Valvular Heart Disease
Clinical Assessment

Common Clinical Scenarios
- Younger people
  - Functional murmur vs MVP vs bicuspid AV
- Older people
  - Aortic sclerosis vs aortic stenosis

Aortic Stenosis - Etiology
- Young patient think congenital
  - Bicuspid AVD
  - 2% population
  - 3:1 male:female distribution
  - Co-existing coarctation 6% of patients
- Rarely
  - Unicuspid valve
  - Sub-aortic stenosis
  - Discrete
  - Diffuse (large)
- Middle aged patient (4th & 5th decades) think bicuspid or rheumatic disease
- Old patient think degenerative (6th, 7th, 8th decades)

Aortic Stenosis: Symptoms
- Cardinal Symptoms
  - Chest pain (angina)
  - Reduced coronary flow reserve
  - Increased demand-high afterload
  - Syncope (exertional pre-syncope)
  - Fixed cardiac output
  - Vasodepressor response
  - Dyspnea on exertion & rest
- Other signs of LV failure
  - Diastolic & systolic dysfunction

Severity of Stenosis
- Normal aortic valve area 2.5-3.5 cm²
- Mild stenosis 1.5-2.5 cm²
- Moderate stenosis 1.0-1.5 cm²
- Severe stenosis < 1.0 cm²
- Onset of symptoms
  ~ 0.9 cm² with CAD
  ~ 0.7 cm² without CAD

Aortic Stenosis: Physical Findings
- S1
- S2
- S1
- S2

Mild-Moderate
Severe
Aortic Stenosis: Physical Findings

- Intensity DOES NOT predict severity
- Presence of thrill DOES NOT predict severity
- “Diamond” shaped, systolic crescendo-decrescendo
- Decreased, delay & prolongation of pulse amplitude
- Paradoxical S2
- S4 (with left ventricular hypertrophy)
- S3 (with left ventricular failure)

Recognizing Aortic Stenosis

<table>
<thead>
<tr>
<th>Sign</th>
<th>Correlation with Severity</th>
</tr>
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<tbody>
<tr>
<td>JVP-prominent A wave</td>
<td>No</td>
</tr>
<tr>
<td>Carotid-delayed, anechoic</td>
<td>Yes</td>
</tr>
<tr>
<td>A2 audible over carotids</td>
<td>Mean AV gradient &lt; 50 mm Hg and stenosis not severe i.e. AVA &gt; 1.0 cm²</td>
</tr>
<tr>
<td>Apex. sustained, atrial kick</td>
<td>Yes</td>
</tr>
<tr>
<td>- enlarged, displaced</td>
<td></td>
</tr>
<tr>
<td>Thrill</td>
<td>No</td>
</tr>
<tr>
<td>Cardioenously - Clinical/CSR</td>
<td>Yes</td>
</tr>
<tr>
<td>S1, S4</td>
<td></td>
</tr>
<tr>
<td>Paradoxical S2</td>
<td>Yes</td>
</tr>
<tr>
<td>S3, S4</td>
<td>Yes</td>
</tr>
<tr>
<td>SEM, intensity</td>
<td>No</td>
</tr>
<tr>
<td>- late peak</td>
<td>Yes</td>
</tr>
<tr>
<td>ECG, LVEF, LVH</td>
<td>Yes</td>
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Aortic Regurgitation: Etiology

- Any conditions resulting in incompetent aortic leaflets
  - Congenital
    - Bicuspid valve
  - Aortopathy
    - Cystic medial necrosis
    - Collagen disorders (e.g. Marfan’s)
    - Ehler-Danlos
    - Osteogenesis imperfecta
    - Pseudoxanthoma elasticum
- Acquired
  - Rheumatic heart disease
  - Dilated aorta (e.g. hypertension)
  - Degenerative
  - Connective tissue disorders (e.g. ankylosing spondylitis, rheumatoid arthritis, teens’s syndrome, Giant-cell arthritis)
  - Syphilis (chronic aortitis)

Aortic Regurgitation: Symptoms

- Dyspnea, orthopnea, PND
- Chest pain.
  - Nocturnal angina >> exertional angina
  - ↓ diastolic aortic pressure and increased LVEDP thus ↓ coronary artery diastolic flow)
- With extreme reductions in diastolic pressures (e.g. < 40) may see angina

Peripheral Signs of Severe Aortic Regurgitation

- Quincke’s sign: capillary pulsation
- Corrigan’s sign: water hammer pulse
- Bisferiens pulse (AS/AR > AR)
- De Musset’s sign: systolic head bobbing
- Mueller’s sign: systolic pulsation of uvula

Aortic Regurgitation: Physical Exam

- Widened pulse pressure
  - Systolic – diastolic = pulse pressure
- High pitched, blowing, crescendo diastolic murmur at LSB
- Best heard at end-expiration & leaning forward
- Hands & Knee position

Wave Sound
Central Signs of Severe Aortic Regurgitation

- Apex:
  - Enlarged
  - Displaced
  - Hyper-dynamic
  - Palpable S3
  - Austin-Flint murmur

- Aortic diastolic murmur
  - length correlates with severity (chronic AR)
  - in acute AR - murmur shortens as Aortic DP=LVEDP
  - in acute AR - mitral pre-closure

Assessing Severity of AR

- Assess severity by impact on peripheral signs and LV
  - ↑ peripheral signs = ↑ severity
  - ↑ LV = ↑ severity
  - S3
  - Austin-Flint
  - LVH
  - radiological cardiomegaly

Aortic Regurgitation: Natural History

Asymptomatic %/Y
- Normal LV function (~good prognosis)
  - Progression to symptoms or LV dysfunction < 6
  - Progression to asymptomatic LV dysfunction < 3.5
  - 75% 5-year survival
  - Sudden death < 0.2
- Abnormal LV function
  - Progression to cardiac symptoms 25
- Symptomatic (Poor prognosis)
  - Mortality > 10

TX: Medical → Surgery BEFORE LV dysfunction

Echo Indicators for Valve Replacement in Asymptomatic Aortic & Mitral Regurgitation

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<th>LVESD mm</th>
<th>EF %</th>
<th>FS</th>
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<td>&lt; 0.27</td>
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<td>&gt; 45</td>
<td>&lt; 60</td>
<td>&lt; 0.32</td>
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Mitral Stenosis Etiology

- Primarily a result of rheumatic fever
  - ~99% of MV’s @ surgery show rheumatic damage
- Scarring & fusion of valve apparatus
- Rarely congenital
- Pure or predominant MS occurs in approximately 40% of all patients with rheumatic heart disease
- Two-thirds of all patients with MS are female.

A 75 year old woman with Recent orthopnea/PND

- Chronic dyspnea Class 2/4
- Fatigue
- Recent orthopnea/PND
- Nocturnal palpitation
- Pedal edema
Mitral Stenosis Pathophysiology

- Normal valve area: 4-6 cm²
- Mild mitral stenosis:
  - MVA 1.5-2.5 cm²
  - Minimal symptoms
- Mild mitral stenosis:
  - MVA 1.0-1.5 cm² usually does not produce symptoms at rest
- Severe mitral stenosis:
  - MVA < 1.0 cm²

Mitral Stenosis Symptoms

- Fatigue
- Palpitations
- Cough
- SOB
- Left sided failure
  - Orthopnea
  - PND
- Palpitation

- AFib
- Systemic embolism
- Pulmonary infection
- Hemoptysis
- Right sided failure
  - Hepatic congestion
  - Edema
- Worsened by conditions that ↑ cardiac output.
  - Exertion, fever, anemia, tachycardia, AFib, intercourse, pregnancy, thyrotoxicosis

Mitral Stenosis Physical Exam

- First heart sound (S1) is accentuated and snapping
- Opening snap (OS) after aortic valve closure
- Low pitch diastolic rumble at the apex
- Pre-systolic accentuation (esp. if in sinus rhythm)

Recognizing Mitral Stenosis

- Palpation:
  - Small volume pulse
  - Tapping apex-palpable S1
  - +/- palpable opening snap (OS)
- Auscultation:
  - Loud S1 - as loud as S2 in aortic area
  - A2 to OS interval inversely proportional to severity
  - Diastolic rumble: length proportional to severity
  - In severe MS with low flow-S1, OS & rumble may be inaudible

Auscultation:

- Width of A2-OS inversely correlates with severity
- The more severe the MS the higher the LAP the earlier the LV pressure falls below LAP and the MV opens

Auscultation - Timing of A2 to OS Interval

- Width of A2-OS inversely correlates with severity
- The more severe the MS the higher the LAP the earlier the LV pressure falls below LAP and the MV opens
Mitral Regurgitation

- Etiology
- Symptoms
- Physical Exam
- Severity
- Natural history
- Timing of Surgery

An 80 year old woman with increasing dyspnea

- Longstanding heart murmur
- Increasing dyspnea & fatigue
- Recent ER visit Dx CHF

Mitral Regurgitation: Etiology

- Valvular-leaflets
  - Myxomatous MV Disease
  - Rheumatic
  - Endocarditis
  - Congenital-clefts
- Chordae
  - Fused/inflammatory
  - Tear/truma
  - Degenerative
  - IE
- Annulus
  - Calcification, IE (abcess)
- Papillary Muscles
  - CAD (ischemia, Infarction, Rupture)
  - HCM
  - Infiltrative disorders
  - LV dilatation & functional regurgitation
  - Trauma

MR Etiology: Surgical series

- MVP(20-70%)
- Ischemia (13-40%)
- RHD (3-40%)
- Infectious endocarditis(10-12%)

MR Pathophysiology

- Chronic LV volume overload ➔ compensatory LVE initially maintaining cardiac output
- Decompensation (increased LV wall tension) ➔ CHF
- LVE ➔ annulus dilation ➔ increased MR
- Backflow ➔ LAE, Afib, Pulmonary HTN

MR Symptoms

- Similar to MS
- Dyspnea, Orthopnea, PND
- Fatigue
- Pulmonary HTN, right sided failure
- Hemoptysis
- Systemic embolization in Afib
Recognizing Chronic Mitral Regurgitation

- Pulse:
  - brisk, low volume
- Apex:
  - hyperdynamic
  - laterally displaced
  - palpable S1 +/- S4
  - late parasternal lift 2° to LA filling
- S1 soft or normal
- S2 wide split (early A2) unless LBBB

- Murmuer-Fixed MR:
  - pansystolic
  - loudest apex to axilla
  - no post extra-systolic accentuation
- Murmuer-Dynamic MR(MVP)
  - mid systolic
  - + click
  - ↑ upright
  - S3 / flow rumble if severe

Recognizing Acute Severe Mitral Regurgitation

- Acute severe dyspnea, CHF & hypotension
- LV size normal
- LV may/may not be hyperdynamic
- Load S1
- Systolic murmur may/may not be pan-systolic
- Inflow/rumble
- S3 present-may be only abnormality
- RV lift
- TTE/TEE for diagnosis
  - Chordal or papillary muscle rupture/tear
  - Infarction with papillary muscle ischaemia or tear
  - Infectious endocarditis with leaflet perforation or disruption or chordal tear
  - Flail MV segment

Comparing AS and MR

Systolic Murmurs
- Aortic stenosis
- Mitral insufficiency
- Mitral valve prolapse
- Tricuspid insufficiency

Diastolic Murmurs
- Aortic insufficiency
- Mitral stenosis

Assessing Severity of Chronic Mitral Regurgitation

Measure the Impact on the LV:
- Apical displacement and size
- Palpable S3
- Longer/louder MR murmer (chronic MR)
- S3 intensity/ length of diastolic flow rumble
- Wider split S2 (earlier A2) unless HPT narrows the split

MR Echocardiography

- Baseline evaluation to identify etiology, quantify severity of MR
- Assess and quantify LV function and dimensions
- Annual or semi-annual surveillance of LV function, estimated EF and LVEDS in asymptomatic severe MR
- To establish cardiac status after change in symptoms
- Baseline study post MVR or repair
MR Echocardiography

- **Etiology:**
  - flail leaflets (chord/pap rupture)
  - thick (RHD)
  - post mv1 of leaflets (MVP)
  - vegetations (IE)
- **Severity:**
  - regurgitant volume/fraction/orifice area
  - LV systolic function
  - increased LV/LA size, EF

MR Stages

- LV size and function defined by echo
- **Stage 1-compensated:**
  - End-diastolic dimension less 63mm, ESD less 42mm
  - EF more than 60
- **Stage 2-transitional**
  - EDD 65-68mm, ESD 44-45mm, EF 53-57
- **Stage 3-decompensated**
  - EDD more than 70mm, ESD more than 45mm, EF less than 50

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RECOMMENDED FREQUENCY OF ECHOCARDIOGRAPHY IN PATIENTS WITH CHRONIC MITRAL REGURGITATION AND PRIMARY MITRAL-VALVE DISEASE.

<table>
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<tr>
<th>SEVERITY OF MITRAL REGURGITATION</th>
<th>LEFT VENTRICULAR FUNCTION*</th>
<th>FREQUENCY OF ECHOCARDIOGRAPHIC FOLLOW-UP</th>
</tr>
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<tr>
<td>Mild</td>
<td>Normal LV size and EF</td>
<td>Every 6 mo</td>
</tr>
<tr>
<td>Moderate</td>
<td>Normal LV size and EF</td>
<td>Annually</td>
</tr>
<tr>
<td>Moderate</td>
<td>ESD &gt;40 mm or EF =0.65</td>
<td>Every 1-2 yr</td>
</tr>
<tr>
<td>Severe</td>
<td>ESD &gt;40 mm or EF =0.65</td>
<td>Annually</td>
</tr>
<tr>
<td>Severe</td>
<td>LVESD &gt;60 mm or EF =0.65</td>
<td>Every 5 yr</td>
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Mitral Valve Prolapse: Epidemiology

- Affects 5-10% of population
- Most common cause of isolated severe MR
- Females >> males; Ages of 14 and 30 years
- Strong hereditary component (? autosomal dominant)
- 2° to failure of apposition/coaptation of the anterior and posterior mitral valve leaflets.
- Results form diverse pathologic conditions, but cause is unknown in a majority of pts

Mitral Valve Prolapse: Symptoms

- Majority are asymptomatic for entire life
- Palpitations
- Chest pain (atypical).
  - Often substernal, prolonged, poorly related to exertion, and rarely resembles typical angina
- Syncope
Mitral Insufficiency: Physical Exam

- Fixed mitral regurgitation
- Mitral valve prolapse

Mitral Valve Prolapse: Physical Exam

- Most important finding: mid → late systolic click.
  - Acute tensing of the mitral valve chordae
- Variable murmurs:
  - high pitched late systolic crescendo-decrescendo murmur,
  - Occasionally “whooping” or “honking” at the apex

Mitral Insufficiency:

S1                   S2
                           C       S1

Wave Sound

Mitral Valve Prolapse:

S1          C    S2

• Most important finding: mid → late systolic click.
  - Acute tensing of the mitral valve chordae

Variable murmurs:

- high pitched late systolic crescendo-decrescendo murmur,
- Occasionally “whooping” or “honking” at the apex

Mitral Valve Prolapse:

• Arrhythmias (Usually PVC, PSVT>>VT)
• Transient cerebral ischemic (embolic – rare)
• Infective endocarditis (if assoc w/ MR)
• Sudden death (rare)