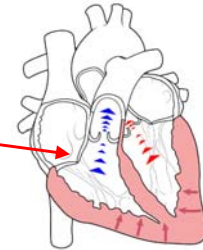


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## Systolic Murmurs: Pathophysiology

- Outflow tracts open → **turbulent flow through stenotic aortic or pulmonic valve** causes murmur.
- AV valves closed → **regurgitation from malfunctioning mitral or tricuspid valve** causes murmur.

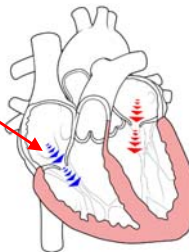


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## Ventricular Diastole

- Ventricles **fill**.
- AV valves should be **OPEN** to allow ventricles to fill.
- **Outflow** tracts should be **CLOSED**.

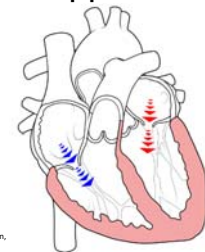


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## Diastolic Murmurs – Opposite!

- Outflow tracts closed → **leaky (regurgitant) aortic or pulmonic valve** causes murmur.
- AV valves open → **stenotic mitral or tricuspid valve** causes murmur.



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## Congratulate Yourself!

- You are half way toward understanding the most common heart murmurs.

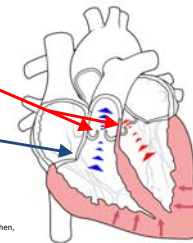


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## DDX: Systolic Murmurs – 1

- **Outflow stenosis:**
  - Aortic stenosis
  - Pulmonic stenosis
- **AV regurgitation/insufficiency:**
  - Mitral regurgitation
  - Tricuspid regurgitation



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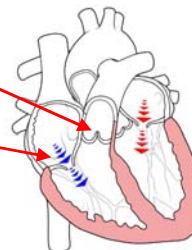
## DDX: Systolic Murmurs – 2

- Other:
  - **Flow murmur**
  - Aortic sclerosis
  - Hypertrophic obstructive cardiomyopathy
  - Ventricular septal defect
  - Atrial septal defect
  - Innocent systolic/Still's murmur

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## DDX: Diastolic Murmurs – 1

- **Outflow regurgitation**
  - Aortic regurgitation
  - Pulmonic regurgitation
- **AV stenosis**
  - Mitral stenosis
  - Tricuspid stenosis



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## DDX: Diastolic Murmurs – 2

- Other:
  - L atrial myxoma
  - Diastolic flow murmur
  - Austin-Flint murmur (aortic regurgitation)
  - Patent ductus arteriosus

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## Continuous Murmurs

- **Patent ductus arteriosus**
- Aortopulmonary window (abnormal connection between aorta & pulmonary artery) – rare.
- Mammary soufflé of pregnancy (occasionally – usually systolic).
- Coronary A-V fistulas – rare.
- Ruptured sinus of Valsalva aneurysm – rare.

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## Innocent (Functional, Physiologic) Murmurs

- Increased blood **flow** across otherwise normal heart valves.
  - Anemia
  - Hyperthyroidism
  - Pregnancy
  - Other high cardiac output

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## Innocent (Functional, Physiologic) Murmurs—Characteristics

- Soft, not too harsh.
- Early-mid **systolic**, but not holosystolic.
- ≤ 3/6 intensity – no thrill.
- No other cardiovascular findings.
  - SOB
  - Easy fatigability
  - Cyanosis, clubbing, edema (actually **LOOK** for them!)
- Normal S2—**split audible during inspiration**.

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## Mnemonic for Innocent Murmurs

- 5 S's
  - **S**oft
  - **S**ystolic
  - **S**hort (not holosystolic)
  - **S**2 normal (split on inspiration, present)
  - **S**x absent

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## What to Tell Pts

- A murmur does not mean anything is wrong with the heart.
- The majority of heart murmurs are harmless, and do not represent heart valve disease.

[http://www.nlm.nih.gov/health/dci/Diseases/heartmurmur/hmumur\\_what.html](http://www.nlm.nih.gov/health/dci/Diseases/heartmurmur/hmumur_what.html)

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## Talking to Pts After You Have Dx

- Valves keep blood flowing correctly through heart.
  - Synchronized, like in car engine.
  - 1-way flow.
- **Stenosis** in lay terms: valve doesn't **open** properly.
- **Regurgitation/insufficiency**: valve doesn't **close** properly → **leaky**.

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## Modalities to W/U Murmur

- Echocardiogram
- ECG
- Chest X-Ray
- Referral to specialist
  - Dr Dave's referral mantra: "**Never blindly entrust the care of your pts to a specialist.**"
  - Stay in touch, get info, know what's going on, make suggestions, continue to treat as appropriate, etc.

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## Costs—Healthcare Bluebook

- Echocardiogram: TTE w/doppler = \$653.
- ECG: \$41.
- CXR: \$67.
- New pt visit, outpt, 99204: \$395.
- Cardiac cath: \$9795.
- Your stethoscope + ears + brain:

Priceless

<https://www.healthcarebluebook.com/> – accessed 8/1/16

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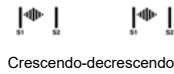
## Cardiology Referral

- **ASAP**:
  - Decompensation (sx, hypotension, etc).
- **Routine**, or await echo results:
  - Everything else.
  - Follow TTE every 1-5 years, depending on severity, sx, diagnosis.

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## Types of Systolic Murmurs

- \*Systolic **ejection** = ejection systolic = mid-systolic murmur.
  - Begins after S1, ends before S2—both S1 and S2 are audible.
- \***Holosystolic** = pansystolic murmur.
  - Starts w/S1, extends up to S2, obscuring both S1 and S2.



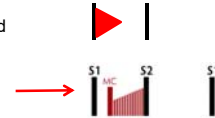
Used w/permission: <http://meded.ucsd.edu/clinicalmed/heart.htm>

[http://www.upstate.com/content/auscultation-of-cardiac-murmurs?ourresearch\\_result&selectedTitle=150](http://www.upstate.com/content/auscultation-of-cardiac-murmurs?ourresearch_result&selectedTitle=150)

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## Types of Systolic Murmurs – 2

- Early systolic murmur: obscures S1, does not extend up to S2.
- \*Late systolic murmur: starts after S1, obscures S2.

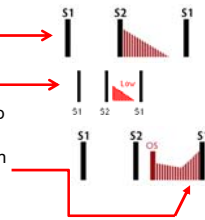


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## Types of Diastolic Murmurs

- \***Early diastolic**: starts with S2.
- Mid-diastolic: starts after S2, ends before S1.
- \***Late diastolic** (presystolic): starts well after S2, extends up to S1
- Harder to hear & separate than systolic



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## Poll Question

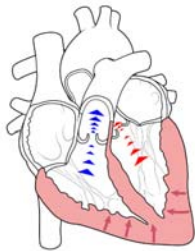
Describe the pattern, timing, and timbre of this murmur.

- Soft systolic ejection murmur
- Harsh systolic ejection murmur
- Blowing holosystolic murmur
- Harsh early diastolic murmur
- Harsh continuous murmur

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## Systolic Murmurs

- Outflow tracts open → **turbulent flow through stenotic aortic or pulmonic valve** causes murmur.
- AV valves closed → **regurgitation from malfunctioning mitral or tricuspid valve** causes murmur.



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## Systolic Murmurs

- **Ejection type** (crescendo-decrescendo) → **outflow tract stenosis or flow** murmur.
  - Aortic outflow tract
    - Aortic stenosis (AS)
    - Hypertrophic obstructive cardiomyopathy (HOCM)
    - Aortic flow murmur
  - Pulmonary outflow tract
    - Pulmonic valve stenosis
    - Pulmonic flow murmur

Used w/permission: <http://meded.ucsd.edu/clinicalmed/heart.htm>

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## More Systolic Murmurs

- **Holosystolic** (= pansystolic) → **AV valve regurgitation** (mostly)

- Mitral regurgitation (MR)
- Tricuspid regurgitation (TR)
- VSD



- **Late systolic** → **AV prolapse** (+/- regurg)

- Mitral valve prolapse (MVP)
- Tricuspid valve prolapse



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## Systolic Ejection Murmurs

- Aortic Stenosis
- Hypertrophic obstructive cardiomyopathy (HOCM, formerly known as idiopathic hypertrophic subaortic stenosis or IHSS)
- Aortic sclerosis
- Pulmonic stenosis
- Innocent/flow murmur

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## Physiologic Maneuvers

- **Inspiration** → ↑ venous return → ↑ **R side murmurs**
- Squatting → ↑ venous return (preload) + ↑ vascular resistance (afterload)
- **Valsalva** → ↓ venous return/↓ ventricular volumes/ ↓ stroke volumes/↓ arterial pressure/reflex tachycardia → most murmurs (incl AS) ↓, **HOCM** ↑
- Sustained **hand grip** → ↑ vascular resistance/↑ BP/ ↑ cardiac output → AS ↓, **MR** ↑
- **Abrupt standing** → ↓ venous return → ↓ valvular systolic murmur; ↑ **HOCM**

[http://www.upstate.edu/content/physiologic\\_and\\_pharmacologic\\_maneuvers\\_in\\_the\\_differential\\_diagnosis\\_of\\_heart\\_murmurs\\_and\\_sounds?source=usa\\_link](http://www.upstate.edu/content/physiologic_and_pharmacologic_maneuvers_in_the_differential_diagnosis_of_heart_murmurs_and_sounds?source=usa_link)

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## Aortic Stenosis Murmur



- Systolic **ejection** murmur (crescendo-decrescendo).
- Harsh.
- Loudest @ **USB**, esp **RUSB** (2<sup>nd</sup> ICS).
  - May be RUSB +/- LUSB.
  - May be prominent @ apex in elderly.

Used w/permission – <http://med.illustration.com/heartexam/>

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## Aortic Stenosis Murmur – 2

- **Radiates to carotids** (this is where blood goes after valve).
- ↓ **w/Valsalva**.
  - ↑ intrathoracic pressure → ↓ LV filling → reduced flow across stenotic aortic valve → softer murmur.

[http://www.upstate.edu/content/physiologic\\_and\\_pharmacologic\\_maneuvers\\_in\\_the\\_differential\\_diagnosis\\_of\\_heart\\_murmurs\\_and\\_sounds?source=usa\\_link](http://www.upstate.edu/content/physiologic_and_pharmacologic_maneuvers_in_the_differential_diagnosis_of_heart_murmurs_and_sounds?source=usa_link)

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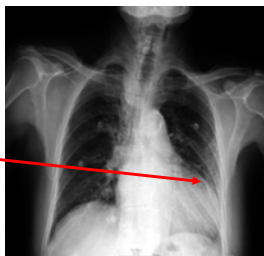
## Aortic Stenosis: Other Exam Findings

- Pulsus parvus et tardus (weak & late carotid pulse).
- Prominent S4 (LVH).
- More severe AS (NB: Intensity **not** related):
  - **L**onger & **L**ater murmur (**L**ousier).
  - Narrower splitting of S2.
  - Severe AS → single S2, no split.

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## Aortic Stenosis: Other

- ECG: LVH common.
- CXR:
  - Dilated ascending aorta.
  - Rounded LV border.\*
  - Signs of heart failure.



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## Poll Question

Which is true about aortic stenosis (AS)?

- A. People w/AS should be restricted from sports & exertion.
- B. Pts w/symptomatic AS should receive ACEI or CCB.
- C. Atrial dysrhythmias, including A Fib, occur early.
- D. Exertional dyspnea is a common presenting sx.
- E. All of the above

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## Aortic Stenosis: Sx

- Classic triad: **a**ngina, **s**yncope, **H**F (once sx appear, it turns you to **a**shes). Esp w/exertion.
  - Exertional syncope + syst murmur—LR for AS = ∞.
- **Exertional dyspnea** is most common presenting sx (↓ exercise tolerance).
- Atrial fibrillation, pulmonary hypertension are preterminal findings.

ActaMedScand 1985;218:397-400

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## Aortic Stenosis & Sx

- May be asymptomatic even with severe dz.
- **Once sx appear, course tends to progress fairly rapidly** (2-3 yr avg survival).
  - Surgery for symptoms.
  - Risk factor management for all (high prevalence of CAD).
  - Exercise limitation: more severe AS → more limitation.

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## Summary of **AS**

- **A-S**ymptomatic
- **A**wfully **S**udden
- Serial echocardiograms, follow clinically.
- ICD-10: I35.0

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## Hypertrophic Obstructive Cardiomyopathy (HOCM)

- Murmur similar to aortic stenosis.
  - Crescendo-decrescendo SEM.
  - May last slightly longer in cycle.
- May be loudest @ **L 4<sup>th</sup> ICS & apex** (AS usu loudest R 2<sup>nd</sup> ICS; in elderly, AS can be @ apex).
- **Increases during Valsalva** (unique)
  - ↓ LV volume → exacerbates subaortic obstruction.

<http://www.upstate.com/contents/clinical-manifestations-of-hypertrophic-cardiomyopathy?source=link>

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## Systolic Ejection Murmurs

Aortic Stenosis



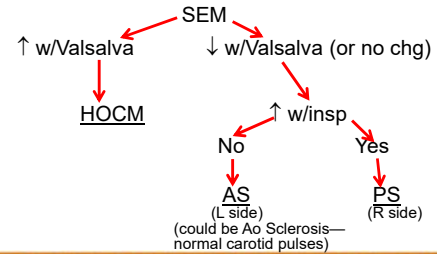
Pulmonic Stenosis



Used w/permission - <http://med1www.case.edu/cardiacexam/>

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## Pathologic Systolic Ejection Murmurs

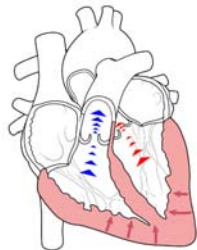


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## Systolic Murmurs

- Outflow tracts open → **turbulent flow through stenotic aortic or pulmonic valve** causes murmur.
- AV valves closed → **regurgitation from malfunctioning mitral or tricuspid valve** causes murmur.

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## Poll Question

Describe this murmur – timing, pattern, pitch.

- Low pitched SEM
- High pitched SEM
- Low pitched holosystolic murmur
- High pitched holosystolic murmur
- Low pitched continuous murmur



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## Holosystolic Murmurs

- Generally regurgitation (AV valves)
  - Mitral regurgitation
  - Tricuspid regurgitation
- Ventricular septal defect (VSD)
- **An opening that's not supposed to be there, blood flows through during ventricular systole.**

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## Mitral Regurgitation (I34.0)

- Holosystolic, higher pitch, less harsh than AS
- Loudest @ **apex**
- Radiation (possible):
  - **L axilla**
  - L anterior axillary area
  - L subscapular area
  - May radiate to base & sound a little like AS/HOCM (check carotid pulses)

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## Poll Question

The holosystolic murmur of VSD indicates a condition that requires referral for surgical correction.

- A. True
- B. False

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## Ventricular Septal Defect

- Higher pressure in LV → blood flows to RV throughout systole → holosystolic
- Loud
  - Louder → better – normal (low) RV pressure allows more flow across VSD
- 3<sup>rd</sup> & 4<sup>th</sup> interspaces – either or both sides

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## VSD – 2

- ↑ w/handgrip & BP cuff (like MR – ↑ resistance → more L→R shunt)
- No chg w/inspiration → not TR
- No radiation to axilla → not MR
- May have thrill
- S2 usually normal

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## VSD (Q21.0)

- Holosystolic
- 3<sup>rd</sup>-4<sup>th</sup> ICS
- ↑ w/↑ afterload (handgrip)
- No chg w/insp
- No rad to axilla
  
- Refer for full CV eval.
- Small VSD → pregnancy OK.

Used w/permission – <http://med.emory.edu/case.edu/cardiacexam/>

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## Holosystolic Murmurs

Mitral Regurgitation

Tricuspid Regurgitation



VSD



Used w/permission – <http://med.emory.edu/case.edu/cardiacexam/>

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## Confusion

- All 3 lesions causing holosystolic murmurs can also give early systolic murmur
  - S1 obliterated by murmur
  - Stops just short of S2
  - BUT – mostly sounds the same throughout the duration of the murmur, vs crescendo-decrescendo of ejection murmur

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## Mitral Valve Prolapse (I34.1)

- **Late systolic murmur**
  - Starts definitely after S1, goes almost or to S2.
  - After click, sounds mostly holosystolic (usually).
- **Preceded by click**
  - Click alone, even w/o murmur, may reveal dx.
  - Click may be hard to hear.
- **Often accompanied by mitral regurgitation**



[http://www.uptodate.com/contents/auscultation-of-cardiac-murmurs?source=search\\_result&selectedTitle=1~150](http://www.uptodate.com/contents/auscultation-of-cardiac-murmurs?source=search_result&selectedTitle=1~150) By commission, Permission given by: Sarah Chen, <http://www.sarahchen.com/>

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## MVP – 2

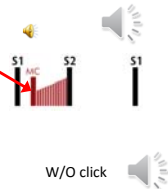
- ↓ LV volume (↓ venous return) → **longer but softer murmur.**
  - Longer: prolapse occurs earlier when ↓ LV volume.
    - Standing
    - **Valsalva**
- ↑ LV volume → may ↑ intensity
  - Squatting
  - Elevation of the legs
  - Isometric exercise (**hand grip**)

[http://www.uptodate.com/contents/auscultation-of-cardiac-murmurs?source=search\\_result&selectedTitle=1~150](http://www.uptodate.com/contents/auscultation-of-cardiac-murmurs?source=search_result&selectedTitle=1~150)

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## MVP Murmur

- Mitral valve prolapse
  - **Late** systolic – fairly unique among murmurs
  - **Click** (may be difficult to hear)
  - Valsalva → longer, but softer
- Generally B9. Annual visit/exam.
- Serial echo (q 1-5 yrs).
- ↑ risk for CV morbidity (HF, AF, death):
  - Older age
  - Presence of **symptoms**
  - **LVEF** <60 percent



By commission, Permission given by: Sarah Chen, <http://www.sarahchen.com/>; Used w/permission – <http://medicawww.cas.u.edu/cardiaceamj/Circulation.2014;129:2440-92>

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## Diastolic Murmurs

- Diastolic murmurs are pathologic.
  - Includes continuous murmurs – if there is a diastolic component, consider it pathologic.
  - There are **no innocent diastolic** murmurs.
- Order an echocardiogram.

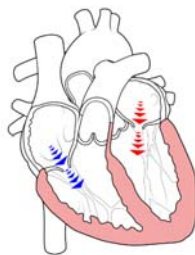


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## Diastolic Murmurs

- Outflow tracts closed → **leaky (regurgitant) aortic or pulmonic valve** causes murmur.
- AV valves open → **stenotic mitral or tricuspid valve** causes murmur.



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## Aortic Regurgitation (I35.1)

- **Early diastolic** murmur (+LR 8.8, -LR 0.2) – decrescendo, stops before S1
- **Low intensity, high pitch**, blowing
- **LSB** – 3<sup>rd</sup>-4<sup>th</sup> ICS
- Use diaphragm, press hard
- Easiest to hear **w/pt sitting, leaning forward, maintaining full expiration**
- May accompany **AS**—listen to diastole!

JAMA 1999;281:2231-2238. [http://www.uptodate.com/contents/auscultation-of-cardiac-murmurs?source=search\\_result&selectedTitle=1~150](http://www.uptodate.com/contents/auscultation-of-cardiac-murmurs?source=search_result&selectedTitle=1~150)

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## Aortic Regurgitation – 2

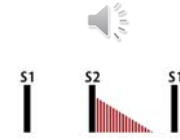
- Wide pulse pressure
  - Water-hammer pulse
- Signs with cool names
  - Quincke's pulses – capillary pulsations in nail beds or lips
  - Mueller's sign – systolic pulsations of uvula
  - Hill's sign: (SBP popliteal – SBP brachial) > 60
  - None are very helpful
- Longer murmur → more severe (Longer = Lousier)

<http://www.uptodate.com/contents/pathophysiology-and-clinical-features-of-chronic-aortic-regurgitation-in-adults?source=link>

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## AR Murmur

- **Early** diastolic ("Aortic is A-Early")
- Low intensity, **high pitch**
- **Sitting, leaning forward, expiration**
- **LSB**



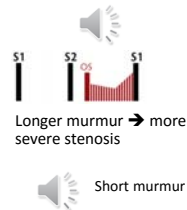
- Long asymptomatic phase.
- Surgery:
  - Severe AR w/sx.
  - A-sx + severe AR + EF < 50%.
- Severe + not surg candidate → ACEI.
- HTN → ACEI, ARB, or CCB.

<http://med.unc.edu/cardiacpacem/>; By commission, Permission given by: Sarah Chen, <http://www.sarahchen.com/>

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## Mitral Stenosis

- **Mid-diastolic**
- **Soft, low-pitched** rumble
- **Apex**
- **Loud S1**
- **Opening snap—soft, low pitch**
- **Heard best w/pt on L side (like MR murmur)**
- Listen with the **bell**
- Low BP & pulse P



<http://med.unc.edu/cardiacpacem/>; <http://www.med.unc.edu/wilkes/tnw.htm>; By commission, Permission given by: Sarah Chen, <http://www.sarahchen.com/>

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## Patent Ductus Arteriosus

- **Continuous** murmur (machinery murmur)
  - Blood flows from hi-P aorta to lower P PA during both systole & diastole
  - May not take up all of systole & diastole



<http://www.med.unc.edu/wilkes/tnw.htm>

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## What's This Sound?



LOUD



Soft

- Low frequency (bell)
- Early diastole
- Not a murmur
- "Kentucky"
- S3

Used w/permission—  
<http://www.med.unc.edu/wilkes/tnw.htm>  
<http://med.unc.edu/cardiacpacem/>

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## S3

- Cont'd filling after ventric relaxation complete.
- Normal in:
  - Children
  - Young adults to age 35-40.
  - 3<sup>rd</sup> trimester pregnancy.
- In others:
  - CHF
  - Volume overload

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## Compare to S4



LOUD

- Low frequency
- Late diastole/"presystolic"
- Not a murmur
- "Tennessee"



Softer

- Atrial contraction vs non-compliant LV
- HTN heart dz
- AS
- CM, incl HOCM
- On R side: PS, pulm HTN

Used w/permission—<http://www.med.utcs.edu/wilkes/fmex.htm>  
<http://medrxiv.org/abs/201903.0001>

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## Who Gets IE (SBE) Prophylaxis? (IIa)

- Prosthetic heart valves
- Prosthetic material used in valve repair
- Prior h/o endocarditis
- Transplant valvulopathy
- Congenital heart dz:
  - Unrepaired cyanotic dz
  - Repaired w/prosthetic material—for 6 mo p-procedure
  - Repaired w/residual defects at or near prosthetic device

J Am Coll Cardiol. 2014;63(22):e57-185

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## Circumstances for Prophylaxis

- **Going through tissue:**
  - Dental procedures involving **manipulation** of gums or periapical tissue, or **perforation** of mucosa.
  - **Incision** or bx of **respiratory** tract mucosa (T & A, bronch w/bx).
  - **Infected** skin or musculoskeletal tissue undergoing surgery.

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## NO Prophylaxis

- Other valve lesions
- **No GI/GU procedures, unless active infection:**
  - Exception: established UTI w/hi risk CV condition
- Vaginal or Cesarean delivery
  - Exception: hi risk lesion w/chorioamnionitis or pyelonephritis
- TEE!

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## Meds for Endocarditis Prophylaxis

- **Single dose 60** min before procedure — no 2<sup>nd</sup> dose!
- **Amoxicillin 2 g.**
  - NPO: IV/IM amp 2g, cefazolin 1g, ceftriaxone 1g.
  - PCN allergic:
    - Po cephalixin 2g, clinda 600 mg, or azithro or clarithro 500 mg.
    - IM/IV cefazolin 1g, ceftriaxone 1g, or clinda 600mg.
    - Vanco 15-20 mg/kg (max 2g), 120 min before.

AmHealthSystPharm 2013;70:195-283; J Am Coll Cardiol. 2014;63(22):e57-185

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## Practice Recommendations

- Echocardiogram should be ordered for all pts w/diastolic murmurs. (SOR C)
- Pts w/heart murmurs should be monitored at least annually for sx, and every 1-5 yrs by echocardiogram, depending on sx, lesions, severity, etc. (SOR C)
- Prophylaxis against infective endocarditis (IE) should be limited to highest risk pts, such as pts w/prosthetic valvular material & pts w/prior hx of IE; and should be used before dental procedures that involve manipulation of gingival tissue or periapical region of teeth, or perforation of the oral mucosa. (SOR B)

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## Questions?

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## Contact Info

- David Schneider, MD
- Work email: [schneid2@sutterhealth.org](mailto:schneid2@sutterhealth.org)
- Facebook:
  - Personal page: <https://www.facebook.com/david.schneider.524381>
  - To Your Health With Dr Dave: <https://www.facebook.com/pages/To-Your-Health-With-Dr-Dave-Schneider/308308468077?fref=ts>

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## References

- AHA Guideline on Valvular Heart dz: *Circulation* 2014;129:2440-92.
- <http://mediswww.case.edu/cardiaceexam/>
- <http://www.med.ucla.edu/wilkes/inex.htm>
- UpToDate.com

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## ICD-10 Codes

- Heart murmur: R01.1
  - CPT code for EKG: 93000 (add -25 to E&M).
- Rheumatic valve dz NOS: I09.1

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## Billing & Coding

### When services performed in conjunction with:

Office Visit + EKG 992xx - 25 + 93000

Preventive + EKG 9938x/9939x - 25 + 93000

MCR IPPE/AWV + EKG G0402/G0438 - 25 + 93000 (if dx is present)

MCR IPPE + EKG G0402 + G0403 (if screening only-no dx present)

### Additional tests to confirm or monitor:

#### Chest x-ray (see CPT for additional options)

71010 Radiological exam, chest; single view, frontal

71020 Radiological exam, chest; 2 views, frontal and lateral

71030 Radiological exam, chest; complete, minimum of 4 views

#### Echocardiography (see CPT for additional options)

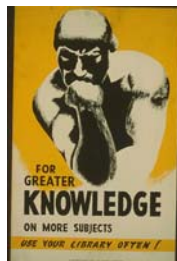
93306 Echo (TTE), 2D, M-mode, complete (including doppler and color flow)

Interested in More CME on this topic?

[aafp.org/fmx-cardio](http://aafp.org/fmx-cardio)

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## Supplemental Material



Public domain, US federal gov via  
[https://commons.wikimedia.org/wiki/File:For\\_greater\\_knowledge\\_on\\_more\\_subjects\\_use\\_your\\_library\\_better\\_1959-1960.jpg](https://commons.wikimedia.org/wiki/File:For_greater_knowledge_on_more_subjects_use_your_library_better_1959-1960.jpg)

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## Do We Know How to Use a Stethoscope?

- QJM 2000;93:685-8: severe AS is easily **missed** on exam.
- Am Heart J 2006;152:85.e1-85.e7 (Copenhagen):
  - Correct dx made by **33%** of doctors using simple stethoscope, 35% w/advanced scope.
  - **No difference** after 4 hr course.

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## Do We Know...?

- JAMA 1997;278:717-722:
  - FM & IM residents recognized **20%** of heart sounds.
  - Performance **did not improve** w/yr of training.
  - No different from med students.

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## Sounding More Dismal...

- Acad Emerg Med 1995;2:622-9:
  - EM residents = senior medical students.
  - EM residents inferior to IM residents.
  - **No improvement** in proficiency over 3 yrs of EM training.
  - Supervised teaching improved performance.
  - AS murmur: IM=79%, EM=77%.
  - Pericardial friction rub: IM=3%, EM=7%.
  - **Pneumothorax**: students=100%, EM=87%, **IM=21%!!!**

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## On the Brighter Side...

- BioMed Central, *BMC Medical Education*  
<http://www.biomedcentral.com/1472-6920/4/5>:
  - Experts recognized 69% of heart sounds, 62% correct dx.
  - FM & IM residents recognized 40%, correct dx = 24%.
  - 45 min/wk X 5 mo → residents **improved** to 35% dx.
- Am J Geriatr Cardiol. 2001;10:283-5: cardiac auscultation has up to 70% sensitivity & 98% specificity for valvular ht dz.

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## Good News, Bad News

- Good: self study w/mp3 players improved auscultation skills > multimedia lecture (why did we come today?!?).
- Residents (esp men) less likely to correctly perform CV exam on female pts.

Jour Contin Educ in Health Professions Spring 2014;34:131-8; Journal Gen Intern Med 2013;28:561-6

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## Can/Should We Examine Pts?

- Perspectives in Biology and Medicine, 2000; 43:548-561: "Must Doctors Still Examine Patients?" → Maybe not, per author (ped cardiologist).
- Others have argued that physical exam wastes time and should be used only when there is evidence to support its use (personal communication).

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