EVALUATING MURMURS

TAPA 2012 Regional CME Conference
Omni Bayfront - Corpus Christi, TX
September 21, 2012
Tina Butler, MPAS, PA-C
Assistant Professor / Clinical Coordinator
TTUHSC PA Program
OBJECTIVES

- Murmur identification
- Distinguishing features of a high risk heart murmur
- General management of valvular heart disease
Murmurs

- Timing
- Intensity
- Pitch
- Shape
- Location
- Radiation
- Response to maneuvers
Murmurs – Timing

- Systole
- Diastole
- Continuous
Murmurs – Intensity

- Grade I/VI – barely audible
- Grade II/VI – faint, but immediately audible
- Grade III/VI – easily heard
- Grade IV/VI – easily heard; palpable thrill
- Grade V/VI – very loud stethoscope lightly placed, thrill
- Grade VI/VI – audible w/o stethoscope on chest, thrill
Murmurs – Pitch

High-frequency
Caused by large pressure gradients between chambers
Diaphragm

Low-frequency
Implies less of a pressure gradient
Bell
Murmurs – Shape

- Describes murmur changes in intensity from its onset to its completion
  - Crescendo-decrescendo
  - Decrescendo
  - Uniform (plateau)
Murmurs – Location

- Region of maximum intensity
  - Aortic area
  - Pulmonic area
  - Tricuspid area
  - Mitral area
Murmurs – Radiation

Sound radiates to other areas of the chest or neck

Relates to direction of turbulent flow
Murmurs – Special Maneuvers

- Respiration
- Standing
- Squatting
- Valsalva
- Hand grip
Murmurs – Special Maneuvers

RESPIRATION
- Increase venous return to right side of heart during inspiration
- Increases intensity of right-sided murmur
- Mitral valve prolapse – murmur and click occur earlier and may diminish
Murmurs – Special Maneuvers

ABRUPT STANDING

- From the supine position decreases venous return, thereby decreasing right & left ventricular diastolic volume and decreased stroke volumes
- May also have a fall in arterial pressure and increase in heart rate
  - Decreases intensity of aortic & pulmonic stenosis murmur
  - Decreases intensity of mitral & tricuspid regurgitation murmur
  - Increase intensity of systolic murmur of HCM (dec LV outflow tract size)
Murmurs – Special Maneuvers

**SQUATTING**

- From a standing position, associated with simultaneous increase in venous return (preload) & systemic vascular resistance (afterload)
- Increases intensity of right-sided murmurs
- Increases intensity of aortic & mitral regurgitation murmurs
- Moves murmur and click of MVP later in systole
- Decreases intensity of HCM murmur
- Increases intensity of AS murmur
Murmurs – Special Maneuvers

VALSALVA

Phase 1 – onset of maneuver there is a transient increase in LV output

Phase 2 – straining phase, decrease in venous return, right and left ventricular volumes, stroke volumes, mean arterial pressure and pulse pressure (dec preload) – associated with reflux increase in HR

Phase 3 – release of valsalva, further reduction LV volume

Phase 4 – increase stroke volume and arterial pressure and reflex slowing of HR
Murmurs – Special Maneuvers

VALSALVA cont.

- Decreases intensity of all left-sided murmurs
- EXCEPT hypertrophic cardiomyopathy (intensity of murmur will increase because LV outflow obstruction made worse by decreased chamber size)
- Moves murmur and click of MVP earlier in systole
Murmurs – Special Maneuvers

HAND GRIP

- Sustained hand grip for 20-30 seconds increases systemic vascular resistance, arterial pressure, cardiac output, and LV volume filling pressure.
- Useful in differentiating between ejection systolic murmur of AS and regurgitant murmur of mitral regurgitation.
- Intensity of AS murmur decreases while MR murmur increases.
Systolic Murmurs

Three different kinds:

- Systolic ejection murmurs
- Pansystolic murmurs
- Late systolic murmurs
Systolic Ejection Murmurs

• Begins after $S_1$ and terminates before $S_2$
• Crescendo-decrescendo
  • Typical of aortic or pulmonic stenosis
Pansystolic (Holosystolic) Murmurs

- Caused by regurgitation of blood across incompetent mitral or tricuspid valve
  - Mitral regurgitation
- Or ventricular septal defect
- Uniform intensity throughout systole
Late Systolic Murmurs

• Begins mid-to late systole
• Continues to end of systole ($S_2$)
  • Mitral regurgitation caused by MVP
  • Usually preceded by midsystolic click
Diastolic Murmurs

- Two types:
  - Early diastolic murmurs
  - Mid- to late diastolic murmurs
Early Diastolic Murmurs

- Result from regurgitant flow across aortic or pulmonic valve
  - Aortic regurgitation
- Decrescendo shape
Mid-to-Late Diastolic Murmurs

- Turbulent across stenotic mitral or tricuspid valve
  - Mitral stenosis
- Begins after $S_2$
- Opening snap
Continuous Murmurs

- Heard throughout cardiac cycle
- Persistent pressure gradient between two structures during systole and diastole
  - Patent ductus arteriosus
  - Venous hum
  - Mammary souffle
Distinguishing Features of a High Risk Heart Murmur
Innocent Heart Murmur

- Common finding on routine examinations of infants and children
  - 50% of normal children have innocent heart murmurs
- No pathologic signs or symptoms
  - S3 may be normal
- Typically I-II/VI in intensity, rarely III/VI, but never louder
  - Musical in nature
- **Heard best while supine**
- **Usually decreases or disappears when sitting or upright**
Pathologic Murmurs

- Late systolic murmurs
- All pansystolic murmurs
- All diastolic murmurs
- Loud murmurs > III/VI
- Continuous murmurs
  - Patent ductus arteriosus
- Associated cardiac abnormalities
Pathologic Murmurs - Midsystolic

Aortic Stenosis

- Impaired blood flow across aortic valve; increases afterload on LV
- Radiates to neck (carotids)
- $A_2$ decreases as AS worsens
- $S_4$ may be present (decreased LV compliance)
- Ejection click may precede murmur
- Delayed carotid upstroke
Aortic Stenosis

- Location: Right 2nd ICS
- Radiation: carotids, down LSB, apex
- Intensity: sometimes soft, often loud with a thrill
- Pitch: medium
- Shape: crescendo-decrescendo
- Quality: harsh; may be musical at apex
- Aids: heard best with patient sitting and leaning forward
Aortic Stenosis

**DIAGNOSTIC MANEUVERS**

- **Valsalva**
  - Decreases preload
  - Decreases intensity of murmur of AS

- **Squatting**
  - Increases preload
  - Increases intensity of murmur of AS

- **Abrupt standing**
  - Decreases preload
  - Decreases intensity of murmur of AS
Aortic Stenosis
Pathologic Murmurs - Pansystolic Murmurs

- Always pathologic

- Heard when blood flows from a chamber of high pressure to one of lower pressure through a valve or other structure that should be closed.

- Murmур begins immediately with $S_1$ and continues up to $S_2$. 
Mitral Regurgitation

- Mitral valve fails to close fully in systole, blood flows back from LV to LA.
- Creates volume overload on LV; dilatation and hypertrophy.
- $S_1$ decreased
- Apical $S_3$ reflects volume overload
- Apical impulse increased
- Does not become louder in inspiration
Mitral Regurgitation

- **Location:** apex
- **Radiation:** left axilla, less often LSB
- **Intensity:** soft to loud; if loud apical thrill
- **Pitch:** medium to high
- **Quality:** blowing
- **Shape:** holosystolic
Mitral Regurgitation

DIAGNOSTIC MANEUVERS

- **Valsalva**
  - Decreases preload
  - Decreases intensity of murmur of MR

- **Squatting**
  - Increases afterload
  - Increases intensity of murmur of MR

- **Leg Raising/lying down**
  - Increases preload
  - Increases intensity of murmur of MR
Mitral Regurgitation

![Diagram showing decreased S1, increased S2, and normal S3]

Systolic Murmurs

**Aortic Stenosis**
- Location: aortic area
- Radiation: neck
- Shape: diamond
- Pitch: medium
- Quality: harsh
- Decreased $A_2$
- Ejection click
- $S_4$
- Narrow pulse pressure

**Mitral Regurgitation**
- Location: apex
- Radiation: axilla
- Shape: holosystolic
- Pitch: high
- Quality: blowing
- Decreased $S_1$
- $S_3$
- Laterally displaced diffuse PMI
Always indicates heart disease!

Two types:

- Early decrescendo diastolic – *regurgitant* flow through an incompetent *semilunar* valve
- Rumbling diastolic murmur in mid- or late diastole, suggest *stenosis* of an *atrioventricular* valve
Aortic Regurgitation

Leaflets fail to close completely during diastole

Blood regurgitates from aorta to LV – results in volume overload of LV
Aortic Regurgitation

- Location: 2nd to 4th left ICS
- Radiation: apex, perhaps right sternal border
- Intensity: Grade I to III
- Pitch: High
- Quality: blowing
- Shape: decrescendo
- Heard best with patient sitting, leaning forward, breath held in exhalation
- If S3 or S4 present – severe AR
Two other murmurs may be heard:

1) Midsystolic murmur from resulting increased forward flow across aortic valve

2) Mitral diastolic (Austin Flint) murmur – attributed to diastolic impingement of the regurgitant flow on anterior leaflet of mitral valve
Aortic Regurgitation
Mitral Stenosis
Mitral valve leaflets thicken, stiffen, become distorted

Murmur has 2 components:
1) Middiastolic (rapid ventricular filling)
2) Pre-systolic (during atrial contraction)
Mitral Stenosis

- Location: limited to apex
- Radiation: little to none
- Intensity: Grade I to IV
- Pitch: low
- Quality: rumble
- Shape: decrescendo
- Best heard left lateral position over apical impulse, in exhalation
- Opening snap often follows $S_2$ and initiates murmur
Mitral Stenosis

Diagram showing the auscultation findings of mitral stenosis with accentuated S1 and S2 sounds.
# Diastolic Murmurs

<table>
<thead>
<tr>
<th>Mitral Stenosis</th>
<th>Aortic Regurgitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location: apex</td>
<td>Location: aortic area</td>
</tr>
<tr>
<td>Radiation: no</td>
<td>Radiation: No</td>
</tr>
<tr>
<td>Shape: decrescendo</td>
<td>Shape: decrescendo</td>
</tr>
<tr>
<td>Pitch: low</td>
<td>Pitch: high</td>
</tr>
<tr>
<td>Quality: rumbling</td>
<td>Quality: blowing</td>
</tr>
<tr>
<td>Increased $S_1$</td>
<td>$S_3$</td>
</tr>
<tr>
<td>Opening Snap</td>
<td>Laterally displaced PMI</td>
</tr>
<tr>
<td>RV rock</td>
<td>Wide pulse pressure</td>
</tr>
<tr>
<td>Pre-systolic accentuation</td>
<td>Austin Flint murmur</td>
</tr>
<tr>
<td></td>
<td>Systolic ejection murmur</td>
</tr>
</tbody>
</table>
Continuous Murmurs

- Begin in systole, peak near S2, and continue into all or part of diastole.

1. Cervical venous hum
   - Audible in kids; can be abolished by compression over the IJV

2. Mammary souffle
   - Represents augmented arterial flow through engorged breasts
   - Becomes audible during late 3rd trimester and lactation

3. Patent Ductus Arteriosus
   - Has a harsh, machinery-like quality
General Management of Valvular Heart Disease
Echocardiogram

Referral to cardiologists for any pathologic murmur

New AHA Guidelines for prevention of bacterial endocarditis

2007, underwent major revisions to the 1997 AHA guidelines

Recommend only patients with the highest risk of development of endocarditis receive antimicrobial prophylaxis

Most patients with valvular heart disease do not require antimicrobial prophylaxis
Back to the Basics

1. When does it occur - systole or diastole
2. Where is it loudest - A, P, T, M

**Systolic Murmurs:**
1. Aortic stenosis - ejection type
2. Mitral regurgitation - holosystolic
3. Mitral valve prolapse - late systole

**Diastolic Murmurs:**
1. Aortic regurgitation - early diastole
2. Mitral stenosis - mid to late diastole
Systolic Murmurs by Position

- RUSB – aortic stenosis
- LUSB – pulmonic stenosis
- LLSB – tricuspid regurgitation, VSD, hypertrophic cardiomyopathy
- APEX – mitral regurgitation
Diastolic Murmurs by Position

- **LUSB** – pulmonary regurgitation
- **LLSB** – tricuspid stenosis
- **APEX** – mitral stenosis
- **3<sup>rd</sup> ICS, LSB** – aortic regurgitation
Summary

A. Presystolic murmur
   ➥ Mitral/Tricuspid stenosis
B. Mitral/Tricuspid regurg.
C. Aortic ejection murmur
D. Pulmonic stenosis (spilling through S20)
E. Aortic/Pulm. diastolic murmur
F. Mitral stenosis w/ Opening snap
G. Mid-diastolic inflow murmur
H. Continuous murmur of PDA
References

