



**Tri-City
Cardiovascular
Symposium**



August 17, 2024



Sulay Patel, MD

- Board Certified In Interventional Cardiology, Cardiovascular Disease, Echocardiography, Nuclear Cardiology, Vascular Imaging, and Internal Medicine
- Completed residency and fellowships at Emory University in Structural Heart Disease, Interventional Cardiology, Cardiovascular Disease, and Internal Medicine
- Earned his Doctor of Medicine Degree at Sidney Kimmel Medical College in Philadelphia, Pennsylvania.
- Specialties include general and interventional cardiology, with expertise in high risk coronary interventions and minimally invasive structural heart procedures including TAVR, transcatheter edge to edge repair, ASD/PFO closure, and left atrial appendage occlusion.
- Outside of work, Dr. Patel enjoys trying new restaurants, exploring different cultures through travel, and spending time with friends and family.



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Objectives

- Utilize a case-based approach to review the surveillance and procedural interventions for mitral regurgitation



Case 1

- 48 year old male presents for an executive physical with no symptomatic complaints. He is active and exercises regularly.
- PMH: None
- PE: BP 120/70, HR 55, 2/6 blowing holosystolic murmur at the ap
- EKG: Sinus rhythm with no significant abnormalities



Case 1

- “Doc, I’ve had that murmur all my life”



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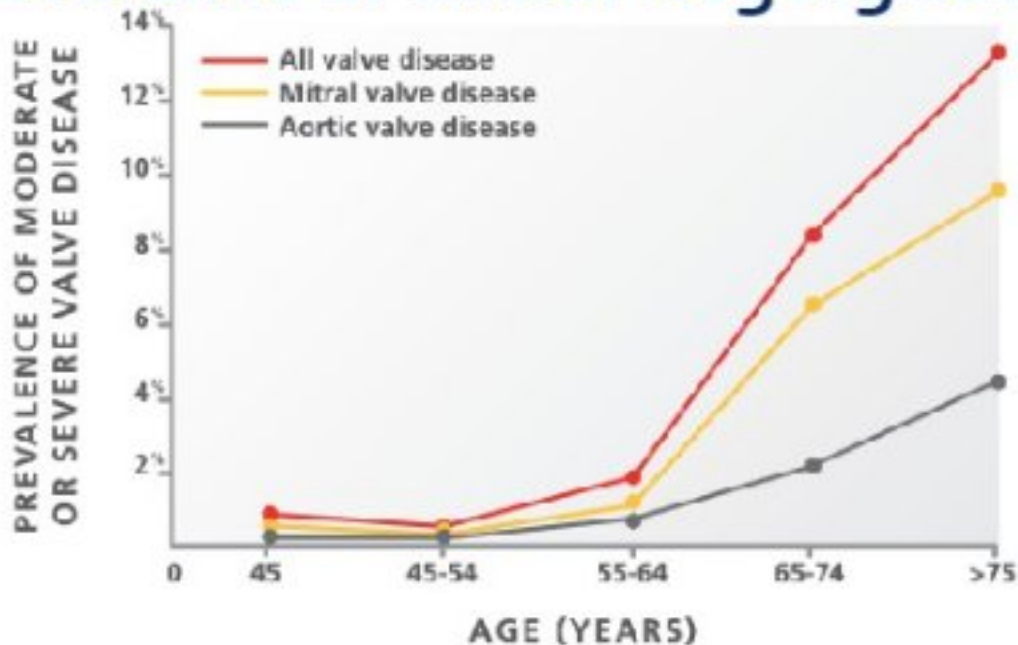
Case 1

What should we do about the murmur?

- A – Nothing...it's been there forever!
- B – Follow up in 1 year for a repeat physical exam
- C – Refer to cardiology for an echocardiogram
- D – Start a beta blocker

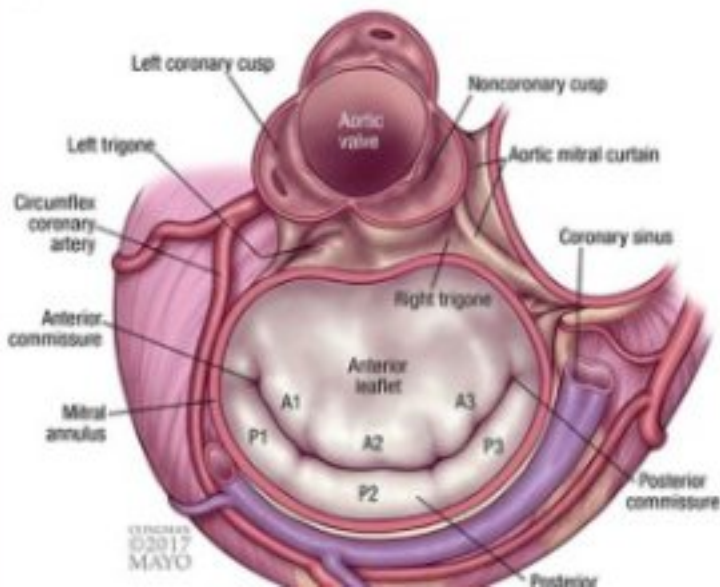


Prevalence of Mitral Regurgitation

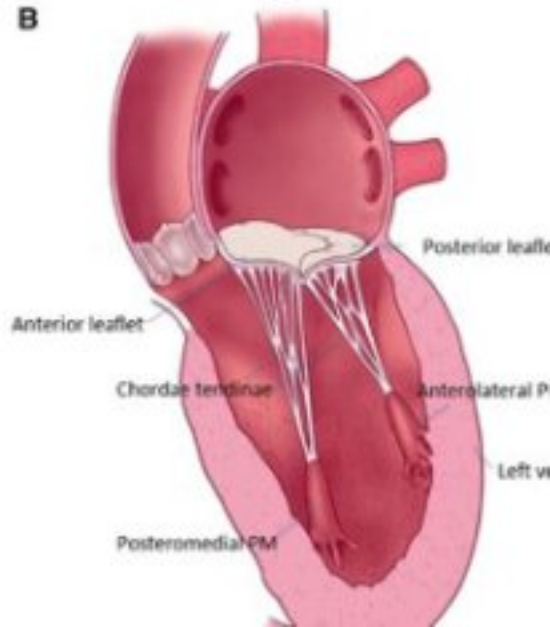


Mitral Valve Anatomy

A



B



Mitral Regurgitation (MR)

Primary MR / Organic MR

Due to Leaflet

Mitral Valve Prolapse

- Fibroelastic deficiency
- Barlow's disease

Calcified deterioration

Other Components

Ruptured chordae/
papillary muscles due to

- Infective endocarditis
- Myocardial infarction

Secondary MR / Functional MR

Due to Left Ventricle

Ischemic heart disease (Ischemic MR)

- Myocardial infarction
- Ischemic cardiomyopathy

Nonischemic cardiomyopathy

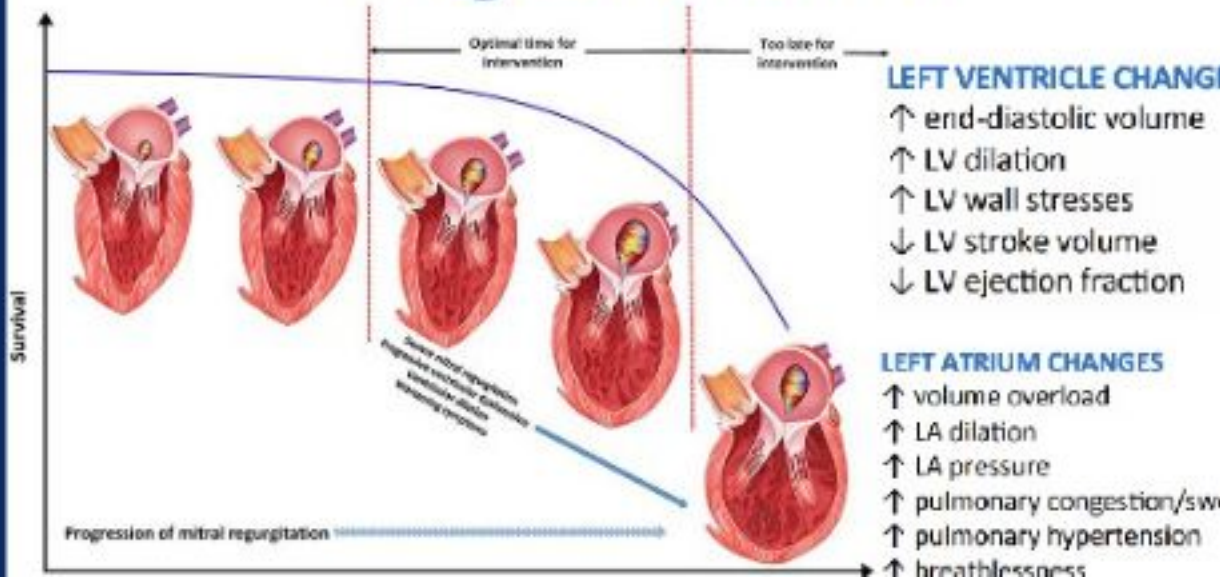
Due to Left Atrium

Severe dilatation
Atriogenic tethering

Stages of Valvular Heart Disease

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

Progression of MR



ACC Guidelines: Initial Imaging

Recommendations for Diagnostic Testing: Initial Diagnosis of Chronic MR

Referenced studies that support the recommendations are summarized in [Table 1](#).

COI	LOE	Recommendations
I	B-NR	1. In patients with known or suspected primary MR, TTE is indicated for baseline evaluation of LV size and function, RV function, LA size, pulmonary artery pressure, and the mechanism and severity of primary MR (Stages A to D). ¹⁻⁴
I	C-ED	2. In patients with primary MR, when TTE provides insufficient or discordant information, TEE is indicated for evaluation of the severity of MR, mechanism of MR, and status of LV function (Stages B to D).
I	B-NR	3. In patients with primary MR, CMR is indicated to assess LV and RV volumes and function and may help with assessing MR severity when there is a discrepancy between the findings on clinical assessment and echocardiography. ^{1,5}

- Start with transthoracic echo
- If findings are unclear or symptoms are out of proportion to the degree of MR, consider TEE
- If diagnostic uncertainty remains, consider cardiac MR

Case 1

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Echo Results

- Normal LV size and function, EF 65%
- Normal RV size and function
- Normal left atrial size
- Mitral valve prolapse with moderate mitral regurgitation
- No other valve disease



Case 1

What do we do next?

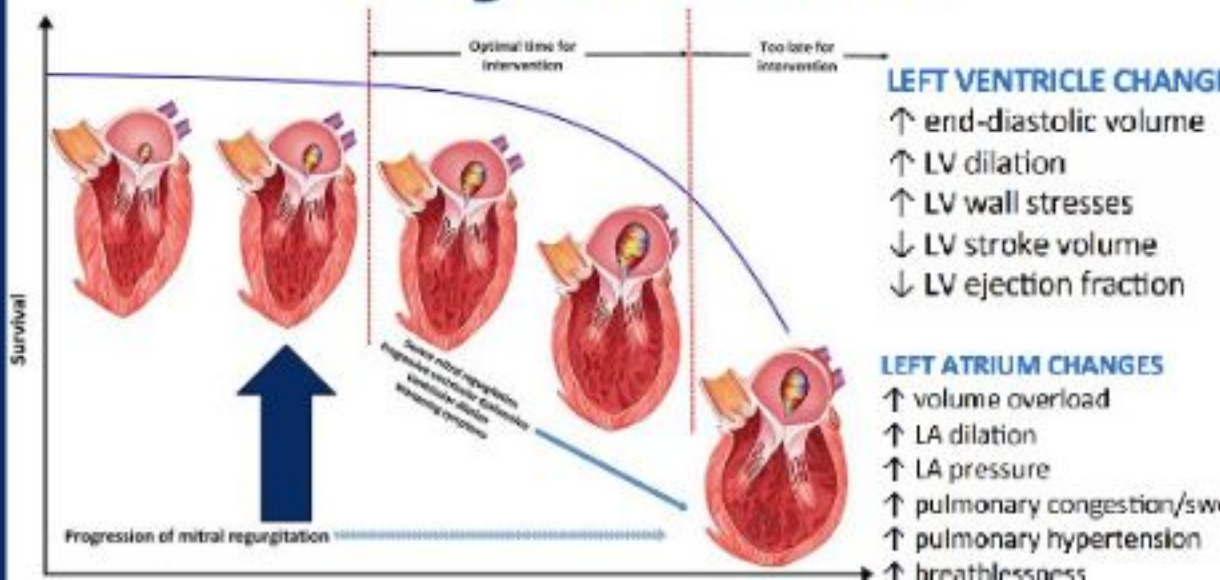
- A – Transesophageal echo
- B – Repeat echo in 1 to 2 years
- C – The valve is leaking. Why wait? Just go ahead and fix it!
- D – Like I said before, start a beta blocker



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Progression of MR



ACC Guidelines: Surveillance Imaging

Stage	Mitral Regurgitation
Progressive (Stage B)	Every 3–5 y (mild severity)
	Every 1–2 y (moderate severity)
Severe asymptomatic (Stage C1)	Every 6–12 mo
	Dilating LV: More frequently

Case 1

What do we do next?

- A – Transesophageal echo
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Case 1

What do we do next?

- A – Transesophageal echo
- **B – Repeat echo in 1 to 2 years**
- C – The valve is leaking. Why wait? Just go ahead and fix it!
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Case 1

- A few years later, our patient is now 52 years old and remains active without cardiac symptoms.
- Physical Exam: BP 110/70, HR 55, 2/6 holosystolic murmur
- Echo:
 - LV EF 50%, LV end systolic dimension 43 mm
 - Normal RV size and function
 - Mild left atrial enlargement
 - Mitral valve prolapse with severe mitral regurgitation
- Coronary CTA: No significant coronary disease



Case 1

Which intervention is the best option?



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Case 1

Which intervention is the best option?

- A – That's a trick question. Do nothing. He's asymptomatic.



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Case 1

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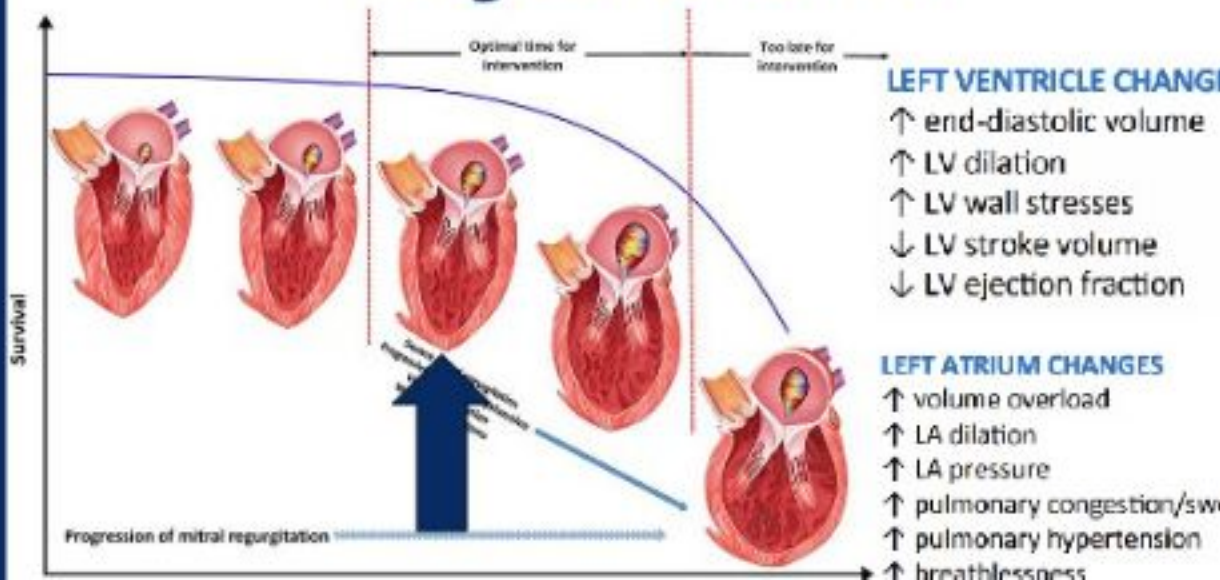
- A – That's a trick question. Do nothing. He's asymptomatic.
- B – Surgical mitral valve repair
- C – Surgical mitral valve replacement
- D – Transcatheter edge to edge repair
- E – C'mon, just let me start a beta blocker



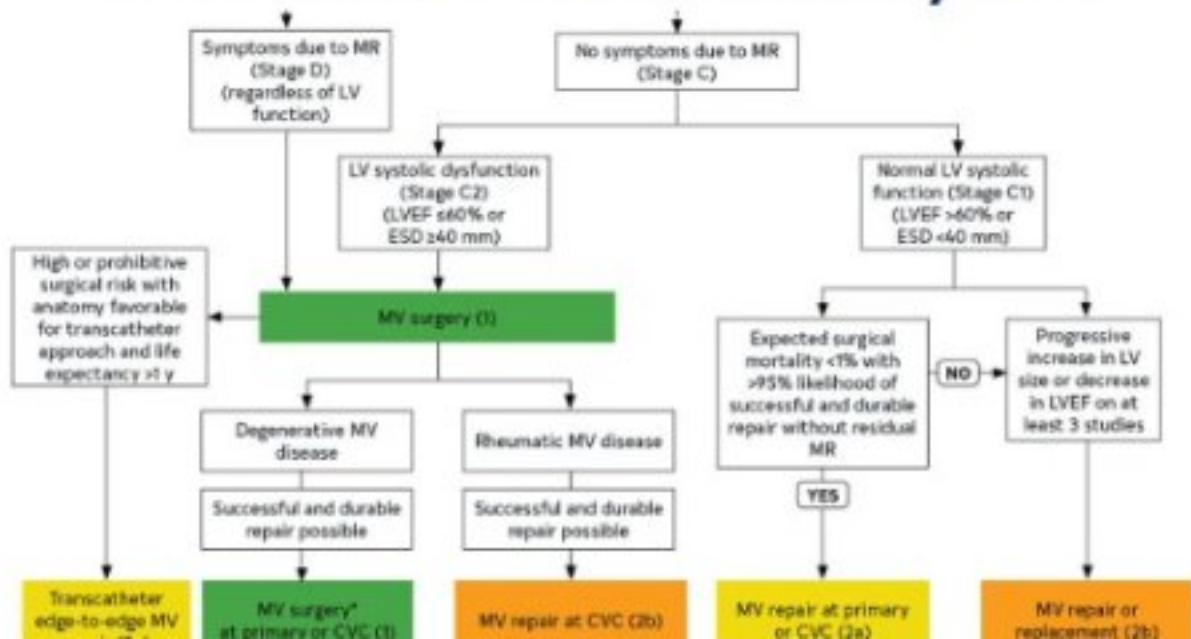
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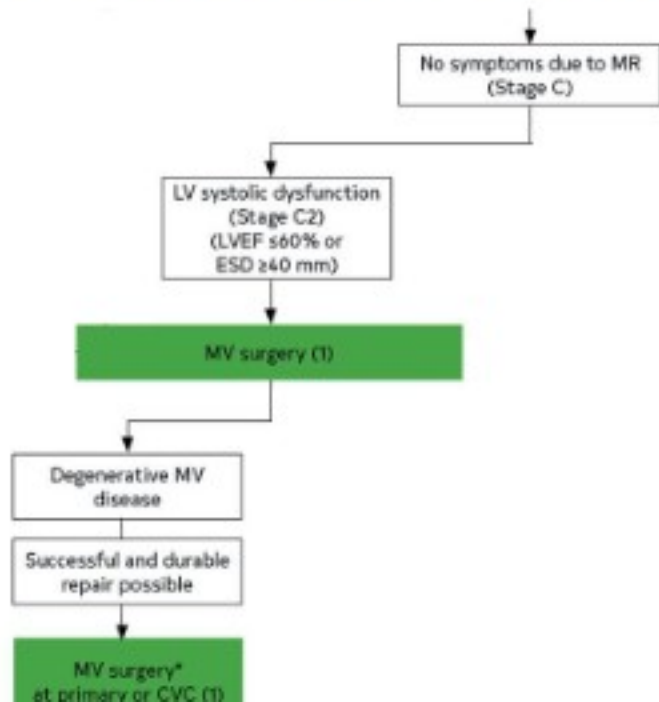
Progression of MR



ACC Guidelines: Primary MR



ACC Guidelines: Primary MR



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- **B – Surgical mitral valve repair**
- C – Surgical mitral valve replacement
- D – Transcatheter edge to edge repair
- E – C'mon, just let me start a beta blocker



Case 2

- 82 year old female with worsening NYHA III shortness of breath
- PMH: HTN, hyperlipidemia, DM2, CAD s/p CABG, paroxysmal AF, CKD stage III, COPD
- Cardiac meds: aspirin, apixaban, atorvastatin, losartan, furosemide
- Exam: BP 110/65, HR 60, 2/6 holosystolic blowing murmur at the apex radiating to the axilla, mild pedal edema



Case 2

- EKG: Sinus rhythm, left atrial enlargement
- Echo: LVEF 65%, normal LV size, left atrial enlargement, severe mitral regurgitation, mild tricuspid regurgitation, mild pulmonary hypertension
- TEE: Severe mitral regurgitation at A2/P2 due to degenerative valve disease. No leaflet calcification. Mitral valve mean gradient at HR of 65 bpm. Systolic flow reversal in the pulmonary veins. Mitral valve area 5.0 cm².
- Cath: Stable CAD with patent bypass grafts



Case 2

How do we fix this mitral valve?

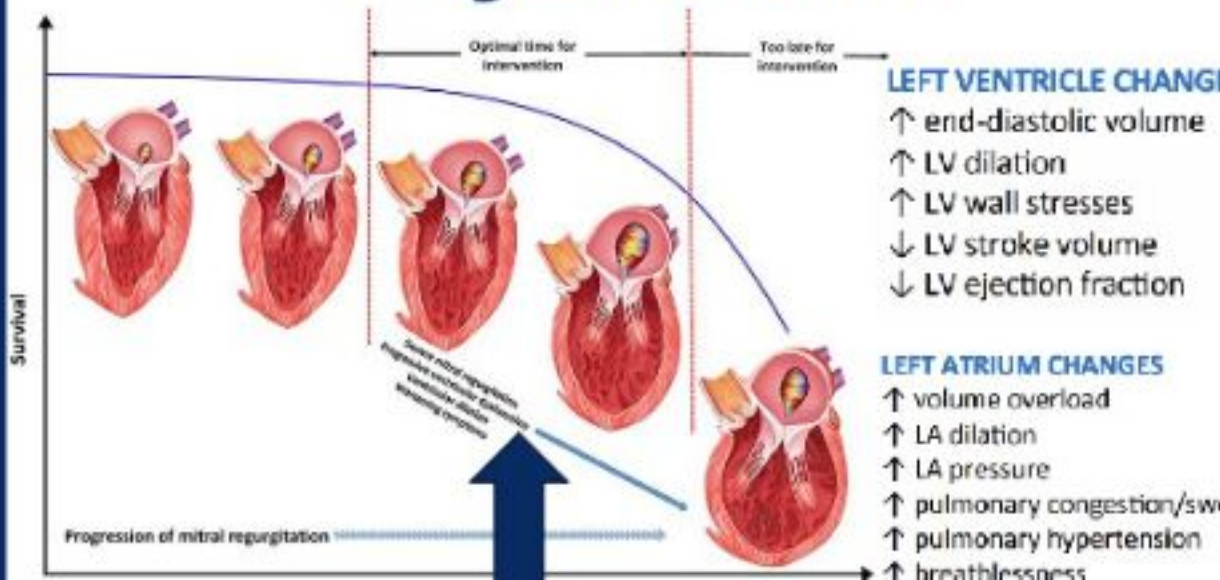
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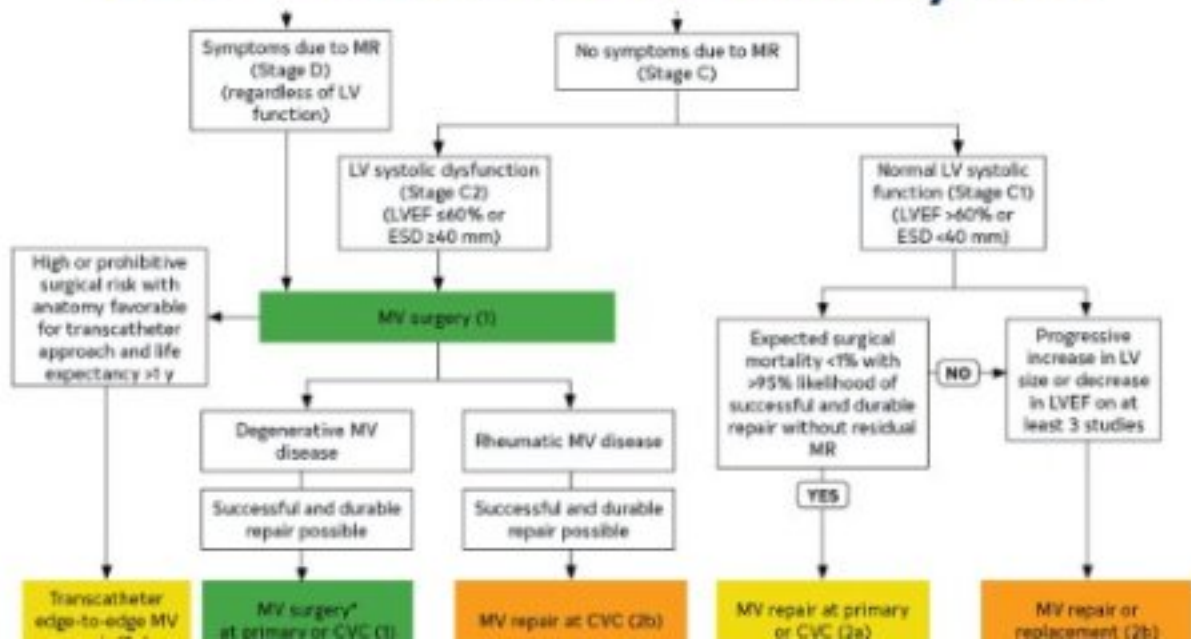
Progression of MR



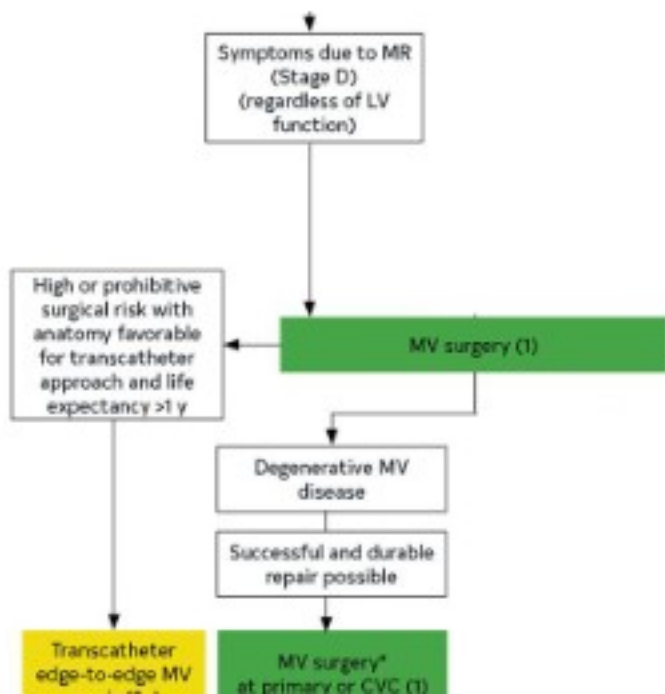
Recommendations for Intervention for Chronic Primary MR

COR	LOE	Recommendations
1	B-NR	1. In symptomatic patients with severe primary MR (Stage D), mitral valve intervention is recommended irrespective of LV systolic function. ^{1,2}
1	B-NR	2. In asymptomatic patients with severe primary MR and LV systolic dysfunction (LVEF \leq 60%, LVESD \geq 40 mm) (Stage C2), mitral valve surgery is recommended. ³⁻¹⁰
1	B-NR	3. In patients with severe primary MR for whom surgery is indicated, mitral valve repair is recommended in preference to mitral valve replacement when the anatomic cause of MR is degenerative disease, if a successful and durable repair is possible. ¹¹⁻¹⁵

ACC Guidelines: Primary MR



ACC Guidelines: Primary MR



Case 2

How do we fix this mitral valve?

- A – Transcatheter edge to edge repair
- B – Surgical mitral valve repair
- C – Surgical mitral valve replacement
- D – Dare I say...start a beta blocker?



Case 2

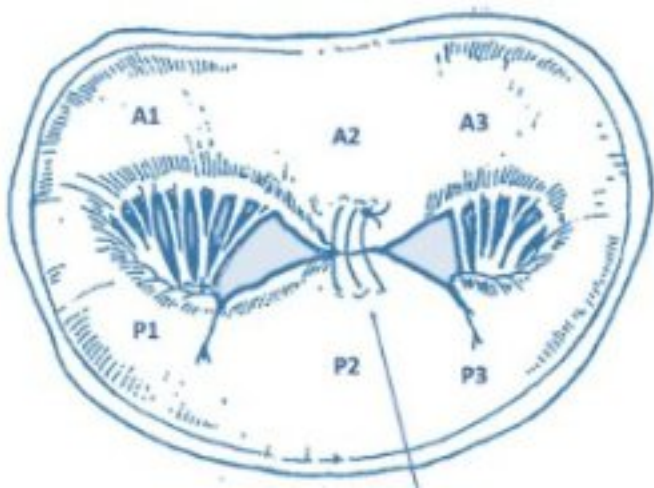
How do we fix this mitral valve?

- **A – Transcatheter edge to edge repair**
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- D – Dare I say...start a beta blocker?

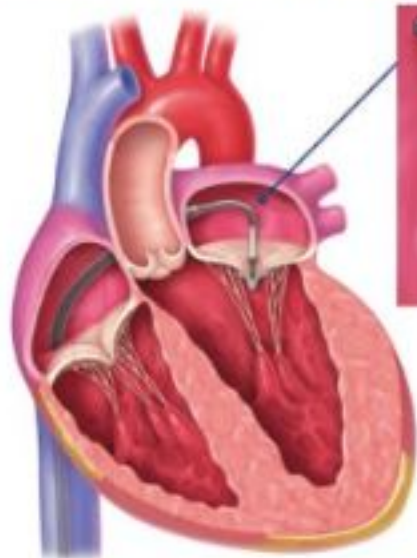


Transcatheter Edge to Edge Repair (TEER)

Alfieri's Stitch



Transcatheter Edge to Edge Repair (TEER)



Side view



Atrial view

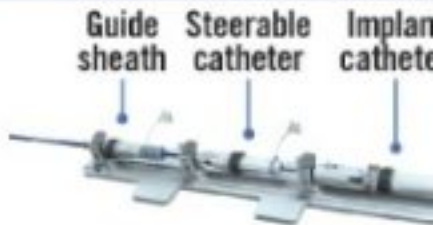


Transcatheter Edge to Edge Repair (TEER)

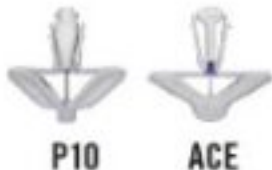
MitraClip (4th-generation)

PASCAL Precision (2nd-generation)

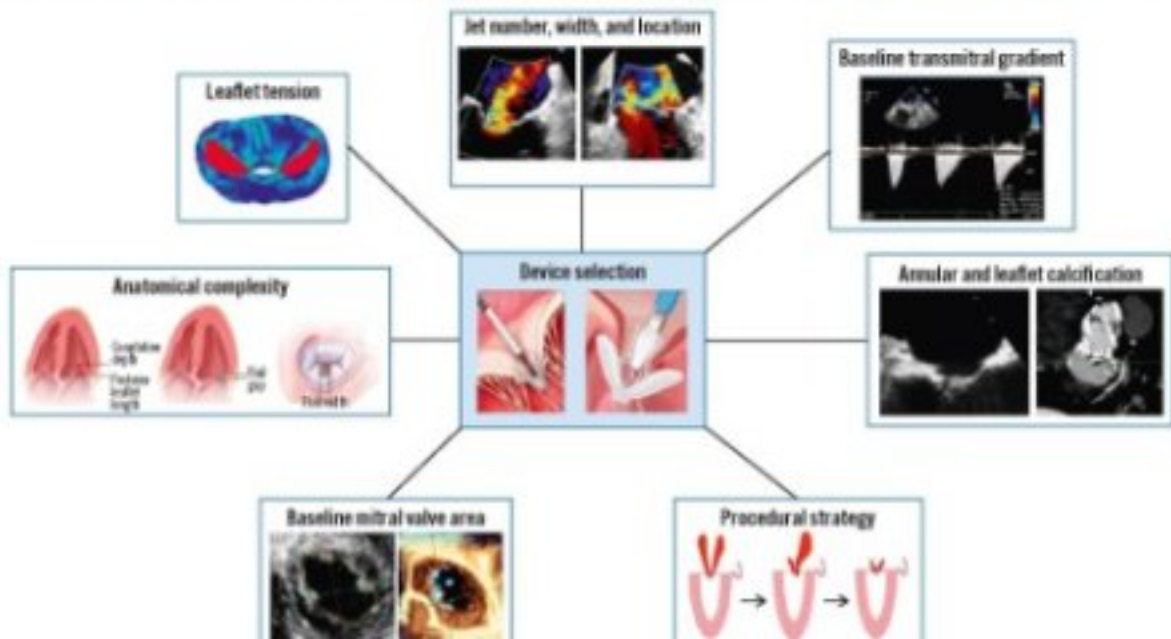
Delivery catheter



Available implants



Transcatheter Edge to Edge Repair (TEER)



ACC Guidelines: TEER

2020 ACC/AHA Guideline for the Management of Patients with Valvular Heart Disease

Class 2a, LOE B-NR

In severely symptomatic patients (NYHA class III or IV) with primary severe MR and high or prohibitive surgical risk, **transcatheter edge-to-edge repair (TEER) is reasonable** if mitral valve anatomy is favorable for the repair procedure and patient life expectancy is at least one year.

Case 3

- 55 year old male with a new diagnosis of CHF with worsening NYHA II shortness of breath
- PMH: HTN
- Cardiac meds: furosemide, losartan
- Exam: BP 140/85, HR 80, 2/6 soft holosystolic murmur at the apex, 1+ pedal edema



Case 3

- EKG: Sinus rhythm with LBBB
- Echo: EF 25%, mild LV dilation, normal RV size/function, severe MR, left atrial enlargement, mild TR, PA pressure 40 mmHg
- Cath: Normal coronary arteries



Case 3

How do we deal with this patient's mitral regurgitation?

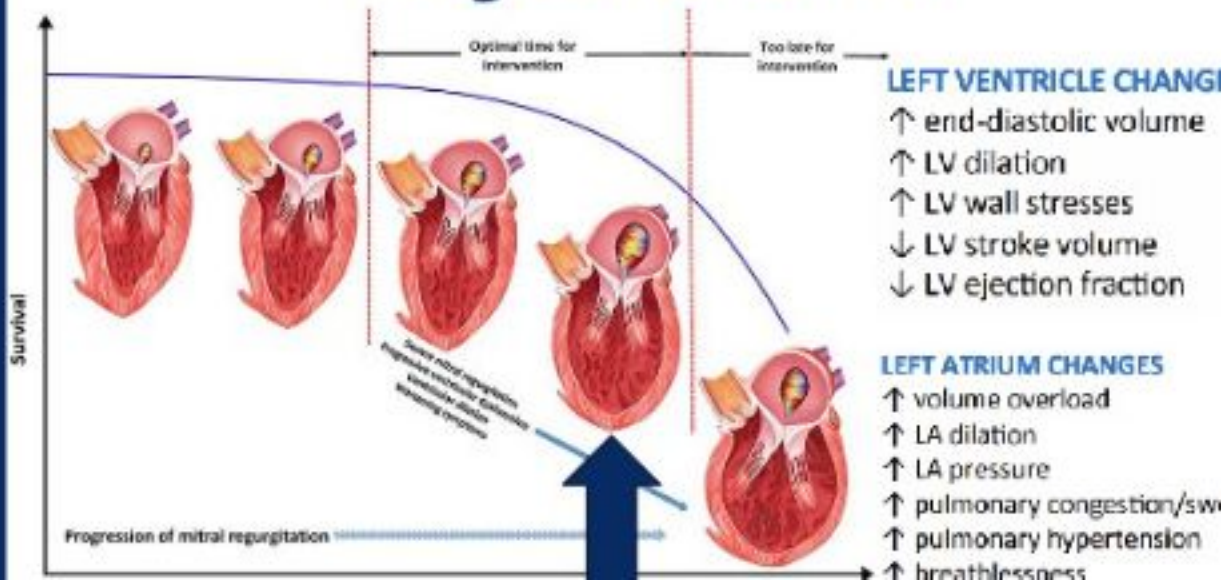
- A – Transcatheter edge to edge repair
- B – Surgical mitral valve repair
- C – Surgical mitral valve replacement
- D – Do cardiologists even use beta blockers anymore?



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Progression of MR



Secondary/Functional MR

Secondary Mitral Regurgitation



Etiology and Prevalence

- 11%-59% post myocardial infarction
- >50% in dilated cardiomyopathy

Diagnosis

- Systolic LV dysfunction
- Restricted leaflet motion and tethering
- Eccentric jet > central jet
- Relative LA dilation

Management

- Optimal HF therapy
- Cardiac resynchronization therapy
- Revascularization

Case 3

How do we deal with this patient's mitral regurgitation?

- A – Transcatheter edge to edge repair
- B – Surgical mitral valve repair
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Case 3

How do we deal with this patient's mitral regurgitation?

- A – Transcatheter edge to edge repair
- B – Surgical mitral valve repair
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- D – Do cardiologists even use beta blockers anymore?

Yes we do!



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Case 3

- Three months later, our patient continues to have NYHA II shortness of breath three months later despite initiation and titration of CHF with GDMT (beta blocker, ARNI, MRA, SGLT₂ inhibitor)
- EKG: Sinus rhythm with LBBB with QRS 160 ms
- Echo: EF 25%, mild to moderate LV dilation, normal RV size/function, severe MR, left atrial enlargement, mild TR, PA pressure 45 mmHg



Case 3

What's next?

- A – Transcatheter edge to edge repair
- B – Surgical mitral valve repair or replacement
- C – Biventricular pacemaker/ICD (CRT-D)
- D – Well, I guess the beta blocker didn't work after all. Hospice?



TEER for Functional MR

Device options for HFref
Symptomatic patients on optimally tolerated GDMT

If no device therapy indicated or still symptomatic

NYHA II-IV
Moderately severe to severe
secondary mitral regurgitation,
ejection fraction > 20% to 50%,
LVESd \leq 70 mm,
PASP \leq 70 mm Hg

Transcatheter mitral valve
edge-to-edge repair (TEER)

Wide QRS
QRS \geq 150 w/o LBBB
QRS 120-149 w/ LBBB
QRS \geq 150 w/ LBBB

EF \leq 35%

ICD†

CRT

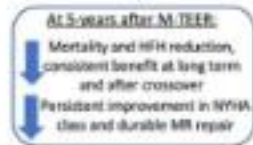
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Transcatheter Edge-to-edge Repair Of Functional Mitral Regurgitation In Heart Failure: Final Five-year Results From The COAPT Trial

Presented at #ACC23 by: Gregg W. Stone

Population	Intervention	Control	Outcome	Time
<ul style="list-style-type: none"> • 614 patients symptomatic (NYHA II/III) for moderate-to-severe or severe SMR despite maximally-tolerated guideline-directed medical therapy (GDMT) and CRT (if appropriate) • LVEF 20%-50% and LVESD \leq 70 mm 	<ul style="list-style-type: none"> • 302 patients • Mitral Transcatheter Edge-to-Edge Repair (M-TEER) using MitraClip® (Abbott) + GDMT 	<ul style="list-style-type: none"> • 312 patients • GDMT • Patients continued to be treated per standard of care • Per protocol, crossover was not to be permitted before 2 years of follow-up 	<ul style="list-style-type: none"> ▣ Primary Effectiveness: All-Heart Failure Hospitalizations: 33.1%/yr in the device group vs. 57.2%/yr in the control group. HR (95% CI) = 0.53 (0.43-0.66) ▣ Primary Safety at 60 months: 1.6% (same as 30 days) ▣ Death or HF Hospitalization: MitraClip + GDMT: 73.6% vs. GDMT: 85.5%, HR (95% CI) = 0.53 (0.44-0.64) ▣ Crossover to MitraClip 22% after 2 years ▣ Death or HFH after Crossovers: Multivariable analysis in GDMT alone group: Adjusted HR (95% CI) after MitraClip= 0.53 (0.36, 0.78) 	<ul style="list-style-type: none"> • 5-year follow-up (final follow-up of trial)



Mitral Transcatheter Edge-to-Edge Repair using MitraClip confirmed to be safe, to reduce the rate of HFHs and improve quality of life and symptoms with a durable result at the final 5-year follow-up of the COAPT trial

ACC Guidelines: TEER

2020 ACC/AHA Guideline for the Management of Patients with Valvular Heart Disease²

Class 2a, LOE B-NR

In patients with chronic severe secondary MR related to LV systolic dysfunction (LVEF < 50%) who have persistent symptoms (NYHA class II, III, or IV) while on optimal GDMT for HF (Stage D), **transcatheter edge-to-edge repair (TEER) is reasonable** in patients with appropriate anatomy as defined on TEE and with LVEF between 20% and 50%, LVESD ≤ 70 mm, and pulmonary artery systolic pressure ≤ 70 mm Hg.

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What's next?

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Future Directions

Leaflet Repair

MitraClip



PASCAL



MV Replacement

CardiAQ
Edwards
valve system



Tandem Mitral
Valve System



Tiara TMVR
System



HighLife MV
replacement



Navigate TMVR



Cardiovalve Valtech



Direct Annuloplasty

Milipede IRIS



Cardioband



Mitralign



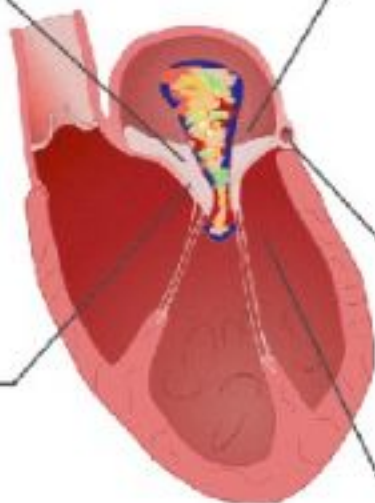
Indirect Annuloplasty

Carillon Mitral
Contour System



Ventriculoplasty

AccuCinch



Summary

- Think of MR management in the terms of etiology (primary vs secondary/functional) and ACC stages (A, B, C1, C2, D)
- Severe Primary MR
 - Stage C2 and D – MV surgery (class 1)
 - For MV surgery, repair is preferred over replacement (class 1)
 - If high/prohibitive risk for surgery, TEER is reasonable (class 2A)
- Severe Secondary/Functional MR
 - For patients who are symptomatic despite GDMT (including CRT-D applicable), TEER is reasonable (class 2A)



Thank You

Laughter

Is the best

Medicine

And the

Beta Blockers

Know it



Ateno**LOL**

Metopro**LOL**

Proprano**LOL**



Any Questions?

Please use the QR code to submit your questions.



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**Thank You For Attending the
Tri-City Cardiovascular Symposium**



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