FIXING THE FLOW: STRUCTURAL CARDIOLOGY

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STRUCTURAL HEART PROGRAM

DISCLOSURES

- I am a speaker and consultant for Edwards Lifesciences - transcatheter aortic valve replacement (TAVR) & Benchmark program.
- All relevant financial relationships have been mitigated.

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OBJECTIVES

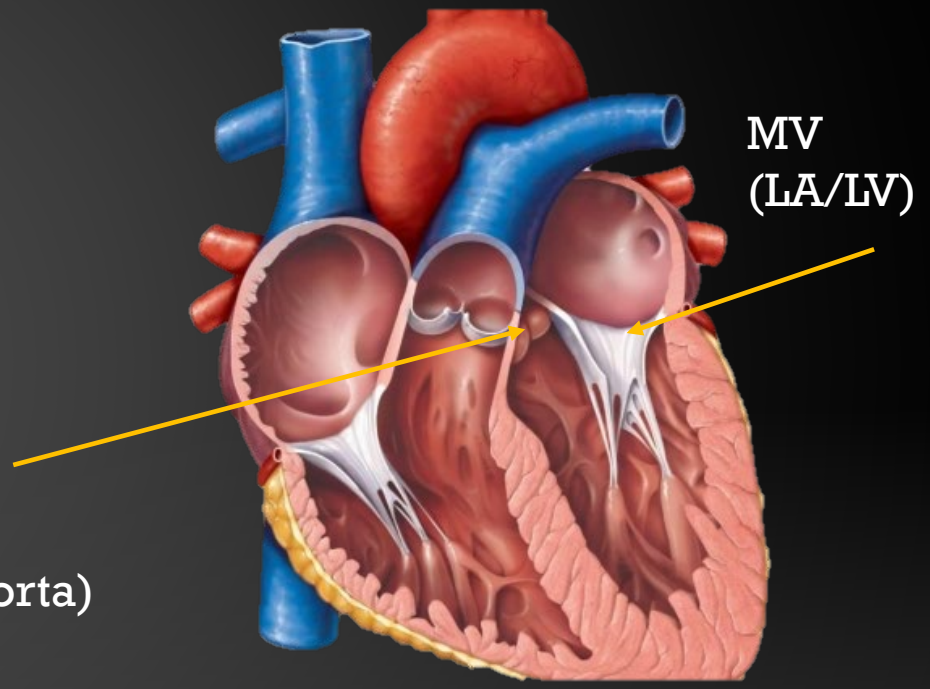
1. The participant will be able to identify and diagnosis **severe aortic stenosis** and **severe mitral regurgitation** using current guidelines and quantitative measurements.

2. The participant will understand the treatment options for valvular heart disease, with a focus on **transcatheter procedures**.

3. Upon completion, the participant will know when to refer to a specialized **valve program** and the role of the **Heart Team.**

STRUCTURAL CARDIOLOGY

- Non-coronary related disease processes
- Aortic stenosis
- Mitral regurgitation
- Transcatheter interventions and treatment options



TAVR = transcatheter aortic valve replacement

TEER=transcatheter edge-to-edge repair (mitral repair)

TMVR=transcatheter mitral valve replacement

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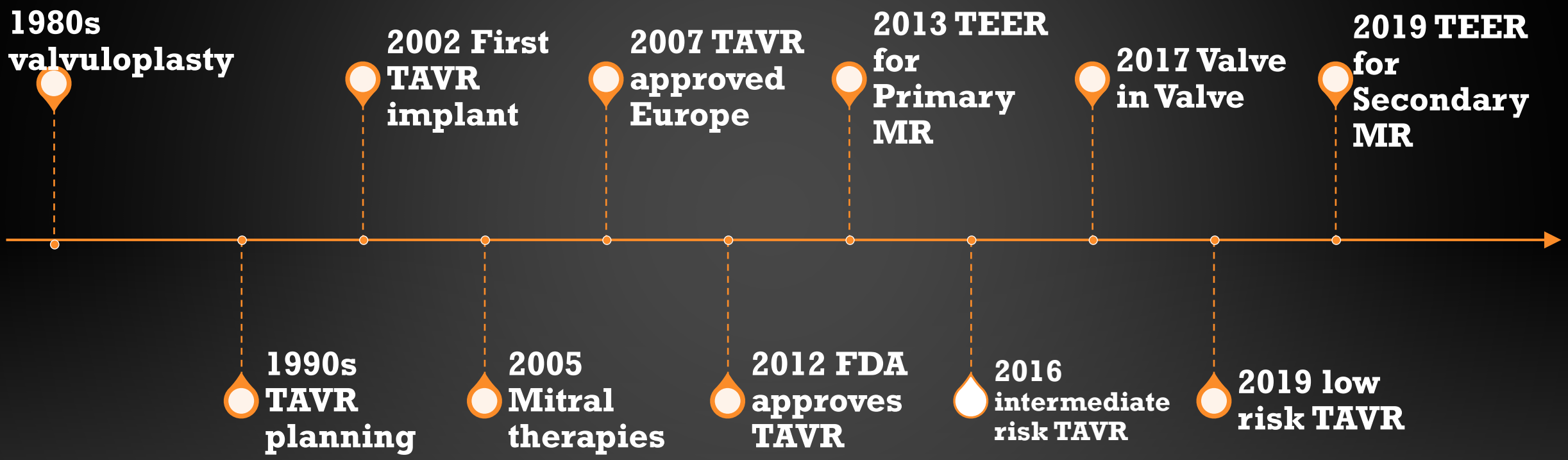
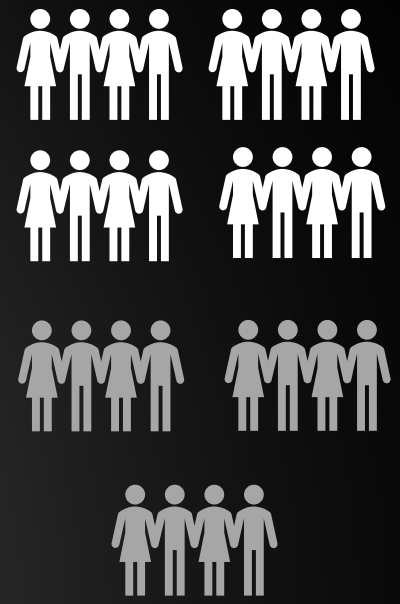
TRANSCATHETER TREATMENT TIMELINE



AORTIC STENOSIS STATS



- 1.5 million Americans have aortic stenosis & 500,000 have severe AS
- 50% of patients with symptomatic severe AS will die within 1-2 years
- ~ 80% will die within 5 years
- Aortic valve replacement (AVR): **Class IA recommendation severe symptomatic AS**
- 60% of those with indication for AVR are left untreated

ETIOLOGY OF AORTIC STENOSIS

- Congenital disease

- Degenerative disease

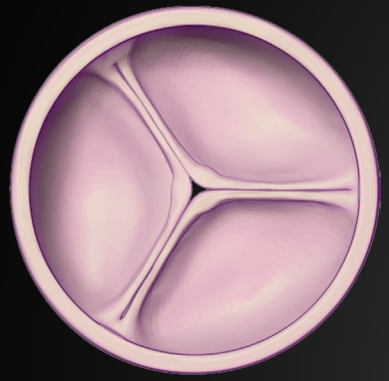
- Rheumatic disease

- Radiation therapy

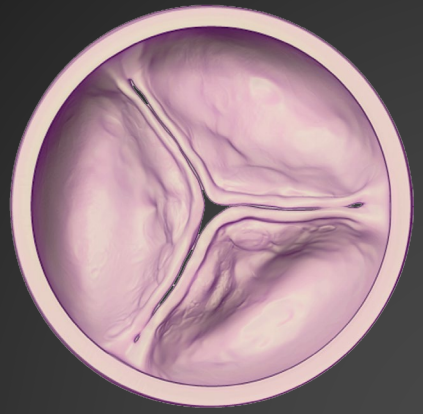
RISK FACTORS FOR AS

- Increasing age
- Hypertension
- Genetics
- Dyslipidemia
- Smoking
- Diabetes/Metabolic

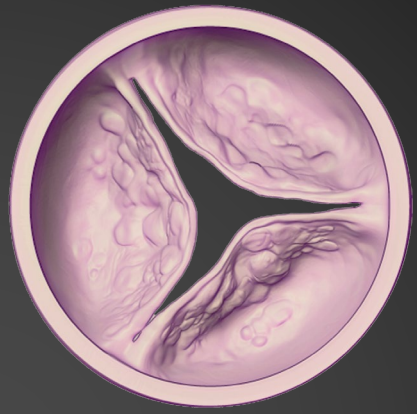
PROGRESSION OF AS



Healthy

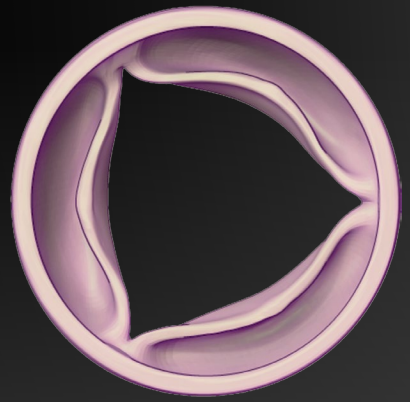


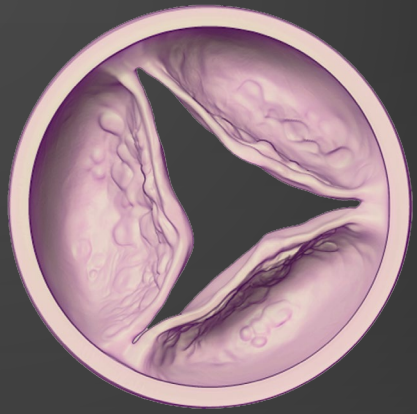
Mild disease

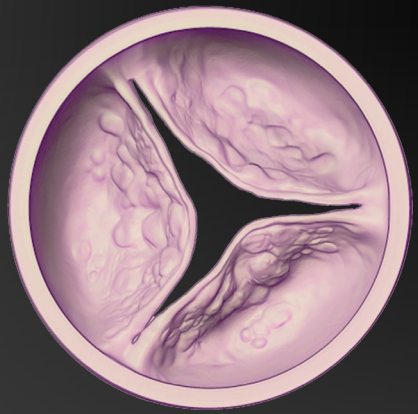


Moderate disease

Severe disease







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SYMPTOMATIC STAGES OF SEVERE AS

Stage	Description	Anatomical changes
D1	Symptomatic + Severe High gradient	LV diastolic dysfunction LV hypertrophy +/- Pulmonary HTN
D2	Symptomatic + Severe low flow Low gradient Low EF	LV diastolic dysfunction LV hypertrophy EF < 50%
D3	Symptomatic + Severe with normal EF or paradoxical low flow	Increased LV wall thickness Small LV chamber/SV Restrictive diastolic filling EF > 50%

ADAPTED FROM: Otto C, Nishimura R, et al. 2020 ACC/AHA Guideline for the Management of Patients With Valvular Heart Disease. *J Am Coll Cardiol.* 2021 Feb, 77 (4) e25–e197.

SEVERE AS: SYMPTOMS

- Shortness of breath
- Fatigue
- Swelling
- Palpitations
- Chest pain
- Syncope

1 : 3 patients do not realize they have symptoms…

SEVERE AS: PHYSICAL EXAM

- 2nd right intercostal space
- Systolic murmur
- Harsh and medium-pitched
- Crescendo-Decrescendo
- Radiates to carotid arteries
- +/- preserved S2 sound
- Pulsus parvus et tardus
- Lower extremity edema

TRANSTHORACIC ECHOCARDIOGRAM

Aortic Valve Area (AVA cm^2)	AV Mean Pressure gradient (MPG mmHg)	AV Peak Velocity (m/sec)
AVA $\leq$ 1.0 cm^2	MPG > 40 mmHg	Velocity > 4.0 m/s

REMEMBER….. 1…..40…..4 ….. for severe AS

VARIATION OF SEVERE AS

- Classical LFLG ~5-10% cases: > Males with CAD
- Paradoxical LFLG ~5-15%: > Women & elderly
- Normal Flow, Low Gradient AS

LOW FLOW LOW GRADIENT (LFLG) AS

AVA $\leq$ 1.0cm^2 and AV MPG < 40 mmHg

+

	Classical LFLG	Paradoxical LFLG	Normal flow, low gradient
LVEF	< 50%	> 50%	> 50%

Small chamber? Thick muscle?

Dobutamine stress ECHO (DSE)
Dobutamine challenge at cath
CTA (TAVR CT) to assess calcium burden

WHAT ELSE CAN WE MEASURE?

- #1 Dimensionless Velocity Index (DVI):

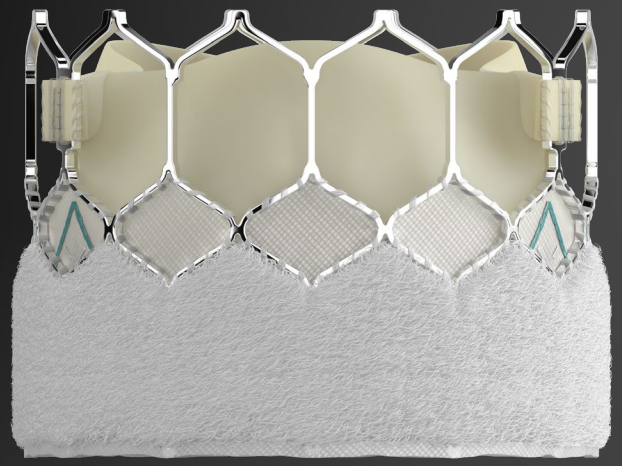
  *Flow-**independent** measure of degree of valve obstruction*

  DVI $\leq$ 0.25 = severe AS

  $$\frac{\text{LVOT VTI}}{\text{AVA VTI}} = \text{DVI}$$

- #2 Stroke Volume Index : SVi < 35ml/m^2

TRANSCATHETER BIOPROSTHETIC AORTIC VALVES COMMERCIALLY AVAILABLE IN U.S.



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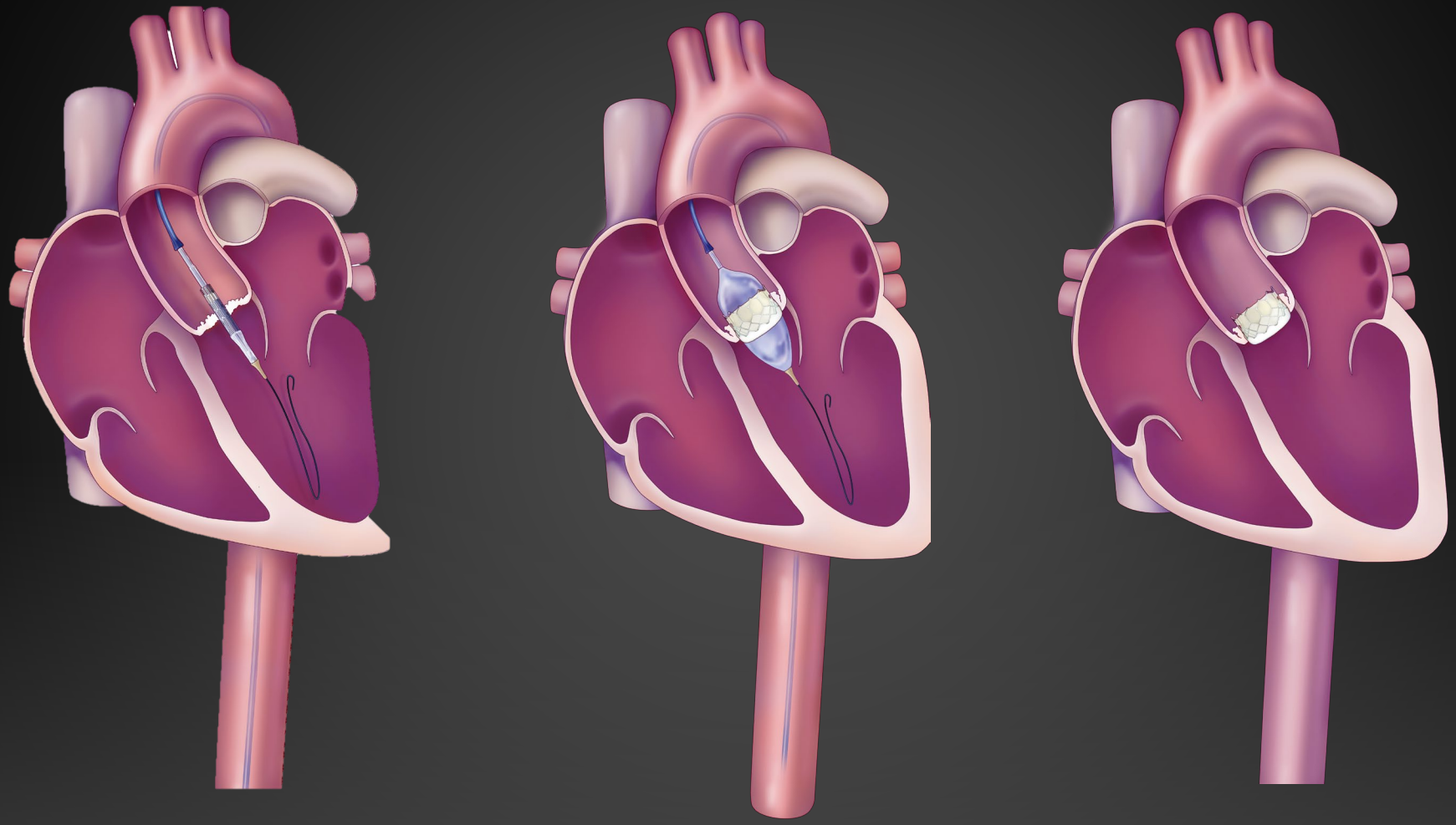
Balloon-expandable valve deployment



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LESS IS MORE…

Nurse-led sedation or MAC sedation

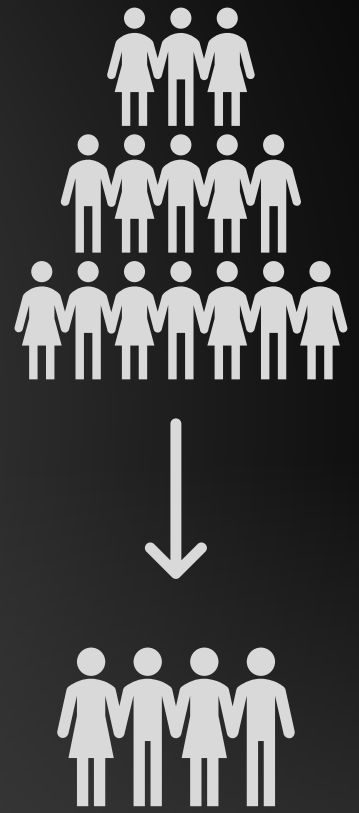
Transthoracic echocardiogram (TTE)

No urinary catheters & central lines

Performed in hybrid / cath lab suites

Home the next day – average LOS 1 day

Minimal down time



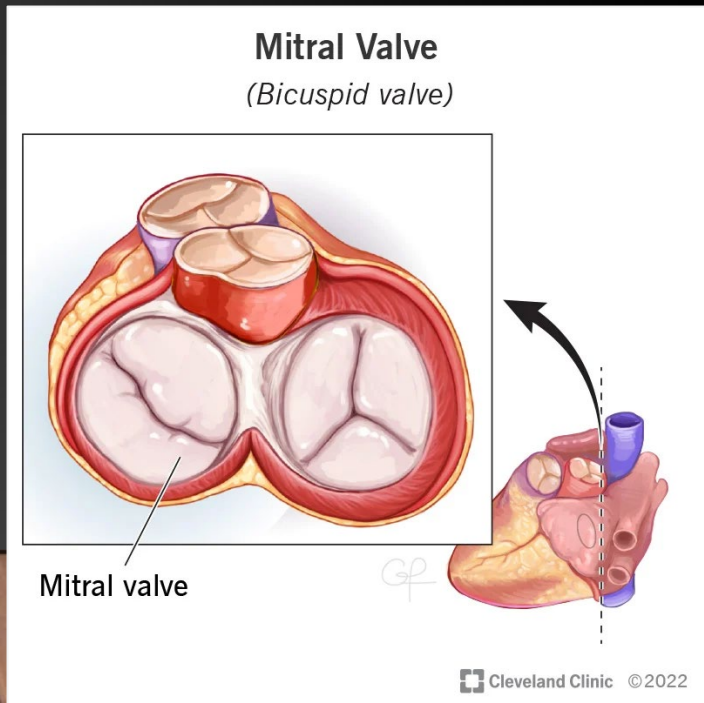
AS PLAYBOOK

- Listen to your patient
- Physical exam
- Order transthoracic echocardiogram
- Refer to valve program (moderate AS - severe AS)
- Evaluation for TAVR vs. SAVR
- Follow up & stay connected with your valve program team

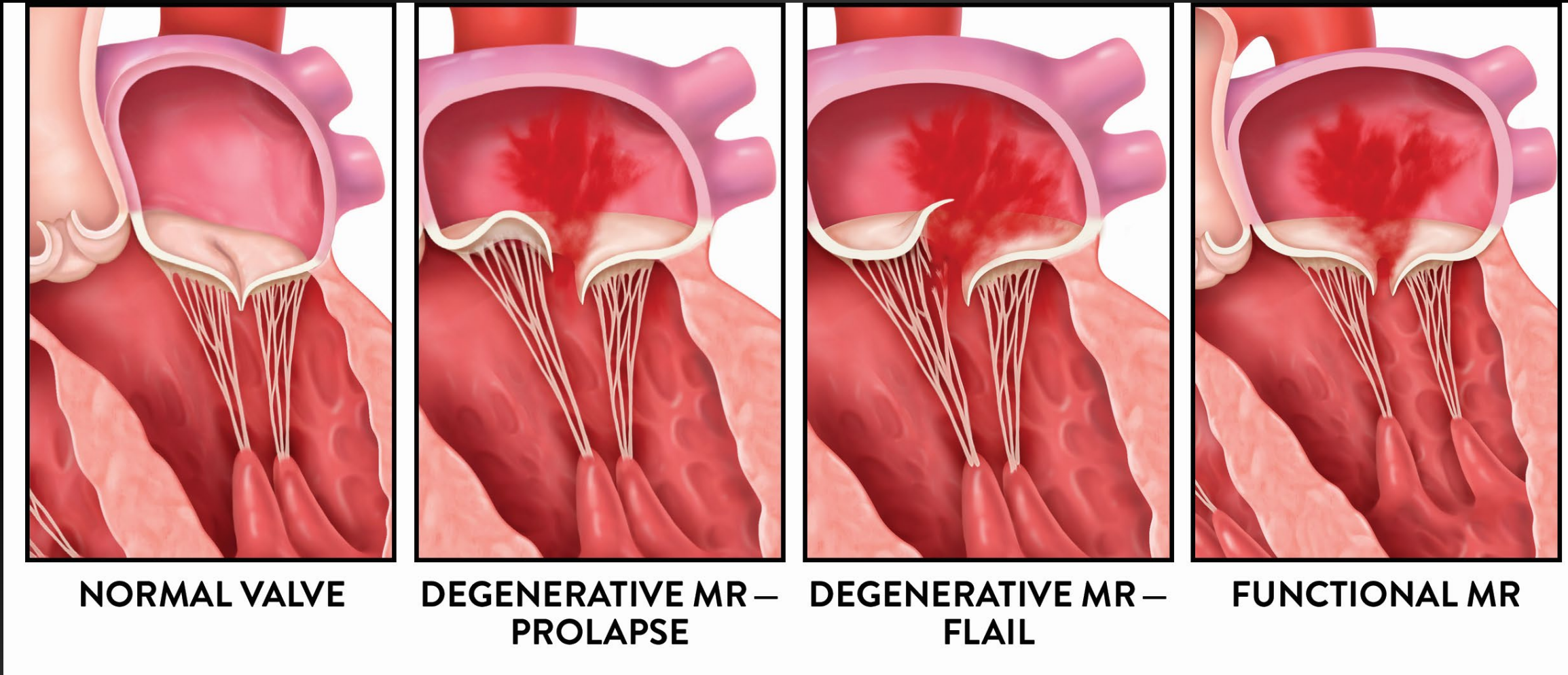
MITRAL REGURGITATION

- 4 million people have significant mitral valve insufficiency
- 1 in 10 adults > 75 years of age have moderate to severe MR
- One of the most common valvular heart diseases in U.S.
- Two types: Primary (Degenerative)

  Secondary (Functional)



https://my.clevelandclinic.org/health/body/23244-mitral-valve



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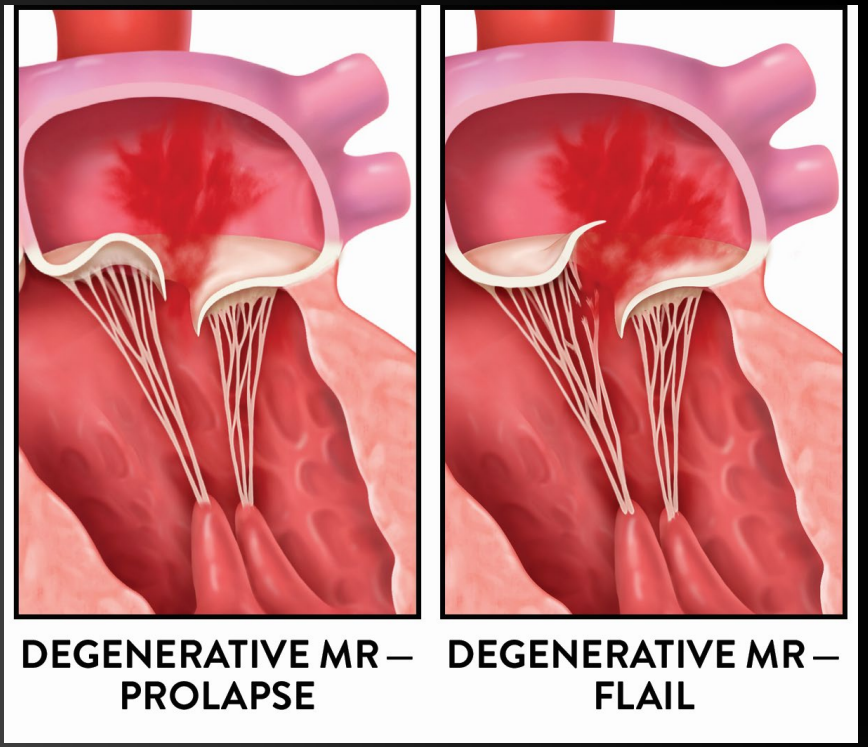
PRIMARY MR

- Primary = problem with valvular structures

- Leaflets
- Chordae
- Papillary muscles
- Description…flail leaflet, rheumatic appearance, prolapse or excessive leaflet motion, ruptured chordae



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SYMPTOMATIC STAGES OF CHRONIC PRIMARY MR

Stage	Description	Anatomical changes
D	*Symptomatic* Loss of coaptation Leaflet thickening Leaflet restriction Prior infective endocarditis	Mod-severe LA enlargement LV enlargement Pulmonary HTN

ADAPTED FROM: Otto C, Nishimura R, et al. 2020 ACC/AHA Guideline for the Management of Patients With Valvular Heart Disease. *J Am Coll Cardiol.* 2021 Feb, 77 (4) e25–e197.

TRANSESOPHAGEAL ECHOCARDIOGRAM (TEE)

Primary MR	Measurement
Jet regurgitation	Central jet > 40% LA or holosystolic eccentric jet
Regurgitant volume	≥ 60 ml
Regurgitant fraction	≥ 50%
Effective regurgitant orifice (ERO)	> 0.40 cm^2
Angiographic grade	3-4 +

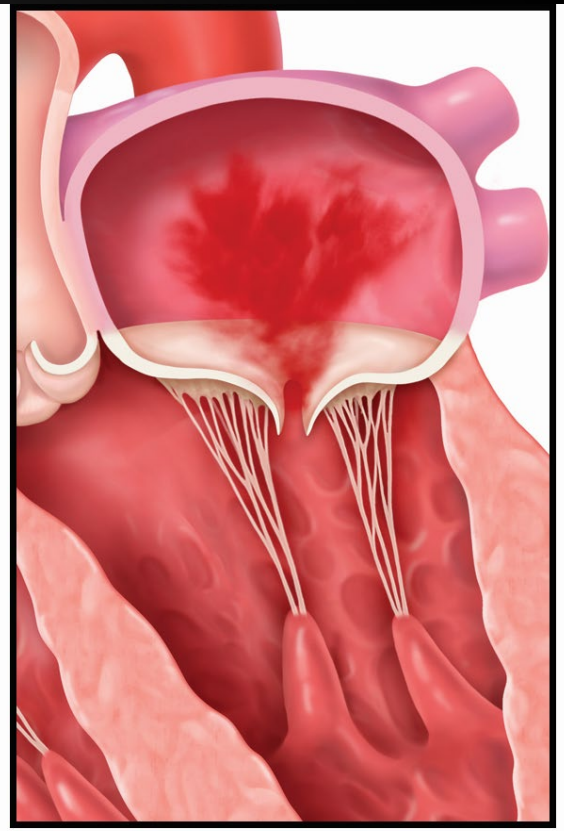
SECONDARY MR

- Secondary = problem with surrounding structures

- Dilated cardiomyopathy
- Wall motion abnormalities
- Enlarged left atrium
- Fix the underlying cause first
- Medications:

  -Guideline directed medical therapy (GDMT)

  -Requires titration and close follow-up



FUNCTIONAL MR

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SYMPTOMATIC STAGE OF CHRONIC SECONDARY MR

Stage	Description	Anatomical changes
D	*Symptomatic* Regional wall motion abnormal LV dilation with leaflet tethering Annular dilation & loss of coaptation	Reduced LV systolic function LV dilation

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TRANSESOPHAGEAL ECHOCARDIOGRAM (TEE)

Secondary MR	Measurement
Effective regurgitant orifice (ERO)	$\geq$ 0.40 cm^2
Regurgitant volume	$\geq$ 60 ml
Regurgitant fraction	> 50%

SEVERE MR: SYMPTOMS

- Dyspnea on exertion or at rest
- Fatigue
- Cough
- Paroxysmal nocturnal dyspnea
- Orthopnea
- Heart palpitations → atrial fibrillation

SEVERE MR: PHYSICAL EXAM

- Edema
- Jugular venous distention
- Crackles
- Holosystolic murmur
- High-pitched, blowing quality
- Fifth intercostal space -left midclavicular line
- Radiation to Axilla

2020 ACC/AHA GUIDELINES

Intervention for valvular regurgitation:

- ✓ Relief of symptoms
- ✓ Prevention of the irreversible long-term consequences of left ventricular volume overload

https://pixabay.com/photos/water-buckets-chocolates-chairs-5094839/

TRANSCATHETER EDGE-TO-EDGE REPAIR

- TEER =

- Severely symptomatic **primary mitral regurgitation** who are at high or prohibitive risk for surgery

- Severely symptomatic **secondary mitral regurgitation** despite guideline-directed management and therapy for heart failure

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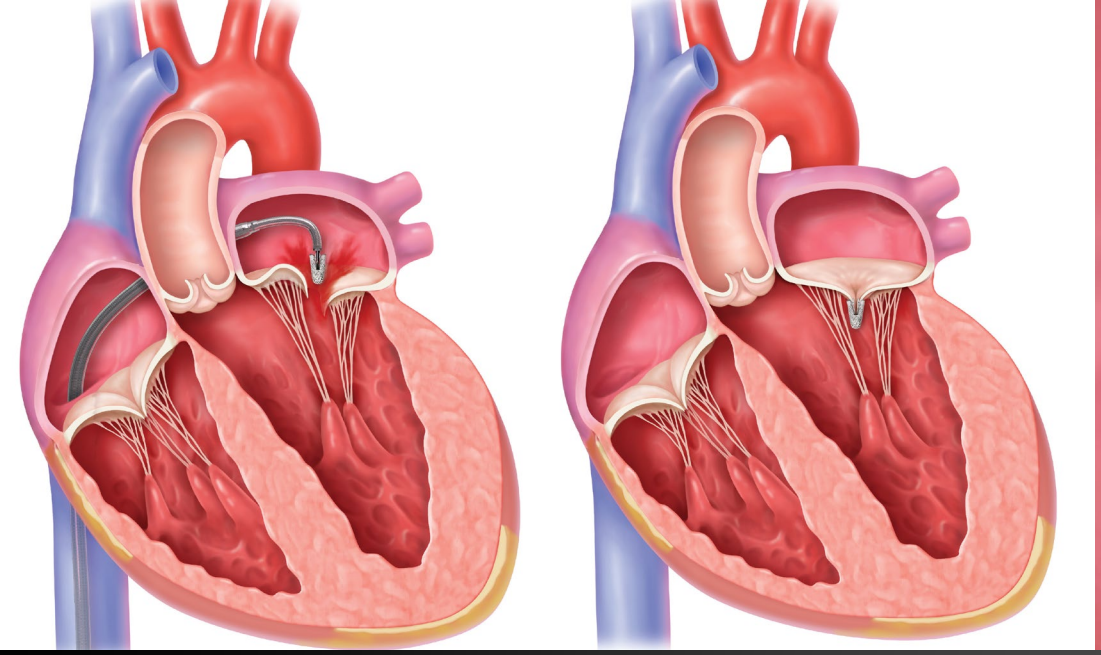
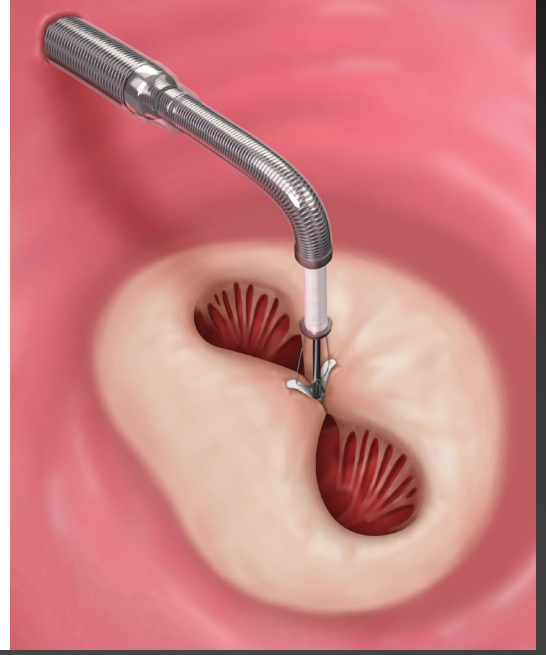
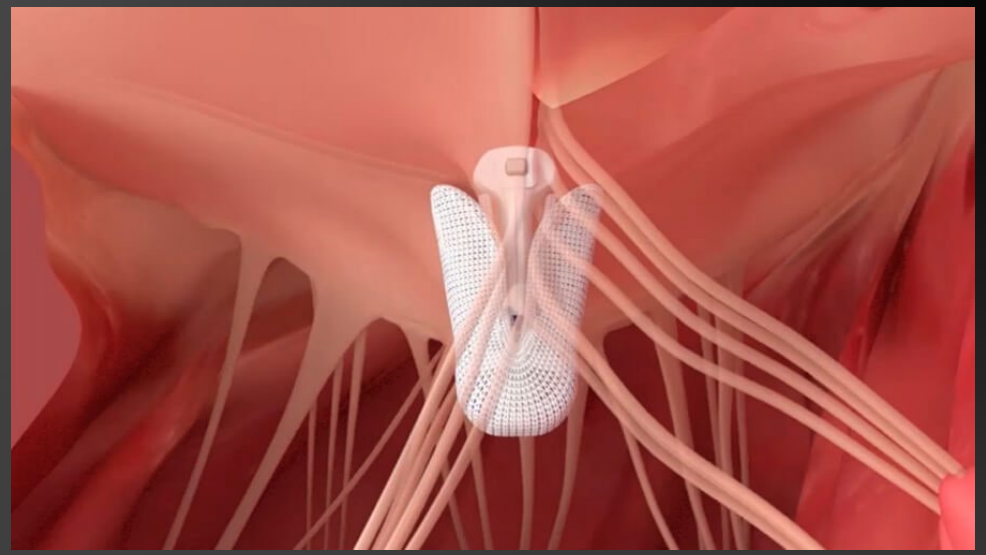




Two commercially available options for TEER in the U.S.



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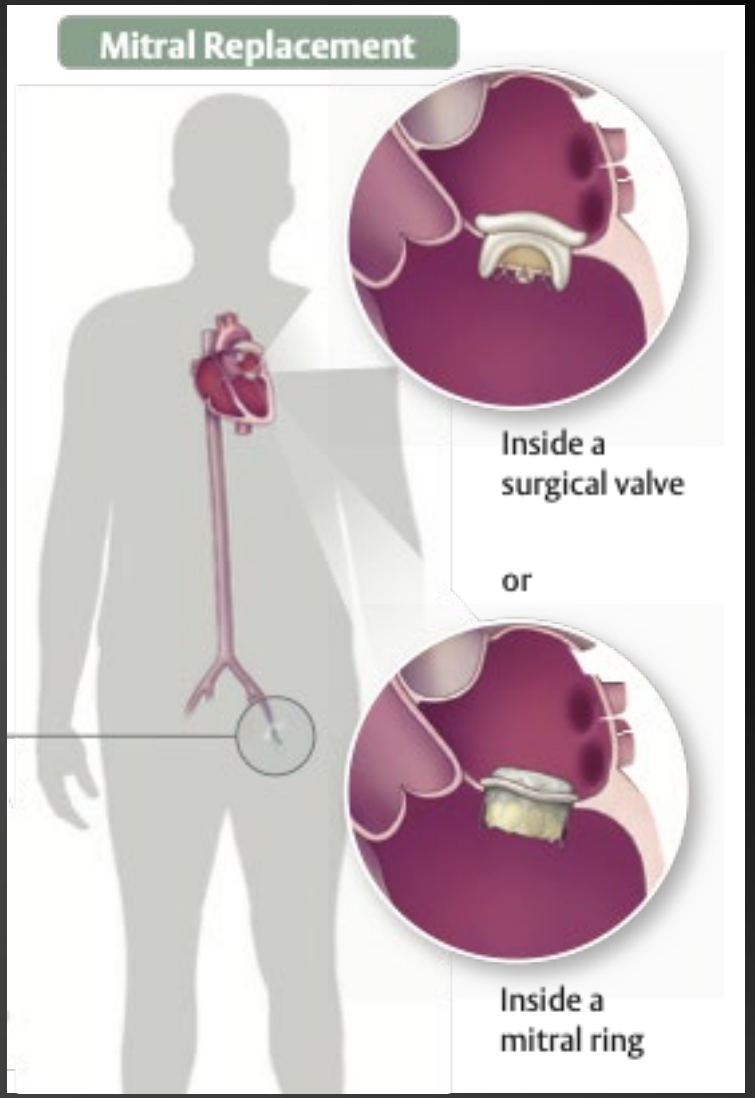
TRANSCATHETER MITRAL VALVE REPLACEMENT (TMVR)

INSIDE AN EXISTING SURGICAL BIOPROSTHETIC VALVE OR RING



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MR PLAYBOOK

- Listen to your patient
- Physical exam
- Order transthoracic echocardiogram to start
- Refer to valve program (moderate MR-severe MR)
- Evaluation for TEER vs. MVR vs. other option
- Follow up & stay connected with your valve program team

2020 ACC/AHA GUIDELINES

ALL patients with **severe valvular heart disease**

being considered for valve intervention should be evaluated by a

multidisciplinary team,

with either referral to or consultation with a

Primary or **Comprehensive Valve Center**

INFORMED CONSENT TAKES ON SHARED DECISION-MAKING

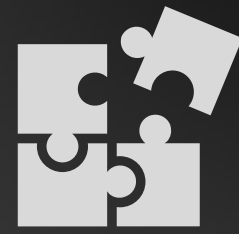
Provider

Patient

Legal document

Multi-disciplinary team

Patient/family/friends



Filling in all the pieces

LIFETIME CONSIDERATIONS

- Future procedures
- Goals of care
- Frailty & functionality
- Symptom relief
- Quality of life
- Prolongation of life
- Comorbidities complicating procedure or recovery effort
- Social support
- Trust
- Access to care & follow-up

"Our job is improving the quality of life, not just delaying death."

(*Patch Adams*, 1998 film)

SHARED DECISION-MAKING

- Shared Decision Making Tools

  -ACC website: CardioSmart
- Valve Conference
- Neurologist
- Geriatrician
- Occupational/Physical therapist/Case management
- Primary Care Provider

http://clipart-library.com/clipart/ziX5GzEXT.htm

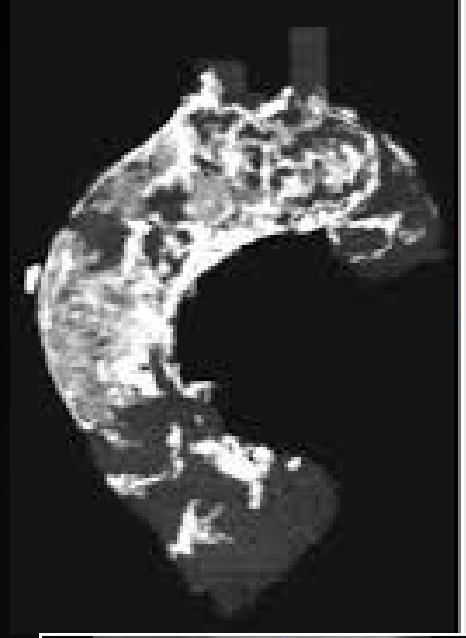
CASE STUDY REVIEW

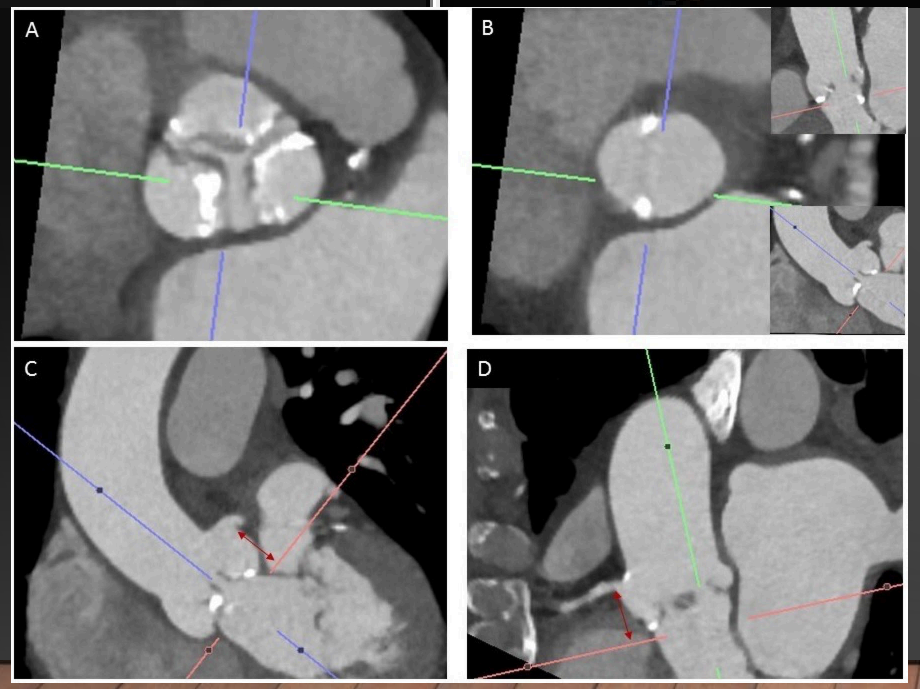
- A. T. is an 82 year old white female
- Lives alone, widowed, family is local-has a daughter & son
- PMH: HTN, CVA with no residual, Aortic stenosis-last echo moderate AS, DM, II

  previous smoker (quit 30 years ago)
- Symptoms: increased fatigue and DOE has worsened over the last 6 months
- Mobility aid: Uses a cane when she goes out of her home

CASE STUDY CONT.

- PE: 3/6 systolic murmur, S1, S2, regular rhythm, lungs clear, no carotid bruit or JVD, 1+ LEE
- TTE: AVA 0.7cm^2 AV MPG 45mmHg AV velocity 4.2 m/s LVEF 55% trace TR
- EKG: SR with RBBB
- LHC: Mild non-obstructive coronary artery disease
- Carotid doppler: 10-20% stenosis bilaterally
- TAVR CT: periphery without significant disease, adequate size vessels, annulus 450mm^2, tri-leaflet AV with calcium score 3400.





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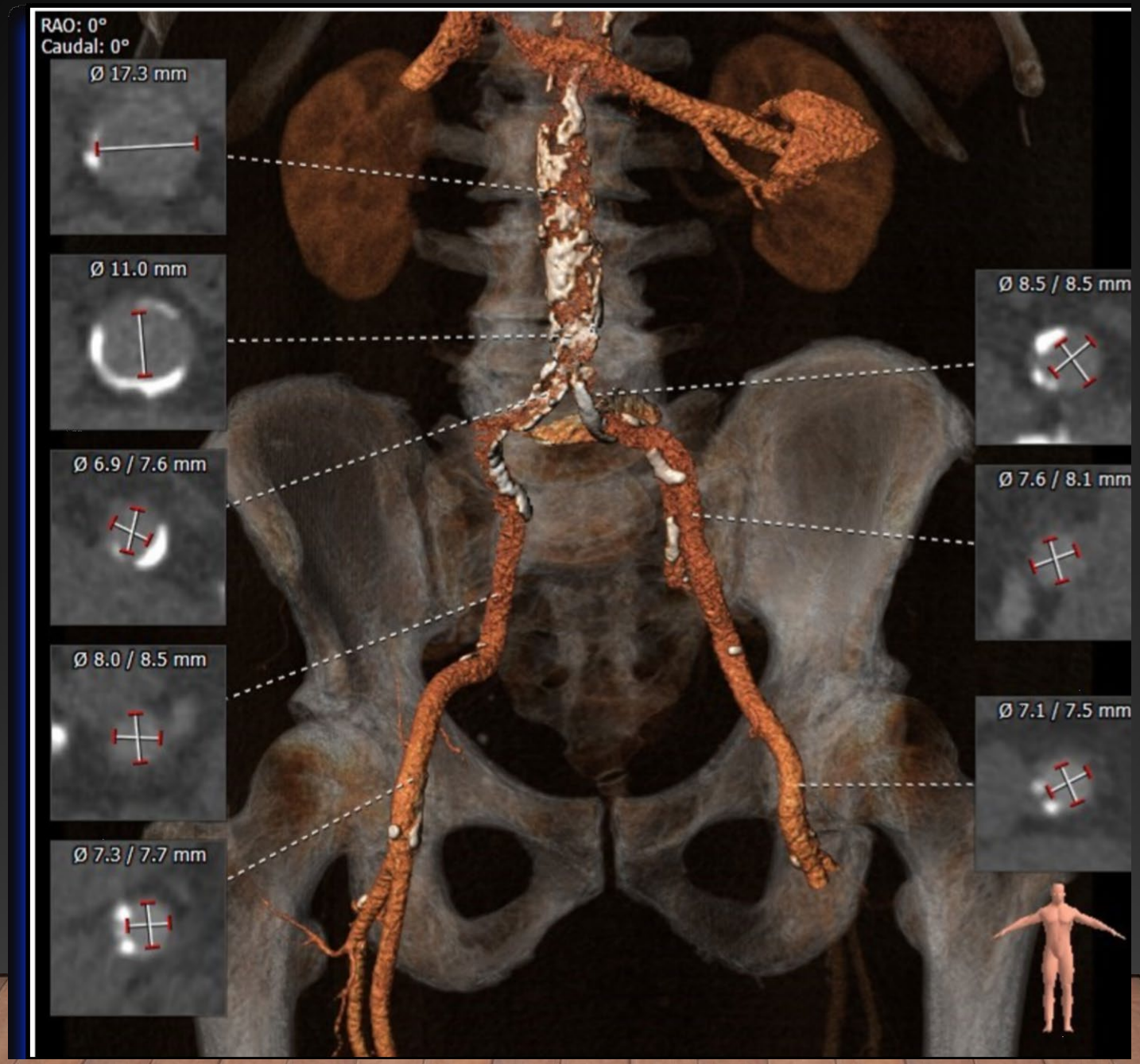

Author's photo

SHARED DECISION MAKING

- STS/PROM & frailty scores, Five meter walk test, KCCQ-12 questionairre, EFT tool
- Goals of care / what does the patient value?
- Family support?
- Procedural considerations

THE FUTURE IS BRIGHT…

Fix ALL the valves!!!

Transcatheter mitral valve (in native mitral valve)

Tricuspid procedures

Maintain minimalist procedure

Consider same-day discharge

Improve patient selection process

Reduce racial and ethnic disparity

HIGH HOPES: Identify early and in ALL settings of care

Contact: christy.cantey@hhsys.org

Author's personal photo