



Valvular Heart Disease


Clinical Assessment

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Common Clinical Scenarios

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





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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 (Tunnel)
- Middle aged patient (4 & 5th decades) think bicuspid or rheumatic disease
- Old patient think degenerative (6, 7, 8th decades)



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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



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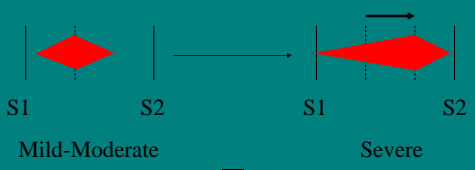
Severity of Stenosis

- 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

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Aortic Stenosis: Physical Findings



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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)

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Recognizing Aortic Stenosis

Sign	Correlation with Severity
JVP-prominent A wave	No
Carotid-delayed, anacrotic	Yes
A2 audible over carotids	Mean AV gradient < 50 mm Hg and stenosis not severe i.e. AVA > 1.0 cm ²
Apex- sustained, atrial kick	Yes
- enlarged, displaced	Yes
Thrill	No
Cardiomegaly- Clinical/CXR	Yes
Soft S1	Yes
Paradoxical S2	Yes
S3, S4	Yes
SEM- intensity	No
- late peak	Yes
ECG- LAE, LVH	Yes

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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, Reiter's syndrome, Giant-cell arteritis)
 - Syphilis (chronic aortitis)
- Acute AI: aortic dissection, infective endocarditis, trauma

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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

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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
- Durosier's sign: femoral retrograde bruits
- Traube's sign: pistol shot femorals
- Hill's sign: BP Lower extremity > BP Upper extremity by
 - > 20 mm Hg - mild AR
 - > 40 mm Hg - mod AR
 - > 60 mm Hg - severe AR

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Aortic Regurgitation: Physical Exam

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

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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

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Assessing Severity of AR

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

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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

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Bolln RO, et al. JACC. 1998;32:1486.


Echo Indicators for Valve Replacement in Asymptomatic Aortic & Mitral Regurgitation

Type of Regurgitation	LVESD mm	EF %	FS
Aortic	> 55	< 55	< 0.27
Mitral	> 45	< 60	< 0.32

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A 75 year old woman with Recent orthopnea/PND

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



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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.

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Mitral Stenosis Pathophysiology

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

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Mitral Stenosis Pathophysiology

Right Heart Failure: Hepatic Congestion JVD Tricuspid Regurgitation RA Enlargement	↑ Pulmonary HTN Pulmonary Congestion LA Enlargement Atrial Fib LA Thrombi ↑ LA Pressure
RV Pressure Overload RVH RV Failure	↓ LV Filling

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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

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Recognizing Mitral Stenosis

Palpation:

- Small volume pulse
- Tapping apex-palpable S1
- +/- palpable opening snap (OS)
- RV lift
- Palpable S2

ECG:

- LAE, AFIB, RVH, RAD

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

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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)

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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

Say	Timing seconds	Severity of MS	Other HS's
Prrr	< .06	Severe	
Pada	.07-.08	Mod-severe	
Pata	.08-.09	Mod	
Papa	> 0.10	Mild	PK 0.1-0.110
Tu-huh	≥ .12		A2-S3 0.12-0.18

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Mitral Regurgitation




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


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An 80 year old woman with increasing dyspnea




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



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Mitral Regurgitation: Etiology




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

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MR Etiology: Surgical series




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

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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

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MR Symptoms



- Similar to MS
- Dyspnea, Orthopnea, PND
- Fatigue
- Pulmonary HTN, right sided failure
- Hemoptysis
- Systemic embolization in A Fib

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Recognizing Chronic Mitral Regurgitation

- Pulse:
 - brisk, low volume
- Apex:
 - hyperdynamic
 - laterally displaced
 - palpable S3 +/- thrill
 - late parasternal lift 2° to LA filling
- S 1 soft or normal
- S 2 wide split (early A2) unless LBBB
- Murmur-Fixed MR:
 - pansystolic
 - loudest apex to axilla
 - no post extra-systolic accentuation
- Murmur-Dynamic MR(MVP)
 - mid systolic
 - +/- click
 - ↑ upright
- S 3 / flow rumble if severe

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Recognizing Acute Severe Mitral Regurgitation

- Acute severe dyspnea, CHF & hypotension
- LV size normal
- LV may/may not be hyperdynamic
- Loud 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

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Comparing AS and MR

<u>Systolic Murmurs</u>	
<u>Diastolic Murmurs</u>	

© Continuing Medical Implementation S1 S2 S1bridging the care gap

Assessing Severity of Chronic Mitral Regurgitation

Measure the Impact on the LV:

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

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Recognizing Mitral Regurgitation

- ECG:
 - LA enlargement
 - Afib
 - LVH (50% pts. With severe MR)
 - RVH (15%)
 - Combined hypertrophy (5%)
- CXR:
 - ↑ LV
 - ↑↑ LA
 - ↑ pulmonary vascularity
 - CHF
 - Ca++ MV/MAC

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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 LVESD in asymptomatic severe MR
- To establish cardiac status after change in symptoms
- Baseline study post MVR or repair

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MR Echocardiography

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

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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.

SEVERITY OF MITRAL REGURGITATION	LEFT VENTRICULAR FUNCTION*	FREQUENCY OF ECHOCARDIOGRAPHIC FOLLOW-UP
Mild	Normal ESD and EF	Every 5 yr
Moderate	Normal ESD and EF	Every 1-2 yr
Moderate	ESD >40 mm or EF <0.65	Annually
Severe	Normal ESD and EF	Annually
Severe	ESD >40 mm or EF <0.65	Every 6 mo

*ESD denotes end-systolic dimension and EF ejection fraction. Otto C.M. NEJM 345:10.
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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 30years
- 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

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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

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Mitral Insufficiency: Physical Exam

- Fixed mitral regurgitation
- Mitral valve prolapse

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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 **crecendo-decrescendo murmur**,
 - Occasionally “whooping” or “honking” at the apex

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Mitral Valve Prolapse: Complications

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

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Diagnosis	Systolic murmur	Second sound	Effect of posture	Amyl nitrate	Phenylephrine
	S1	S2	Erect	Squatting	
	Changes in intensity of systolic murmur				
Hypertrophic obstructive cardiomyopathy		Variable, is – reversed partially reversed narrow or normal	↑	↓	↑
Mitral incompetence		widely split	↓	↑	↓
a. Pure severe			↓	↑	↓
b. Papillary muscle dysfunction		normal or partially reversed	↑	↑	↑
c. Mitral valve prolapse	EC	normal	↑	↑	↓
d. Rheumatic of moderate degree		slightly wide	↓	↑	↓
Valvular aortic stenosis		narrow or partially reversed	↓	↑	–
marked		reversed	↓	↑	–
Ventricular septal defect		slightly wide	–	↑	↓
Innocent vibratory systolic murmur		normal	↓	–	↓

EC=ejectio click: – No change from control ↑↑ Degree of increase ↓↓ Degree of decrease

Diagrammatic representation of the character of the systolic murmur and of the second heart sound in several abnormalities. The effects of posture, amyl nitrite inhalation, and phenylephrine injection on the intensity of the murmur are shown. (With permission from Barlow, J.B. Perspectives on the Mitral Valve. F.A. Davis, Philadelphia 1987.)

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CV Exam Links

- [Blotz Heart Sounds Tutorial](#) Comment: AMAZING!!
- [Introduction to the Cardiovascular Exam](#)
- [Internal Clinical Skills Database](#)
- [Ohio State University Interactive Learning Center](#)
- [UConn Simulator](#)
- [The Association Assistant](#)

Frontal Anatomy

Labels: Pulmonary veins, Left atrium, Left ventricle, Aorta, Right Atrium, Right ventricle, Pulmonary arteries, Ribs, Left Atrial Appendage, Fossa Ovalis, Mitral Valve, Left Ventricle, Descending Aorta.

Active View: Left Heart, Right Heart, Entire Heart

Cartoon X-Ray