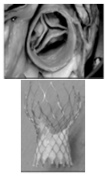
Valvular Heart Disease

Review and Update



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No conflict of interest

Overview

- The new staging system of valvular heart disease
- Aortic valve stenosis
- Transcatheter aortic valve replacement (TAVR)
- Mitral valve regurgitation
- Transcatheter mitral valve repair (TMVR)

Overview

- Valvular heart disease is increasing in prevalence due to the aging population
- A detailed history and physical exam are essential in diagnosing, staging and treating valvular disease
- There has been great change in the field with new surgical and interventional procedures and new guidelines

The New Staging System of Valvular Disease

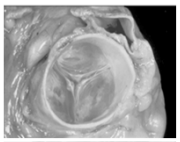
Stages of Progression of VHD

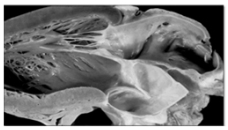
Stage	Definition	Description
A	At risk	Patients with risk factors for the development of VHD
B	Progressive	Patients with progressive VHD (mild-to-moderate severity and asymptomatic)
C	Asymptomatic severe	Asymptomatic patients who have reached the criteria for severe VHD C1: Asymptomatic patients with severe VHD in whom the left or right ventricle remains compensated C2: Asymptomatic patients who have severe VHD, with decompensation of the left or right ventricle
D	Symptomatic severe	Patients who have developed symptoms as a result of VHD

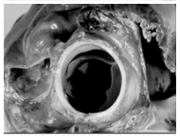
Aortic Stenosis

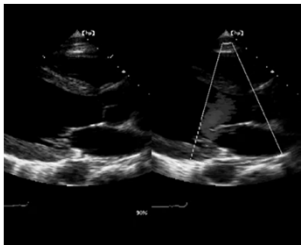
The Normal Aortic valve

- Complex structure with remarkable durability
- 3 cusps of equal size, each surrounded by a sinus
- Cusps are crescent and open fully
- The free edges curve upward and at the tip form the Arantius nodules







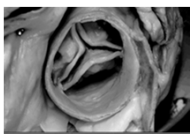


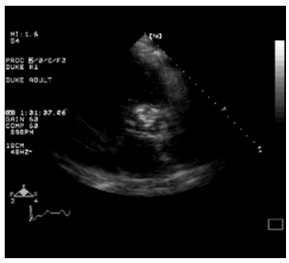
Etiology

- Calcific aortic stenosis of a tricuspid valve
- Bicuspid or unicuspid valves
- Rheumatic valve disease
- Rare causes such as Fabry's disease, Paget disease…

Calcific Aortic Stenosis

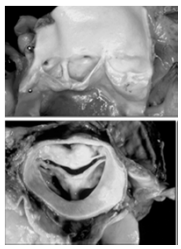
- Most common in the US
- Progresses from base to tip of the leaflet
- No commissural fusion
- Active disease process inflammation, lipid accumulation and calcification
- Similar to atherosclerosis with significant differences
- More often and earlier in ESRD

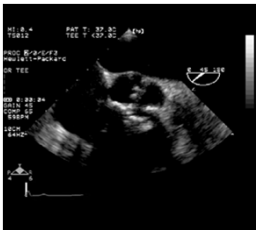




Bicuspid Aortic Valve

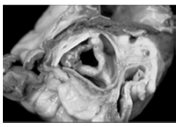
- Most common congenital heart anomaly (1-2% of the general population)
- Younger pts
- May be associated with aortic root pathology or aortic coarctation
- Usually normal function at birth and then causes AS or AR due to scarring and calcification



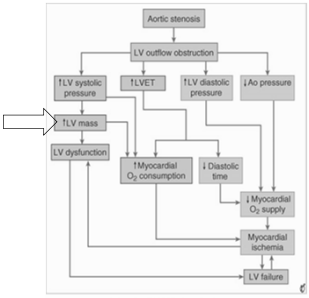


Rheumatic AS

- Not common in the US
- Most common etiology worldwide
- Commissural fusion with scarring and then calcification
- Almost always associated with MV disease



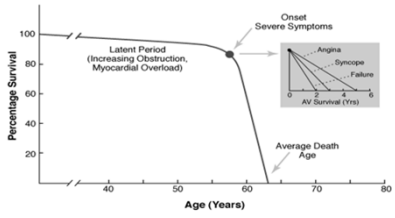
Pathophysiology



Symptoms

- Prolonged asymptomatic period
- Symptoms are rare until severe AS is present
- The classic triad is angina, syncope or dizziness, and heart failure or dyspnea
- SYMPTOMS SHOULD BE EXERTIONAL
- Even mild cardiac symptoms should trigger prompt intervention due to poor survival otherwise

Survival in Symptomatic Patients



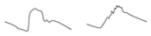
Symptoms

- Exertional dyspnea is the most common symptom
  - Diastolic dysfunction
  - Inability to increase cardiac output
  - Overt heart failure is a late presentation
- Syncope reflects decreased cerebral perfusion with exertion
- Angina occurs in two thirds of pts with severe AS
  - Half of them have CAD
  - Myocardial ischemia due to LVH and reduced coronary flow

Symptoms

- Sudden cardiac death
  - 0-5% in asymptomatic, 8-34% in symptomatic pts
  - Unclear etiology (possibly arrhythmic)
  - AVR reduces risk
- AF
  - Uncommon in isolated AS
  - May occur with HF
  - Not well tolerated in severe AS
- Bleeding tendency
  - due to acquired VW syndrome
  - Worse with severe AS

Physical Examination



- Pulsus parvus et tardus
  - Reduced in amplitude
  - Delayed
- S2 soft, single or paradoxically split
- S4 can be heard
- Systolic ejection murmur
  - Second right intercostal space
  - Radiates to the carotid arteries
  - A loud murmur is specific for severe AS but not sensitive
  - Late-peaking murmur predicts severe AS

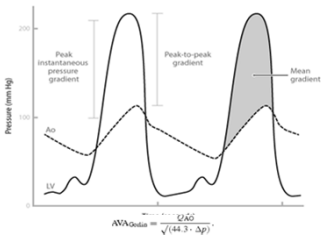
Echocardiography

- The gold standard for diagnosis and severity
- 2D, spectral Doppler and color Doppler
- Good leaflet movement on 2D virtually rules out significant AS
- Valve morphology, LVH, LA size, ascending aorta
- Color Doppler shows turbulence, associated AR
- Spectral Doppler measures flow velocity, gradients, and aortic valve area
- Pulmonary artery pressure
- **May underestimate severity if not well done**

Severity of Aortic Stenosis

Indicator	Mild	Moderate	Severe
Jet velocity (m per s)	less than 3.0	3.0 – 4.0	Greater than 4.0
Mean Gradient (mmHg)	Less than 25	25 – 40	Greater than 40
Valve area (cm2)	Greater than 1.5	1.0 – 1.5	Less than 1.0
Valve area index (cm2 per m2)			Less than 0.6

AS During Cardiac Cath



Aortic Stenosis: Diagnosis and Follow-Up

Recommendations	COR	LOE
TTE is indicated in patients with signs or symptoms of AS or a bicuspid aortic valve for accurate diagnosis of the cause of AS, hemodynamic severity, LV size and systolic function, and for determining prognosis and timing of valve intervention	I	B
Low-dose dobutamine stress testing using echocardiographic or invasive hemodynamic measurements is reasonable in patients with stage D2 AS with all of the following: a. Calcified aortic valve with reduced systolic opening; b. LVEF less than 50%; c. Calculated valve area 1.0 cm^2 or less; and d. Aortic velocity less than 4.0 m per second or mean pressure gradient less than 40 mm Hg	IIa	B

Aortic Stenosis: Diagnosis and Follow-Up

Recommendations	COR	LOE
Exercise testing is reasonable to assess physiological changes with exercise and to confirm the absence of symptoms in asymptomatic patients with a calcified aortic valve and an aortic velocity 4.0 m per second or greater or mean pressure gradient 40 mm Hg or higher (stage C)	IIa	B
Exercise testing should not be performed in symptomatic patients with AS when the aortic velocity is 4.0 m per second or greater or mean pressure gradient is 40 mm Hg or higher (stage D)	III: Harm	B

Stages of Valvular Aortic Stenosis

Stage	Definition	Valve Anatomy	Valve Hemodynamics	Hemodynamic Consequences	Symptoms
A	**At risk of AS**	• Bicuspid aortic valve (or other congenital valve anomaly) • Aortic valve sclerosis	• Aortic V_{max} <2 m/s	• None	• None
B	**Progressive AS**	• Mild-to-moderate leaflet calcification of a bicuspid or trileaflet valve with some reduction in systolic motion or • Rheumatic valve changes with commissural fusion	• Mild AS: Aortic V_{max} 2.0–2.9 m/s or mean ΔP <20 mm Hg • Moderate AS: Aortic V_{max} 3.0–3.9 m/s or mean ΔP 20–39 mm Hg	• Early LV diastolic dysfunction may be present • Normal LVEF	• None

Stages of Valvular Aortic Stenosis

Stage	Definition	Valve Anatomy	Valve Hemodynamics	Hemodynamic Consequences	Symptoms
C - Asymptomatic severe AS					
C1	**Asymptomatic severe AS**	• Severe leaflet calcification or congenital stenosis with severely reduced leaflet opening	• Aortic V_{max} ≥4 m/s or mean ΔP ≥40 mm Hg • AVA typically is ≤1 cm^2 (or AVAi ≤0.6 cm^2/m^2) • Very severe AS is an aortic V_{max} ≥5 m/s, or mean ΔP ≥60 mm Hg	• LV diastolic dysfunction • Mild LV hypertrophy • Normal LVEF	• None–exercise testing is reasonable to confirm symptom status
C2	**Asymptomatic severe AS with LV dysfunction**	• Severe leaflet calcification or congenital stenosis with severely reduced leaflet opening	• Aortic V_{max} ≥4 m/s or mean ΔP ≥40 mm Hg • AVA typically is ≤1 cm^2 (or AVAi ≤0.6 cm^2/m^2)	• LVEF <50%	• None

Stages of Valvular Aortic Stenosis

Stage	Definition	Valve Anatomy	Valve Hemodynamics	Hemodynamic Consequences	Symptoms
D - Symptomatic severe AS					
D1	**Symptomatic severe high-gradient AS**	• Severe leaflet calcification or congenital stenosis with severely reduced leaflet opening	• Aortic V_{max} ≥4 m/s, or mean ΔP ≥40 mm Hg • AVA typically is ≤1 cm^2 (or AVAi ≤0.6 cm^2/m^2), but may be larger with mixed AS/AR	• LV diastolic dysfunction • LV hypertrophy • Pulmonary hypertension may be present	• Exertional dyspnea or decreased exercise tolerance • Exertional angina • Exertional syncope or presyncope
D2	**Symptomatic severe low-flow/low-gradient AS with reduced LVEF**	• Severe leaflet calcification with severely reduced leaflet motion	• AVA ≤1 cm^2 with resting aortic V_{max} <4 m/s or mean ΔP <40 mm Hg • Dobutamine stress echo shows AVA ≤1 cm^2 with V_{max} ≥4 m/s at any flow rate	• LV diastolic dysfunction • LV hypertrophy • LVEF <50%	• HF, • Angina, • Syncope or presyncope

Stages of Valvular Aortic Stenosis

Stage	Definition	Valve Anatomy	Valve Hemodynamics	Hemodynamic Consequences	Symptoms
D - Symptomatic severe AS					
D3	**Symptomatic severe low-gradient AS with normal LVEF or paradoxical low-flow severe AS**	• Severe leaflet calcification with severely reduced leaflet motion	• AVA ≤1 cm^2 with aortic V_{max} <4 m/s, or mean ΔP <40 mm Hg • Indexed AVA ≤0.6 cm^2/m^2 and • Stroke volume index <35 mL/m^2 • Measured when the patient is normotensive (systolic BP <140 mm Hg)	• Increased LV relative wall thickness • Small LV chamber with low-stroke volume. • Restrictive diastolic filling • LVEF ≥50%	• HF, • Angina, • Syncope or presyncope

Surgical AVR

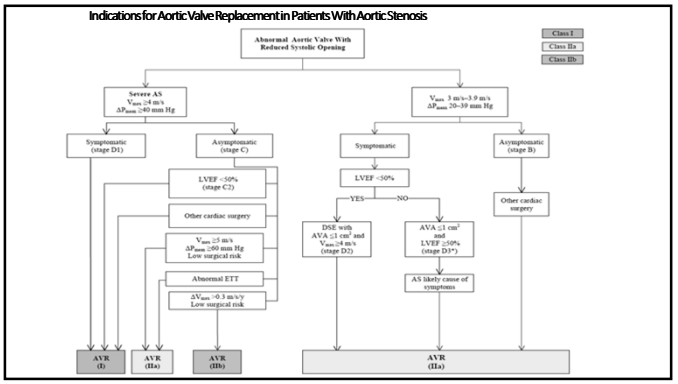
- Surgery improves symptoms and prolongs survival
- Average mortality risk of 3-5% for AVR alone and about 5-7% for AVR+CABG
- Reduces the risk of SCD
- Surgical outcomes are worse with low EF and in pts with several co-morbidities
- The timing of surgery in truly asymptomatic pts with severe AS is still controversial

Aortic Stenosis: Timing of Intervention

Recommendations	COR	LOE
AVR is recommended with severe high-gradient AS who have symptoms by history or on exercise testing (stage D1)	I	B
AVR is recommended for asymptomatic patients with severe AS (stage C2) and LVEF <50%	I	B
AVR is indicated for patients with severe AS (stage C or D) when undergoing other cardiac surgery	I	B

Aortic Stenosis: Timing of Intervention (cont.)

Recommendations	COR	LOE
AVR is reasonable for asymptomatic patients with very severe AS (stage C1, aortic velocity ≥5 m/s) and low surgical risk	IIa	B
AVR is reasonable in asymptomatic patients (stage C1) with severe AS and decreased exercise tolerance or an exercise fall in BP	IIa	B
AVR is reasonable in symptomatic patients with low-flow/low-gradient severe AS with reduced LVEF (stage D2) with a low-dose dobutamine stress study that shows an aortic velocity ≥4 m/s (or mean pressure gradient ≥40 mm Hg) with a valve area ≤1.0 cm^2 at any dobutamine dose	IIa	B



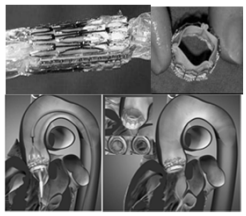
TAVR

Trans-catheter Aortic Valve Replacement (TAVR)

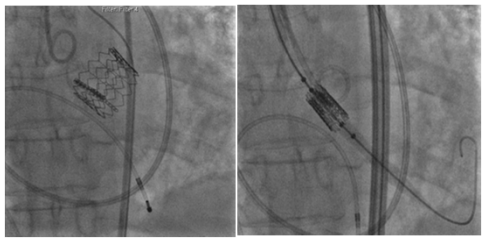
- Extremely promising
- Developed to offer an option for pts with symptomatic severe AS who are not candidates for surgery
- Multiple approaches studied but most important are:
  - Transfemoral
  - Transapical
  - Subclavian
  - Direct aortic route

Balloon Expandable Valve

SAPIEN valve made by Edwards
Balloon expandable
FDA approved in November of 2011

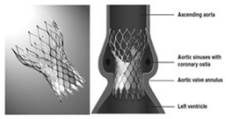


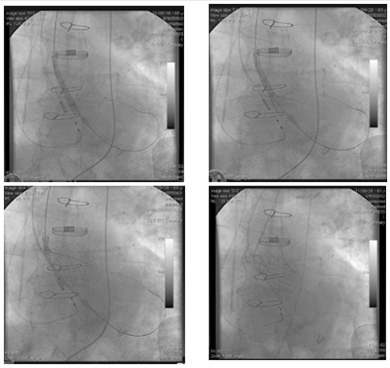
The Procedure



Self-Expandable Valve

The CoreValve made by Medtronic
Self-expanding valve
FDA Approved
Has the potential for smaller catheter size and repositioning

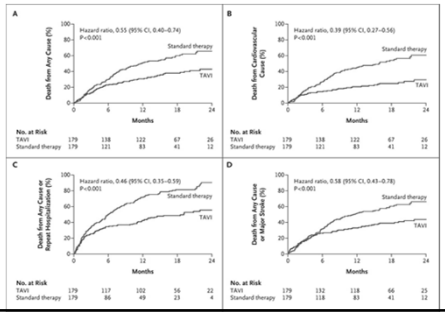




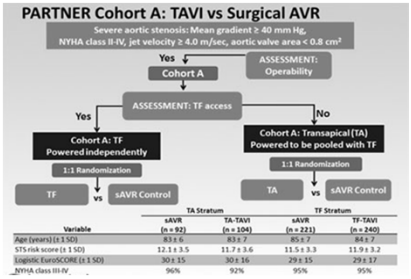
The PARTNER Trial

- The pivotal clinical study in the US to gain FDA approval
- Randomized controlled multi-center study
- PARTNER cohort B compared TAVR using the SAPIEN valve vs medical therapy
- 358 patients were randomized in 25 centers

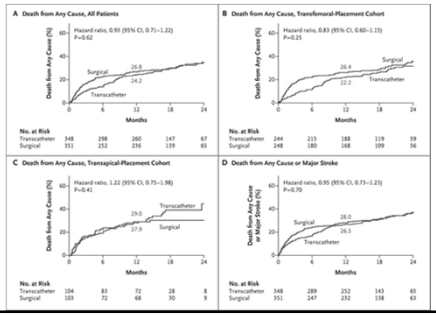
Partner Cohort B Outcomes



Partner Cohort A Trial Design



Partner Cohort A Outcomes



Challenges

- Exact placement of the valve is essential
- Vascular complications
- AV block requiring pacing
- Paravalvular leak and AR
- Peripheral vascular disease
- The risk of CVA

Aortic Stenosis: Choice of Surgical or Transcatheter Intervention

Recommendations	COR	LOE
Surgical AVR is recommended in patients who meet an indication for AVR (listed in Section 3.4) with low or intermediate surgical risk	I	A
For patients in whom TAVR or high-risk surgical AVR is being considered, members of a Heart Valve Team should collaborate closely to provide optimal patient care	I	C
TAVR is recommended in patients who meet an indication for AVR for AS who have a prohibitive surgical risk and a predicted post-TAVR survival >12 months	I	B

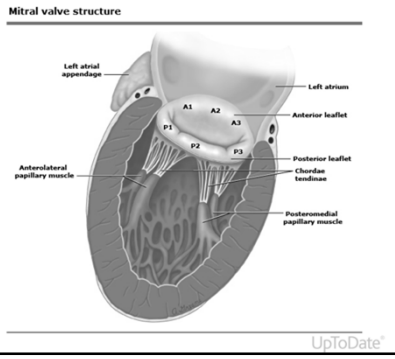
Aortic Stenosis: Choice of Surgical or Transcatheter Intervention (cont.)

Recommendations	COR	LOE
TAVR is a reasonable alternative to surgical AVR for AS in patients who meet an indication for AVR and who have high surgical risk	IIa	B
Percutaneous aortic balloon dilation may be considered as a bridge to surgical or transcatheter AVR in severely symptomatic patients with severe AS	IIb	C
TAVR is not recommended in patients in whom the existing comorbidities would preclude the expected benefit from correction of AS	III: No Benefit	B

In Conclusion

- Aortic stenosis is very common and is associated with high morbidity and mortality if not treated
- Close follow up of asymptomatic patients is essential to decide timing of surgery
- Echocardiography with Doppler is sufficient in most cases to diagnose and assess the severity of AS
- Surgical AVR is the most effective treatment and is still the gold standard for most patients
- TAVR is a promising treatment for the growing group of pts with severe symptomatic AS who are ineligible or very high risk for surgery

Mitral Regurgitation



Prevalence

- The second most common valvular lesion after AS
- Trivial "physiologic MR" can be detected by echo in up to 70% of healthy adults
- Moderate MR was present in 2%
- Severe MR present in 0.2% in the Strong Heart Study

Etiology

- Primary MR
  - Mitral valve prolapse
  - Rheumatic
  - Endocarditis
  - Congenital
- Secondary MR
  - Ischemic heart disease
  - Functional (secondary to dilated cardiomyopathy)
  - HOCM

Mitral Valve Prolapse

- Most common cause of primary MR
- Myxomatous valve (redundancy of leaflets and chordae)
- ≥2 mm of billowing above the mitral valve annulus
- Prevalence of 0.6-2.4%
- Increased incidence of chord rupture and flail leaflet

Ischemic Mitral Regurgitation

- Most common cause of secondary MR
- Occurs in patients with prior MI, especially inferior MI
- Gets worse with adverse LV remodeling and dilatation
- The mechanism is tethering or tenting of the leaflets caused by papillary muscle displacement

Functional Mitral Regurgitation

- Annular enlargement caused by LV dilatation
- Most pts with dilated cardiomyopathy have some degree of MR
- Severity is a predictor of mortality in pts with cardiomyopathy
- Contributes to symptoms in pts with cardiomyopathy

Symptoms

- Pts with mild or moderate MR are asymptomatic
- Many pts with severe MR are asymptomatic
- Symptoms are caused by LV dilatation and dysfunction, pulmonary hypertension, or atrial fibrillation
- Dyspnea and fatigue are most common
- Heart failure symptoms eventually develop
- Palpitations due to AF

Physical Examination

- Mostly holosystolic murmur at the apex (late systolic in MVP)
- Radiation can be to the axilla or the left sternal border depending of direction of the MR jet
- S1 can be diminished due to malcoaptation
- Widely split S2 can be present with pulmonary hypertension
- S3 can be heard with LV dilatation and failure

Chronic *Primary* Mitral Regurgitation: Diagnosis and Follow-Up

Recommendations	COR	LOE
TTE is indicated for baseline evaluation of LV size and function, right ventricular (RV) function and left atrial size, pulmonary artery pressure, and mechanism and severity of primary MR (stages A to D) in any patient suspected of having chronic primary MR	I	B
CMR is indicated in patients with chronic primary MR to assess LV and RV volumes, function, or MR severity and when these issues are not satisfactorily addressed by TTE	I	B

Chronic *Primary* Mitral Regurgitation: Diagnosis and Follow-Up (cont.)

Recommendations	COR	LOE
Intraoperative TEE is indicated to establish the anatomic basis for chronic primary MR (stages C and D) and to guide repair	I	B
TEE is indicated for evaluation of patients with chronic primary MR (stages B to D) in whom noninvasive imaging provides nondiagnostic information about severity of MR, mechanism of MR, and/or status of LV function	I	C

Chronic *Primary* Mitral Regurgitation: Diagnosis and Follow-Up (cont.)

Recommendations	COR	LOE
Exercise hemodynamics with either Doppler echocardiography or cardiac catheterization is reasonable in symptomatic patients with chronic primary MR where there is a discrepancy between symptoms and the severity of MR at rest (stages B and C)	IIa	B
Exercise treadmill testing can be useful in patients with chronic primary MR to establish symptom status and exercise tolerance (stages B and C)	IIa	C

Stages of *Primary* Mitral Regurgitation

Stage	Definition	Valve Anatomy	Valve Hemodynamics	Hemodynamic Consequences	Symptoms
A	**At risk of MR**	• Mild mitral valve prolapse with normal coaptation • Mild valve thickening and leaflet restriction	• No MR jet or small central jet area <20% LA on Doppler • Small vena contracta <0.3 cm	• None	• None
B	**Progressive MR**	• Severe mitral valve prolapse with normal coaptation • Rheumatic valve changes with leaflet restriction and loss of central coaptation • Prior IE	• Central jet MR 20%–40% LA or late systolic eccentric jet MR • Vena contracta <0.7 cm • Regurgitant volume <60 cc • Regurgitant fraction <50% • ERO <0.40 cm^2 • Angiographic grade 1–2+	• Mild LA enlargement • No LV enlargement • Normal pulmonary pressure	• None

Stages of *Primary* Mitral Regurgitation (cont.)

Stage	Definition	Valve Anatomy	Valve Hemodynamics	Hemodynamic Consequences	Symptoms
C	**Asymptomatic severe MR**	• Severe mitral valve prolapse with loss of coaptation or flail leaflet • Rheumatic valve changes with leaflet restriction and loss of central coaptation • Prior IE • Thickening of leaflets with radiation heart disease	• Central jet MR >40% LA or holosystolic eccentric jet MR • Vena contracta ≥0.7 cm • Regurgitant volume ≥60 cc • Regurgitant fraction ≥50% • ERO ≥0.40 cm^2 • Angiographic grade 3–4+	• Moderate or severe LA enlargement • LV enlargement • Pulmonary hypertension may be present at rest or with exercise • **C1**: LVEF >60% and LVESD <40 mm • **C2**: LVEF ≤60% and LVESD ≥40 mm	• None

Stages of *Primary* Mitral Regurgitation (cont.)

Stage	Definition	Valve Anatomy	Valve Hemodynamics	Hemodynamic Consequences	Symptoms
D	**Symptomatic severe MR**	• Severe mitral valve prolapse with loss of coaptation or flail leaflet • Rheumatic valve changes with leaflet restriction and loss of central coaptation • Prior IE • Thickening of leaflets with radiation heart disease	• Central jet MR >40% LA or holosystolic eccentric jet MR • Vena contracta ≥0.7 cm • Regurgitant volume ≥60 cc • Regurgitant fraction ≥50% • ERO ≥0.40 cm^2 • Angiographic grade 3–4+	• Moderate or severe LA enlargement • LV enlargement • Pulmonary hypertension present	• Decreased exercise tolerance • Exertional dyspnea

Stages of *Secondary* Mitral Regurgitation (cont.)

Grade	Definition	Valve Anatomy	Valve Hemodynamics	Associated Cardiac Findings	Symptoms
A	**At risk of MR**	• Normal valve leaflets, chords, and annulus in a patient with coronary disease or a cardiomyopathy	• No MR jet or small central jet area <20% LA on Doppler • Small vena contracta <0.30 cm	• Normal or mildly dilated LV size with fixed (infarction) or inducible (ischemia) regional wall motion abnormalities • Primary myocardial disease with LV dilation and systolic dysfunction	• Symptoms due to coronary ischemia or HF may be present that respond to revascularization and appropriate medical therapy

Stages of *Secondary* Mitral Regurgitation (cont.)

Grade	Definition	Valve Anatomy	Valve Hemodynamics	Associated Cardiac Findings	Symptoms
B	**Progressive MR**	• Regional wall motion abnormalities with mild tethering of mitral leaflet • Annular dilation with mild loss of central coaptation of the mitral leaflets	• ERO <0.20 cm^2 • Regurgitant volume <30 cc	• Regional wall motion abnormalities with reduced LV systolic function • LV dilation and systolic dysfunction due to primary myocardial disease	• Symptoms due to coronary ischemia or HF may be present that respond to revascularization and appropriate medical therapy

Stages of *Secondary* Mitral Regurgitation (cont.)

Grade	Definition	Valve Anatomy	Valve Hemodynamics	Associated Cardiac Findings	Symptoms
C	**Asymptomatic severe MR**	• Regional wall motion abnormalities and/or LV dilation with severe tethering of mitral leaflet • Annular dilation with severe loss of central coaptation of the mitral leaflets	• ERO ≥0.20 cm^2 • Regurgitant volume ≥30 cc	• Regional wall motion abnormalities with reduced LV systolic function • LV dilation and systolic dysfunction due to primary myocardial disease	• Symptoms due to coronary ischemia or HF may be present that respond to revascularization and appropriate medical therapy

Stages of *Secondary* Mitral Regurgitation (cont.)

Grade	Definition	Valve Anatomy	Valve Hemodynamics	Associated Cardiac Findings	Symptoms
D	**Symptomatic severe MR**	• Regional wall motion abnormalities and/or LV dilation with severe tethering of mitral leaflet • Annular dilation with severe loss of central coaptation of the mitral leaflets	• ERO ≥0.20 cm^2 • Regurgitant volume ≥30 cc	• Regional wall motion abnormalities with reduced LV systolic function • LV dilation and systolic dysfunction due to primary myocardial disease.	• HF symptoms due to MR persist even after revascularization and optimization of medical therapy • Decreased exercise tolerance • Exertional dyspnea

Chronic *Primary* Mitral Regurgitation: Intervention

Recommendations	COR	LOE
MV surgery is recommended for symptomatic patients with chronic severe primary MR (stage D) and LVEF >30%	I	B
MV surgery is recommended for asymptomatic patients with chronic severe primary MR and LV dysfunction (LVEF 30%–60% and/or LVESD ≥40 mm, stage C2)	I	B
MV repair is recommended in preference to MVR when surgical treatment is indicated for patients with chronic severe primary MR limited to the posterior leaflet	I	B

Chronic *Primary* Mitral Regurgitation: Intervention (cont.)

Recommendations	COR	LOE
MV repair is recommended in preference to MVR when surgical treatment is indicated for patients with chronic severe primary MR involving the anterior leaflet or both leaflets when a successful and durable repair can be accomplished	I	B
Concomitant MV repair or replacement is indicated in patients with chronic severe primary MR undergoing other cardiac surgery	I	B

Chronic *Primary* Mitral Regurgitation: Intervention (cont.)

Recommendations	COR	LOE
MV repair is reasonable in asymptomatic patients with chronic severe primary MR (stage C1) with preserved LV function (LVEF >60% and LVESD <40 mm) in whom the likelihood of a successful and durable repair without residual MR is >95% with an expected mortality <1% when performed at a Heart Valve Center of Excellence	IIa	B

Chronic *Primary* Mitral Regurgitation: Intervention (cont.)

Recommendations	COR	LOE
MV repair is reasonable for asymptomatic patients with chronic severe nonrheumatic primary MR (stage C1) and preserved LV function in whom there is a high likelihood of a successful and durable repair with 1) new onset of AF or 2) resting pulmonary hypertension (PA systolic arterial pressure >50 mm Hg)	IIa	B
Concomitant MV repair is reasonable in patients with chronic moderate primary MR (stage B) undergoing other cardiac surgery	IIa	C

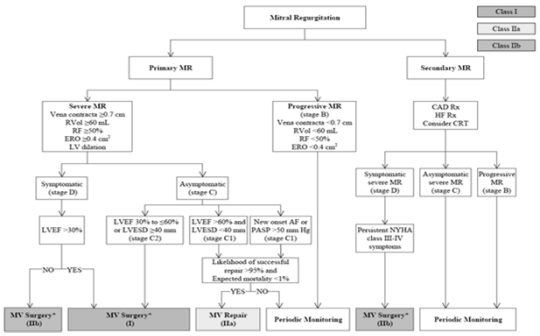
Chronic *Secondary* Mitral Regurgitation: Medical Therapy

Recommendations	COR	LOE
Patients with chronic secondary MR (stages B to D) and HF with reduced LVEF should receive standard GDMT therapy for HF, including ACE inhibitors, ARBs, beta blockers, and/or aldosterone antagonists as indicated	I	A
Noninvasive imaging (stress nuclear/positron emission tomography, CMR, or stress echocardiography), cardiac CT angiography, or cardiac catheterization, including coronary arteriography, is useful to establish etiology of chronic secondary MR (stages B to D) and/or to assess myocardial viability, which in turn may influence management of functional MR	I	A

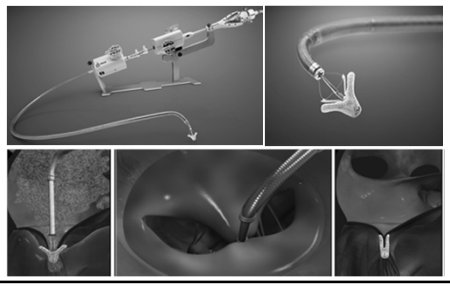
Chronic Severe *Secondary* Mitral Regurgitation: Intervention

Recommendations	COR	LOE
MV surgery is reasonable for patients with chronic severe secondary MR (stages C and D) who are undergoing CABG or AVR	IIa	C
MV surgery may be considered for severely symptomatic patients (NYHA class III-IV) with chronic severe secondary MR (stage D)	IIb	B
MV repair may be considered for patients with chronic moderate secondary MR (stage B) who are undergoing other cardiac surgery	IIb	C

Indications for Surgery for Mitral Regurgitation



Transcatheter Mitral Valve Repair MitraClip System



Procedure

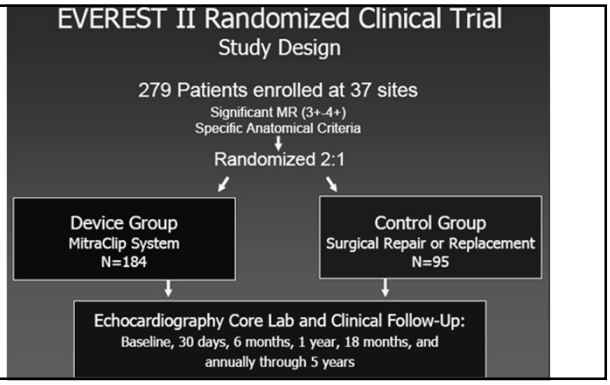
- Cath lab procedure done under fluoroscopic and TEE guidance
- Usually done under general anesthesia
- Access through the femoral vein
- Trans-septal puncture
- The catheter is then advanced into the LA and steered under TEE guidance to LV and then to grasp the leaflets
- Sometimes more than one clip is needed

Indication

- Severely symptomatic (NYHA Class III or IV) heart failure despite medical therapy
- Chronic severe primary MR
- Favorable anatomy for the repair procedure
- Reasonable life expectancy
- Prohibitive surgical risk due to comorbidities

Outcomes

The EVEREST II Trial



Results

- Similar mortality at 1 year between TMVR and MV surgery (6%)
- Similar rates of +3 or +4 MR at 1 year between the 2 groups (20 vs. 21%)
- Similar rates of mortality and significant MR at 4 years
- At 4 years, MTVR was associated with higher rates of surgery for MV dysfunction (24.8 vs. 5.5%)

Outcomes

- Other studies showed improvements in
  - MR severity
  - LV and LA volumes
  - Quality of life
  - Exercise capacity
- Observational studies suggest that TMVR can reduce MR and improve symptoms in pts with secondary MR

Conclusion

- MR is a common and very complex valvular lesion that can be a primary valve lesion or complicate CAD or dilated cardiomyopathy
- Secondary MR worsens ischemic and dilated cardiomyopathy and can be very difficult to treat
- TTE and TEE are the gold standards for diagnosis and evaluation of severity
- MV surgery, preferably repair is the most effective treatment for primary MR
- TMVR is a promising treatment for pts with primary or secondary MR who have appropriate anatomy and are deemed at high surgical risk

Thank you

Questions???