Structural Heart Diseases for the Non-Cardiologists

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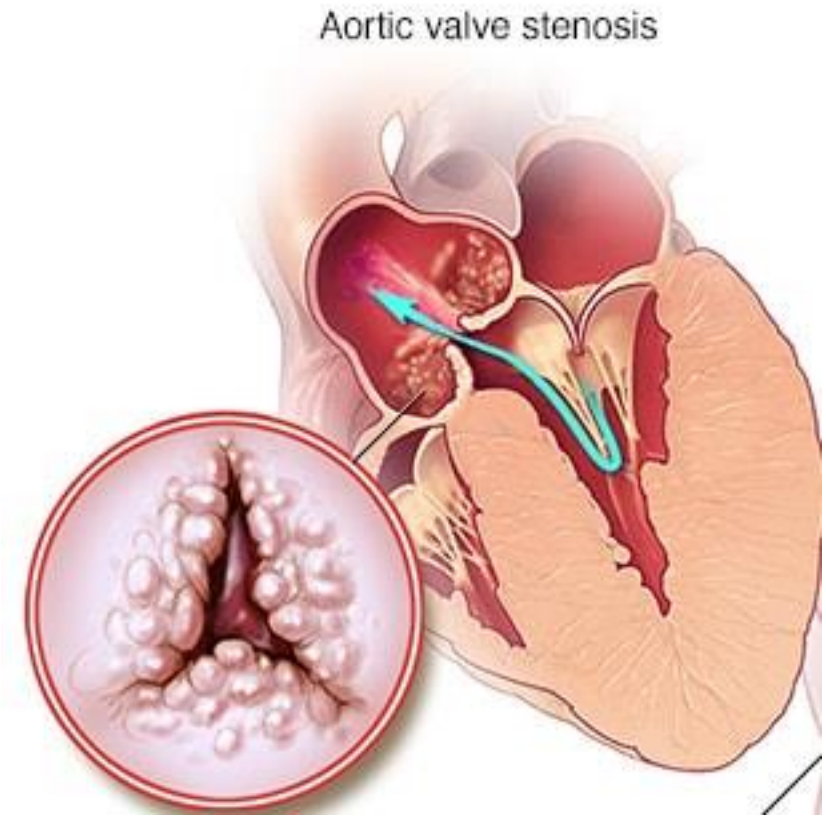
Disclosures

» No financial disclosures

Aortic Stenosis



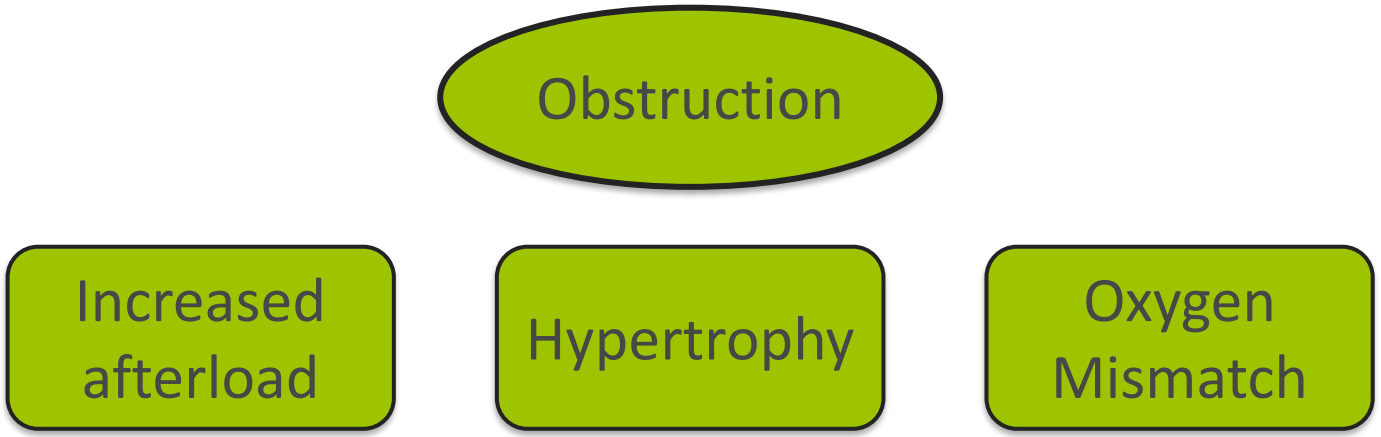
Valvular Aortic Stenosis

Age-related etiology

- <30: Congenital (unicuspid, bicuspid)
- 40-60: Rheumatic or Calcified bicuspid
- >70: Senile degenerative (most common)

Aortic Stenosis Pathophysiology

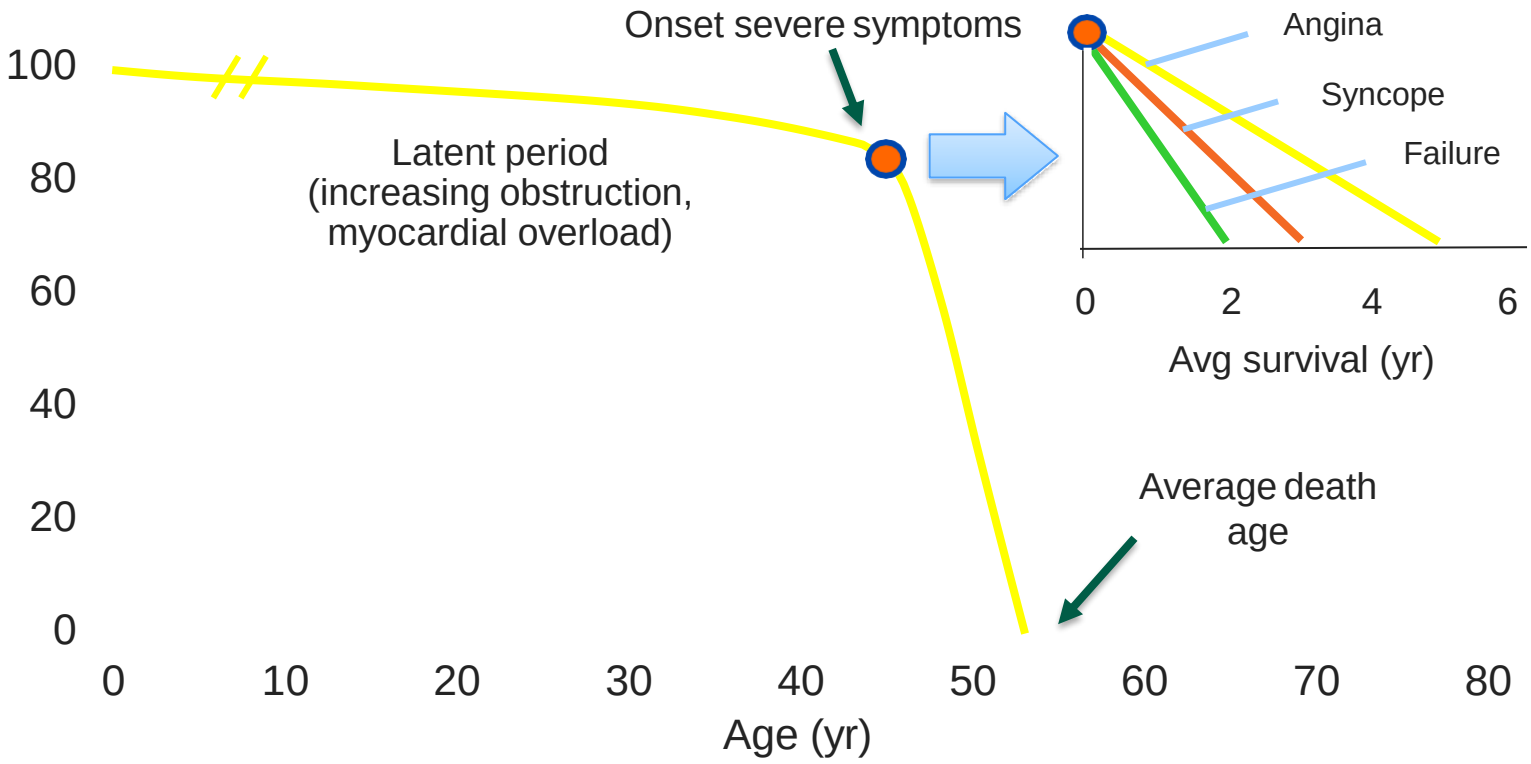
- Wall stress = (LV pressure x LV dimension) / Wall thickness
- Increased thickness will “normalize” wall stress
- LV size stays normal in early stages, later will dilate
- LVEF remains normal early, later will drop



Aortic Stenosis Presentation

- Heart Failure
- Syncope
- Angina

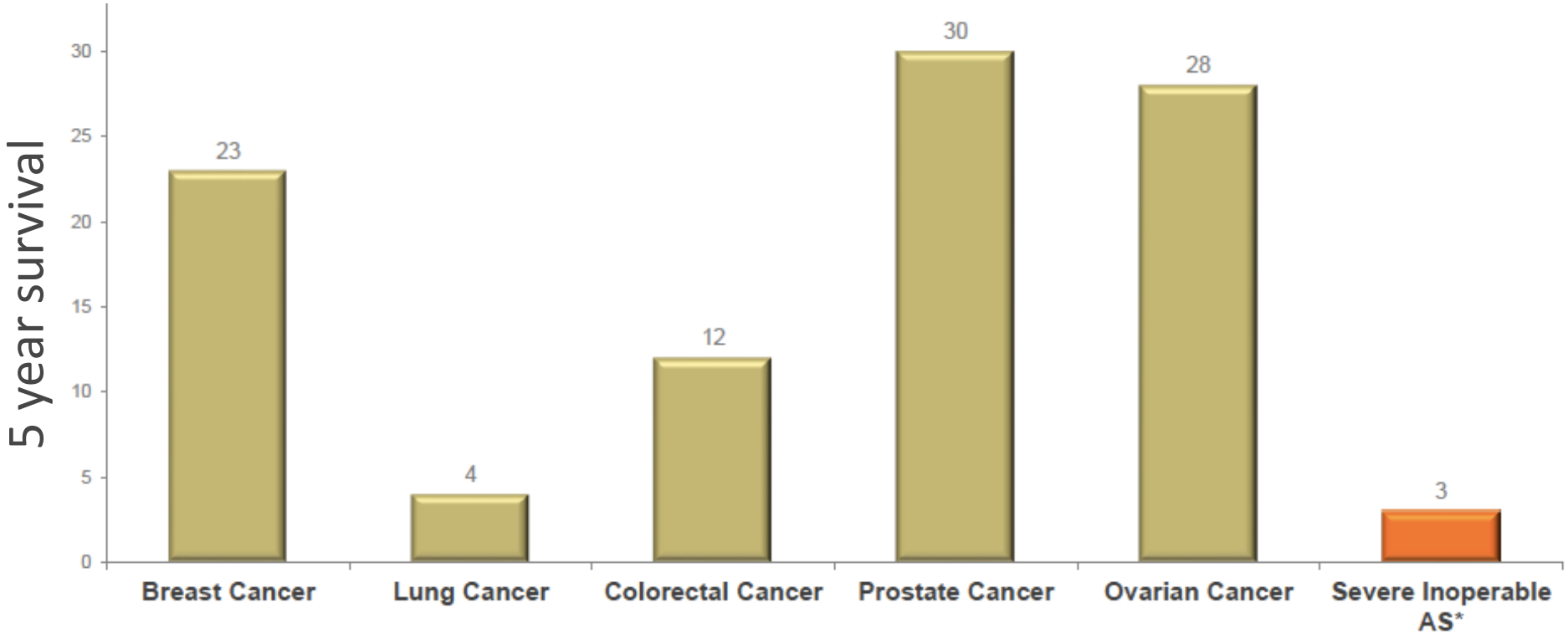
Natural History of Aortic Stenosis



Ross J Jr. and Braunwald E: Circ 38(Suppl 5):61, 1968

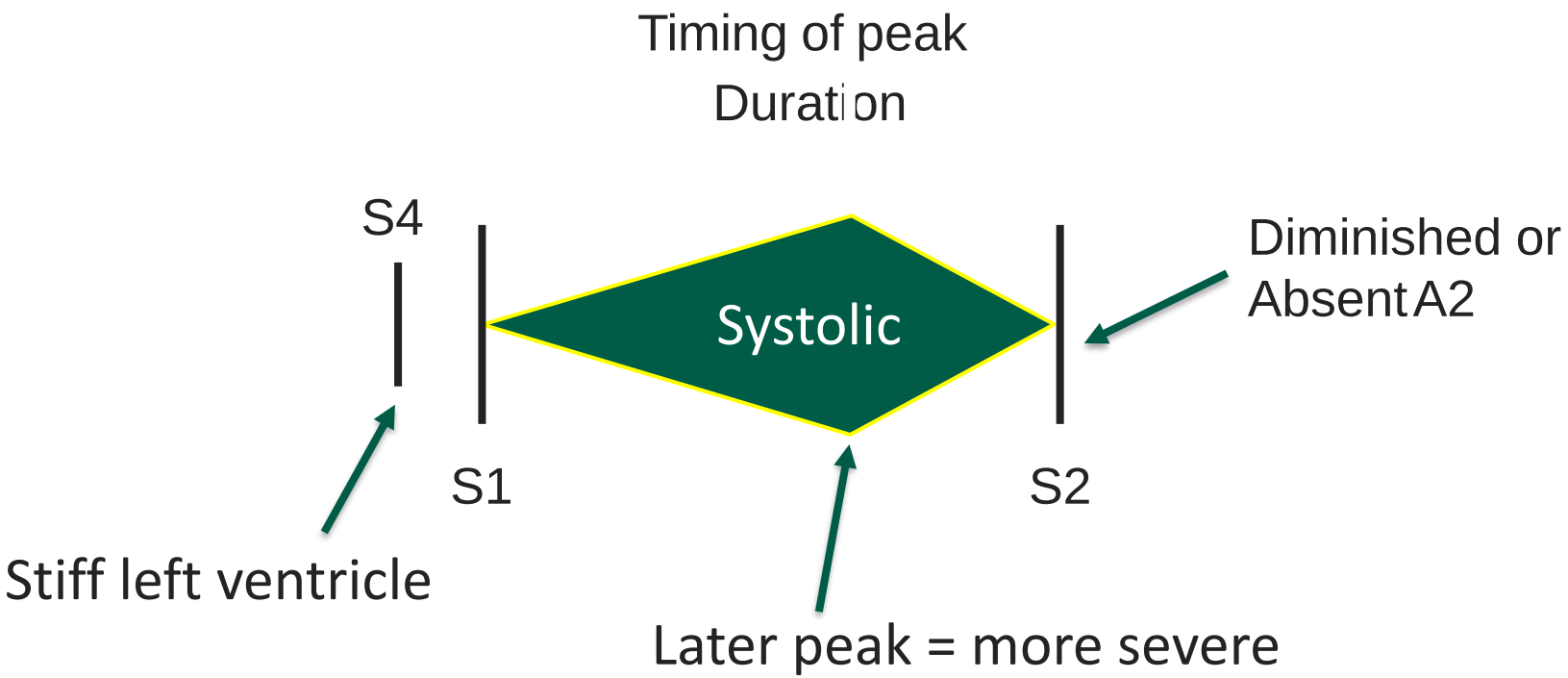
Poor prognosis if untreated; average life expectancy after symptoms is 2-5 years

Worse than metastatic cancer



*Using constant hazard ratio. Data on file, Edwards Lifesciences LLC. Analysis courtesy of Murat Tuczu, MD, Cleveland Clinic

Physical Examination



Carotids: Parvus (weak) et tardus (late)

2D Anatomy

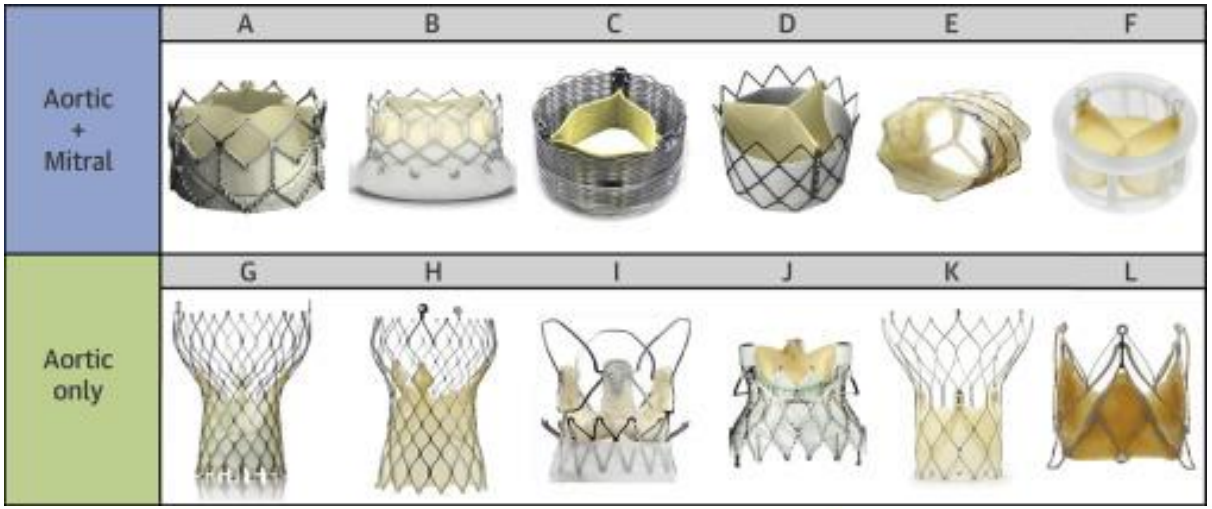
Hemodynamics

Doppler

Aortic valve replacement - Types

Surgical:

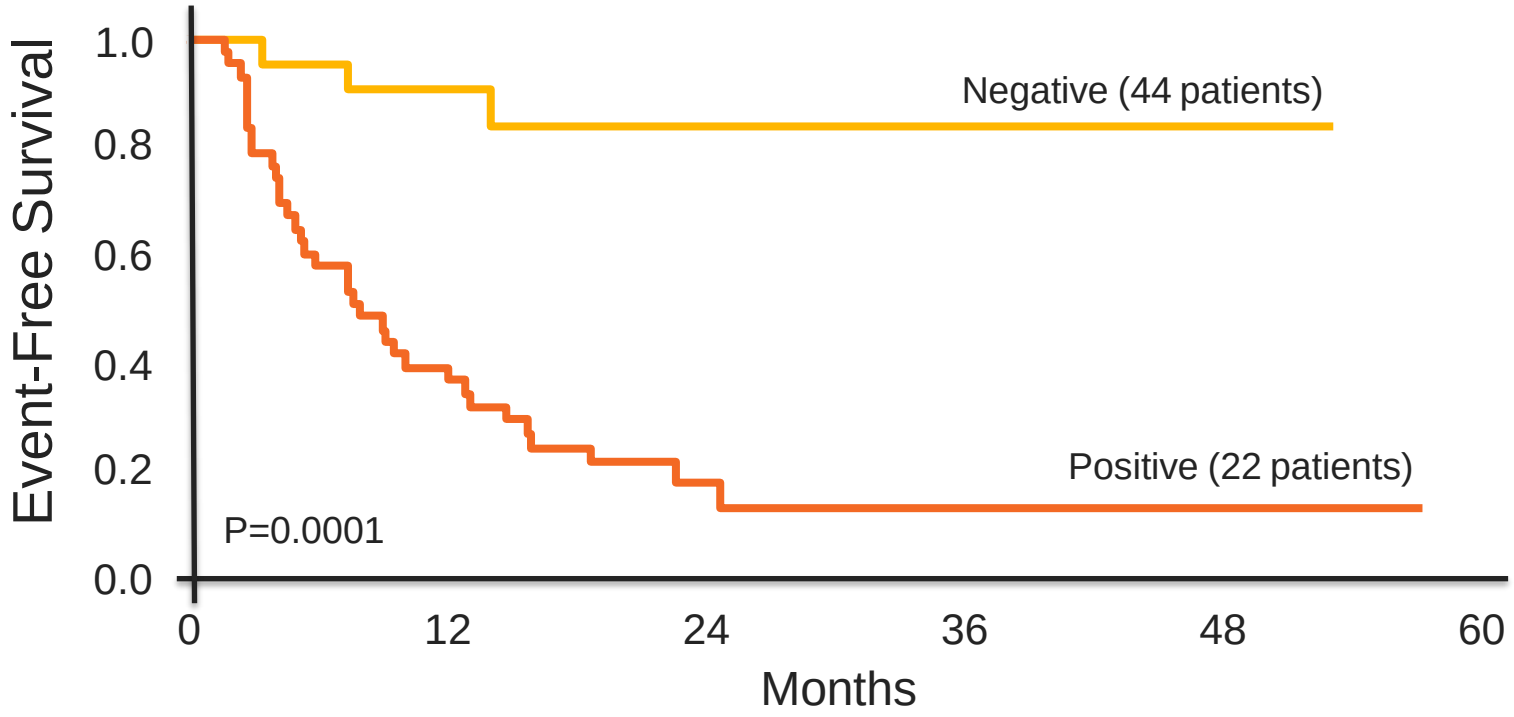
Trans-catheter:



Aortic valve replacement

- Indications:
  - Operate at onset of ***ANY*** symptoms
  - Undergoing other cardiac surgery (even if moderate AS)

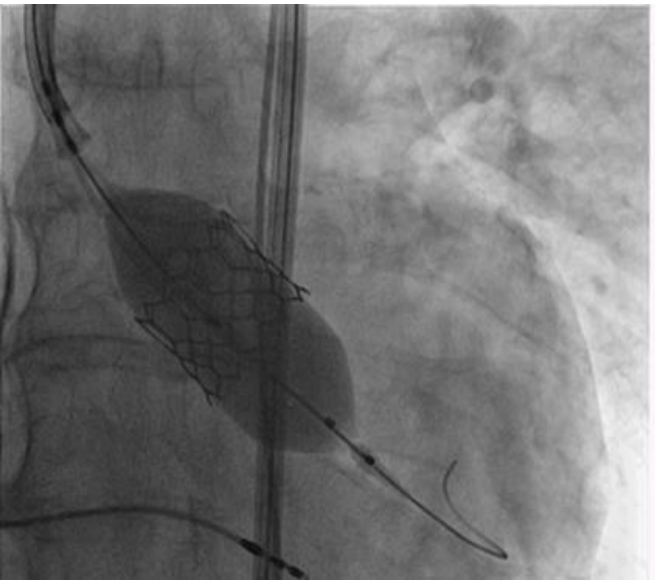
Role of Exercise Testing in Asymptomatic pts

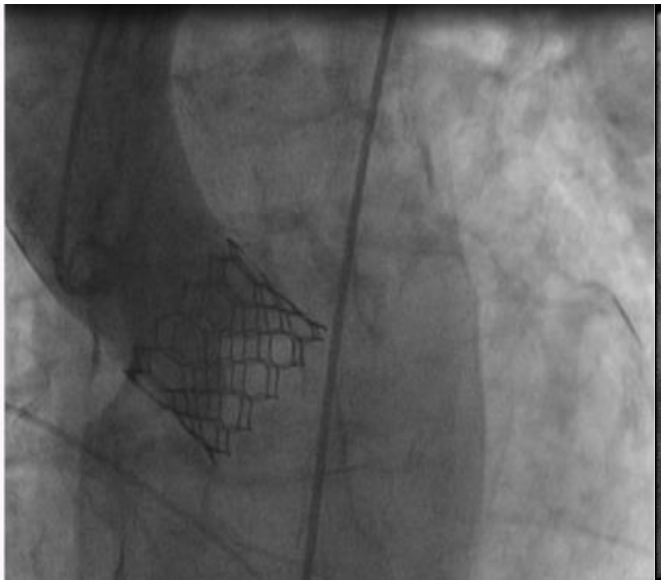


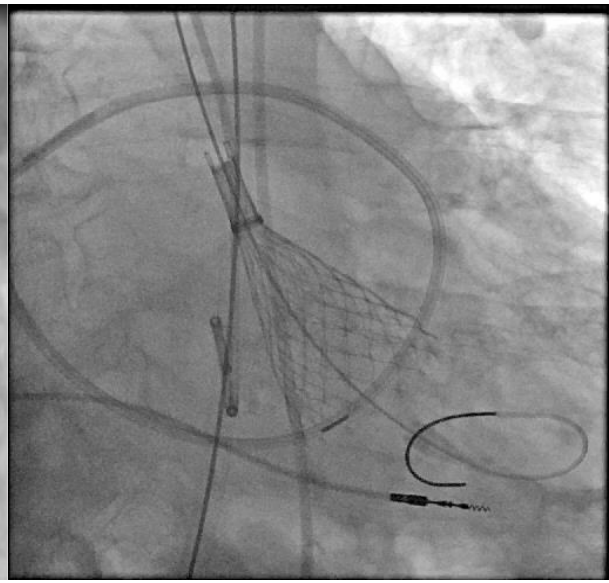
Amato et al: Heart 86:381, 2001

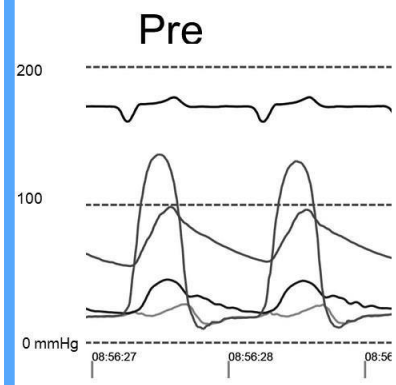
Positive TMET
(limited exercise capacity for age, BP drop or flat response, VT)

Trans-catheter Aortic Valve Replacement (TAVR): A dramatic relief of obstruction within seconds







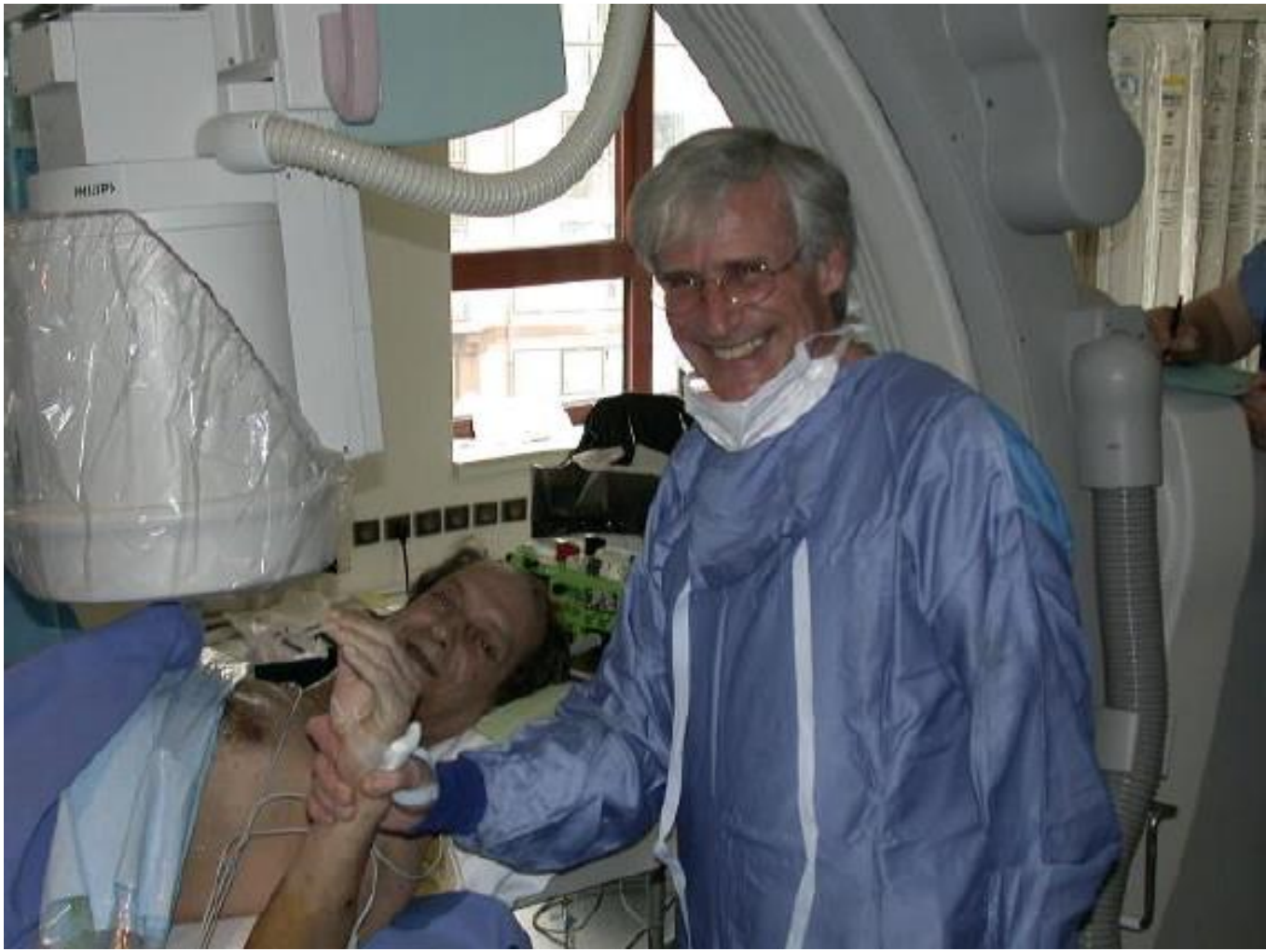


	Pre	Post
Mean gradient	32 mmHg	6 mmHg
AVA	0.8 cm2	5.0 cm2
SVI	29 ml/m2	50 ml/m2

Pics adapted from Mayo clinic board review

April 16, 2002

- 15 min post first in-man TAVR

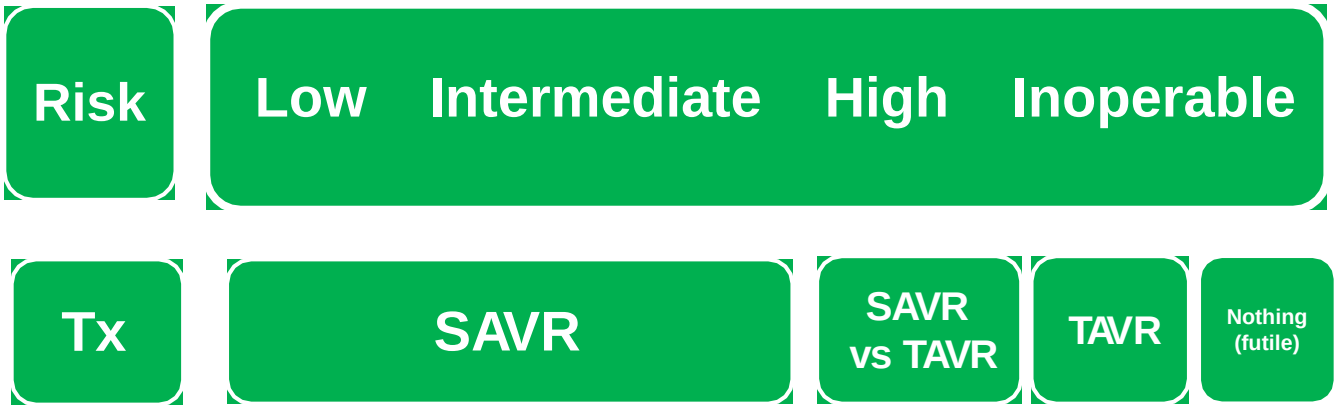


Pics adapted from Mayo clinic board review

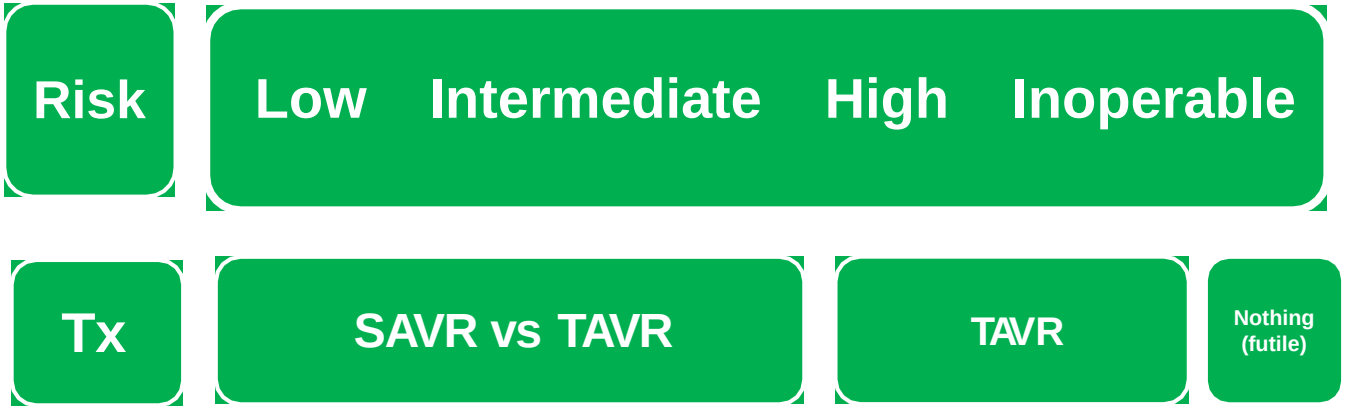
TAVR – Trial Results Summary

- TAVR - inoperable pts
  - Lower mortality vs medical Rx
- TAVR - high risk patients
  - Comparable mortality vs SAVR
- TAVR – intermediate risk patients
  - Comparable mortality vs SAVR
- TAVR – low risk patients
  - Comparable mortality vs SAVR (2 yr F/U; age > 65)

Changing Spectrum

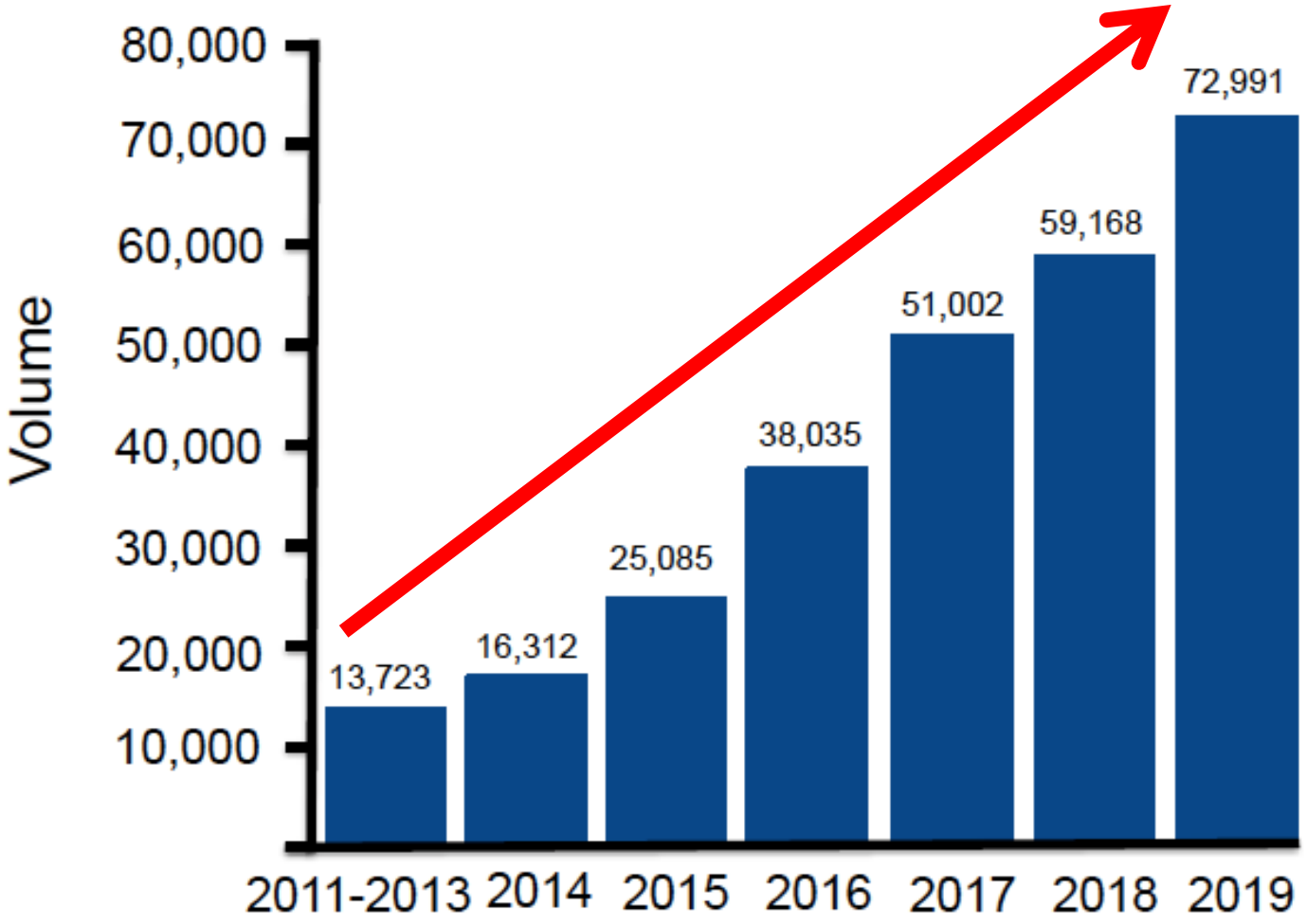


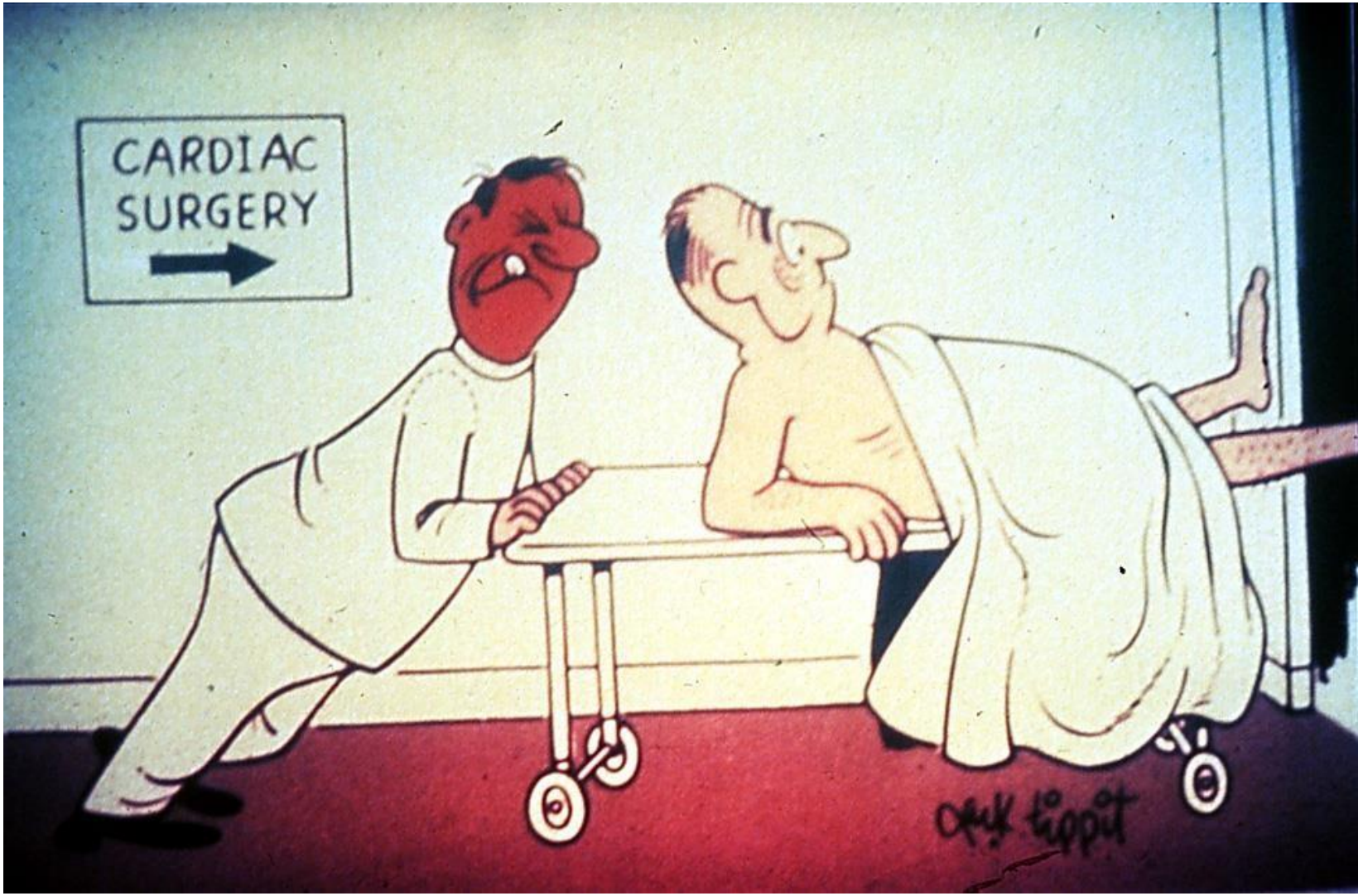
2014 Guidelines



2020 Guidelines

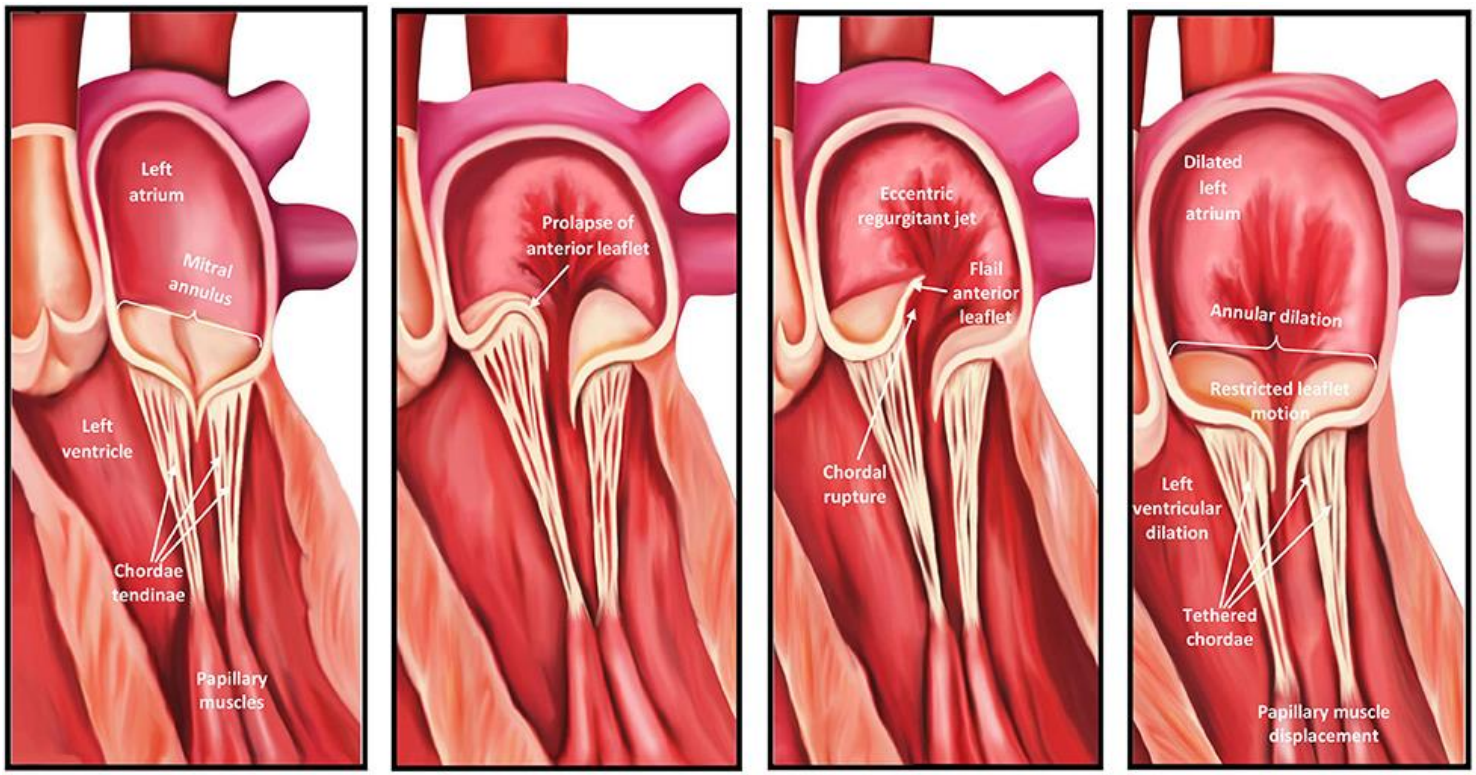
TAVR Volume Overtime





Pics adapted from Mayo clinic board review

Mitral Regurgitation

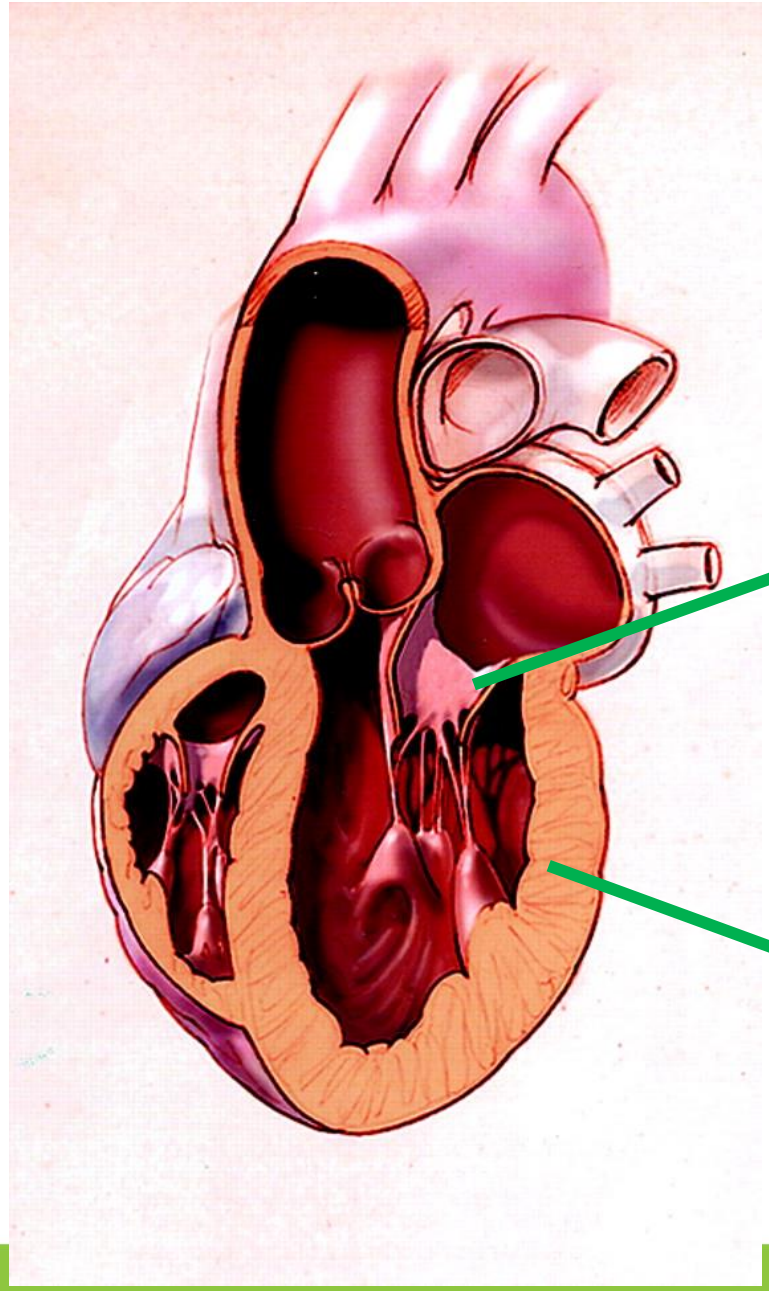


Normal mitral valve anatomy

Primary mitral regurgitation due to valve prolapse

Primary mitral regurgitation due to flail leaflet

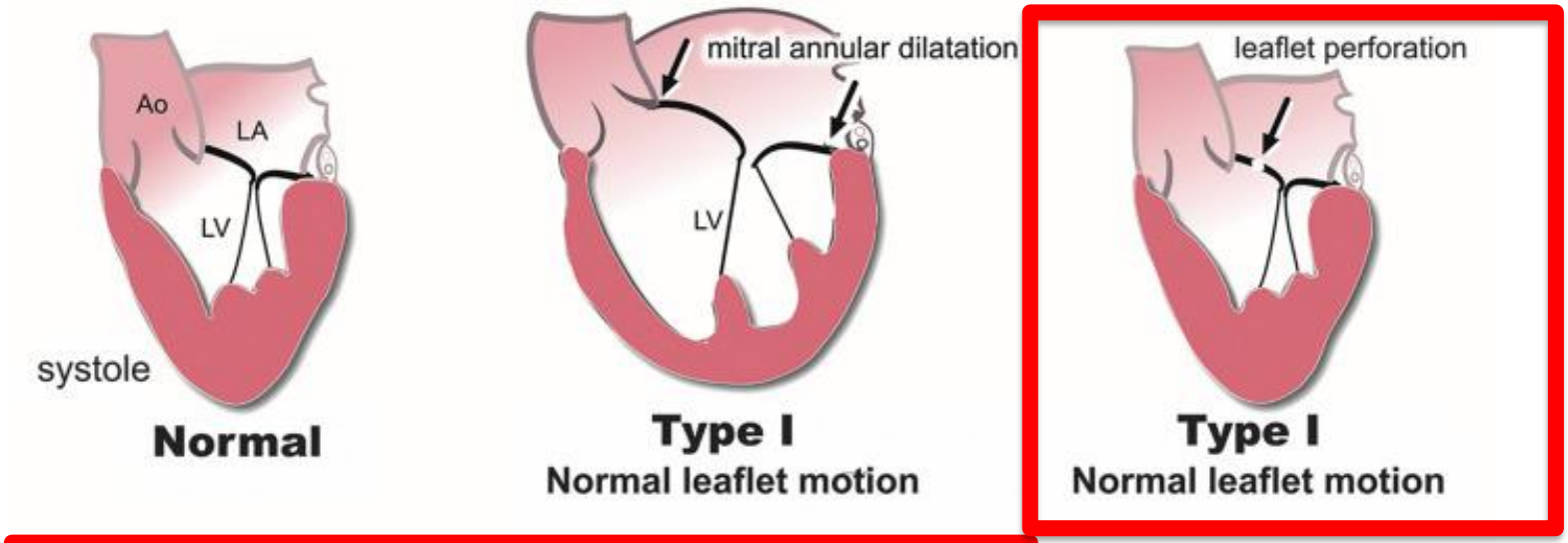
Functional mitral regurgitation



Primary MR
(Valve is main issue)

Secondary MR
(LV is main issue)

Carpentier's Classification
Primary MR

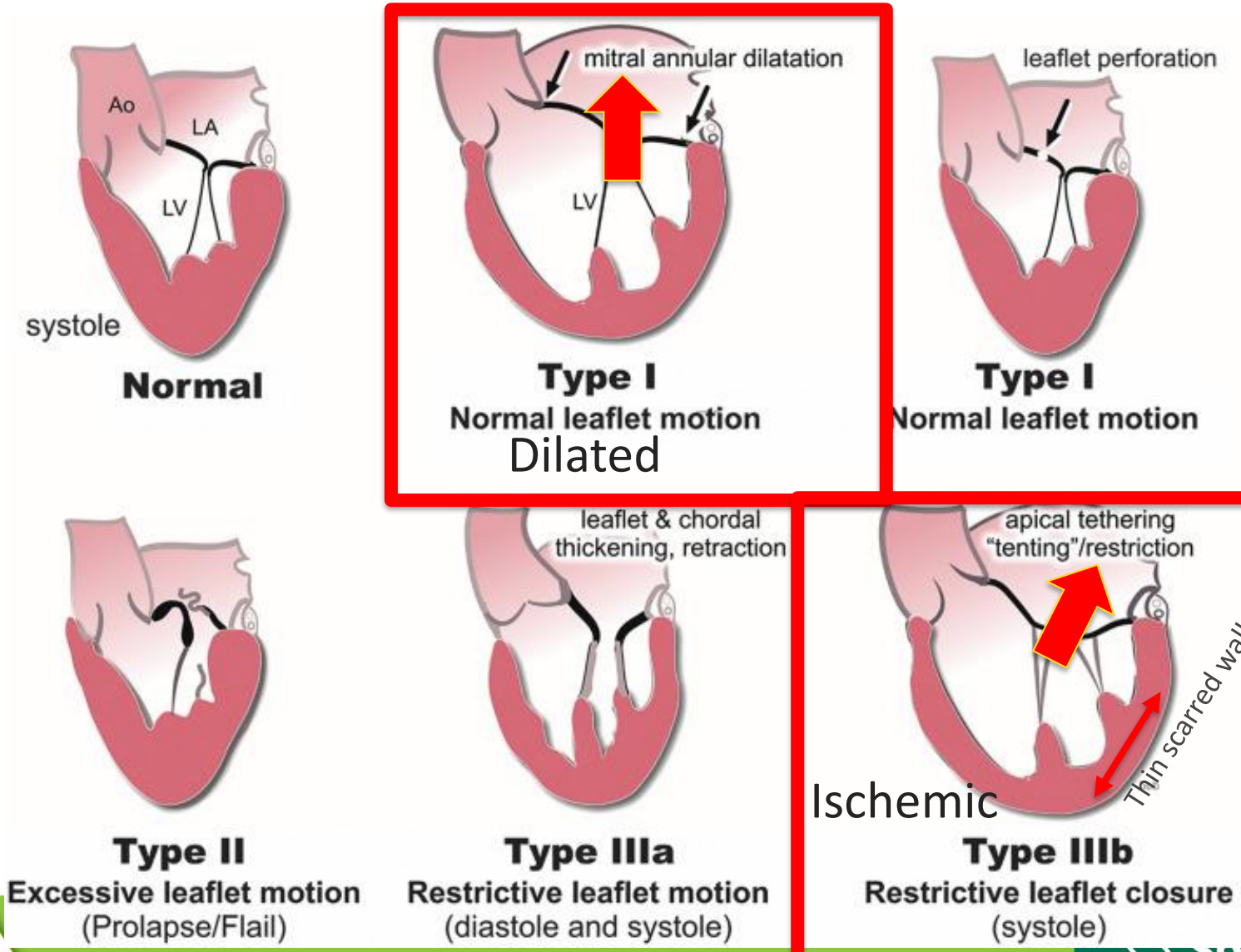


Degenerative Rheumatic

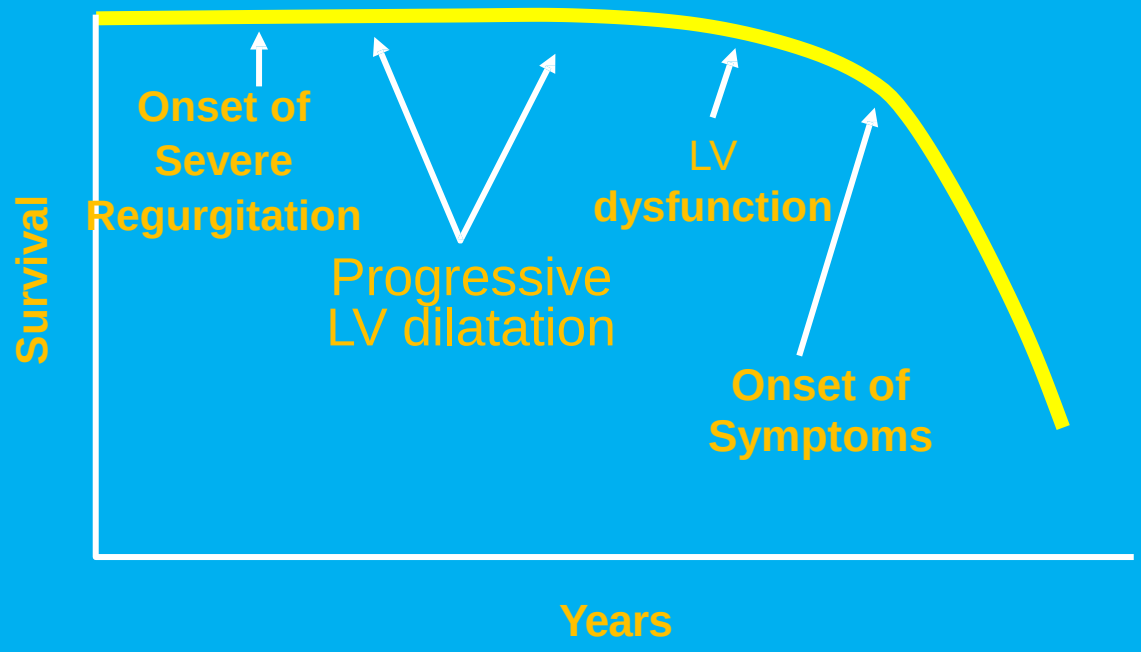
PATIENT
CAREGIVER
VISION
MISSION
VALUES
PILLARS OF EXCELLENCE
THE SPARROW WAY

Sparrow

Carpentier's Classification Secondary MR



Concept of volume overload in regurgitant lesions

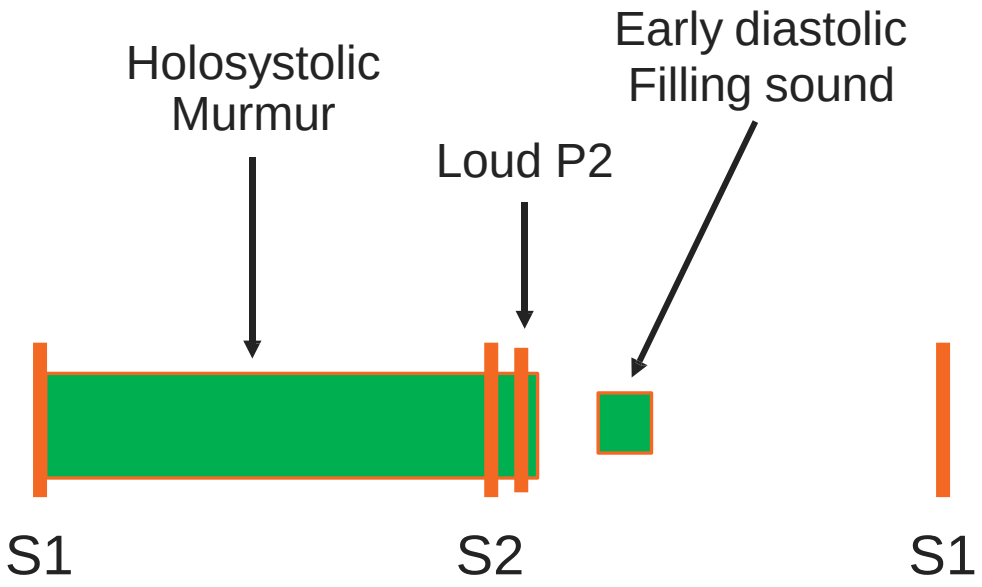


Long standing volume overload causes LV dysfunction
By the time symptoms start – It might be too late

Chronic mitral regurgitation

- Sometimes prolonged asymptomatic period
- Low output state
- Pulmonary congestion sxs

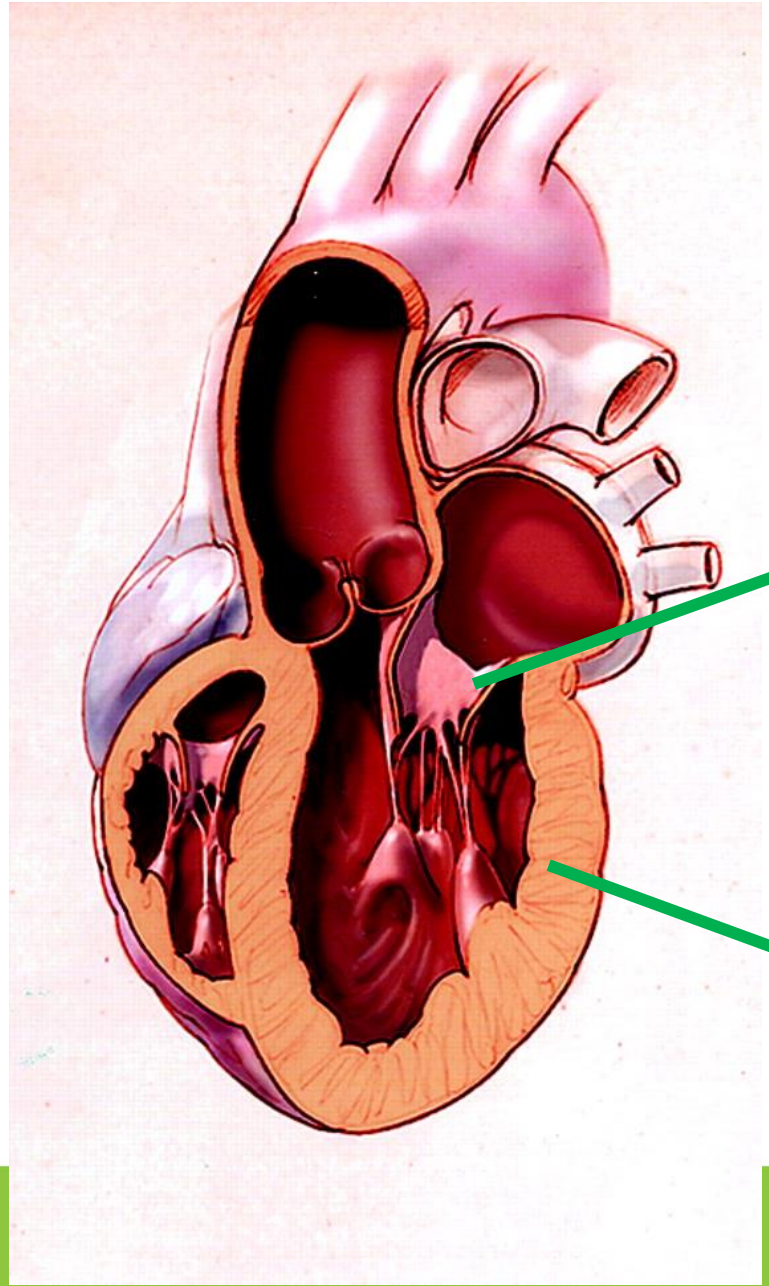
Physical examination



Echo assessment of MR

- Cause of MR?
- Degree of MR?
- Effects on LV?

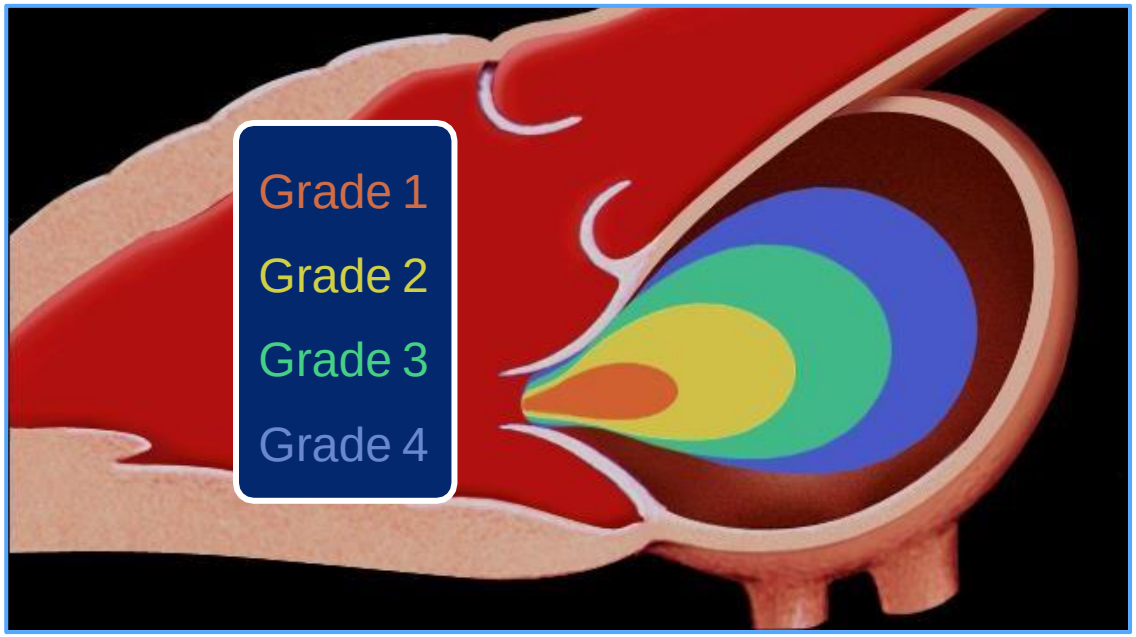
The cause of MR



Primary MR
(Valve is main issue)

Secondary MR
(LV is main issue)

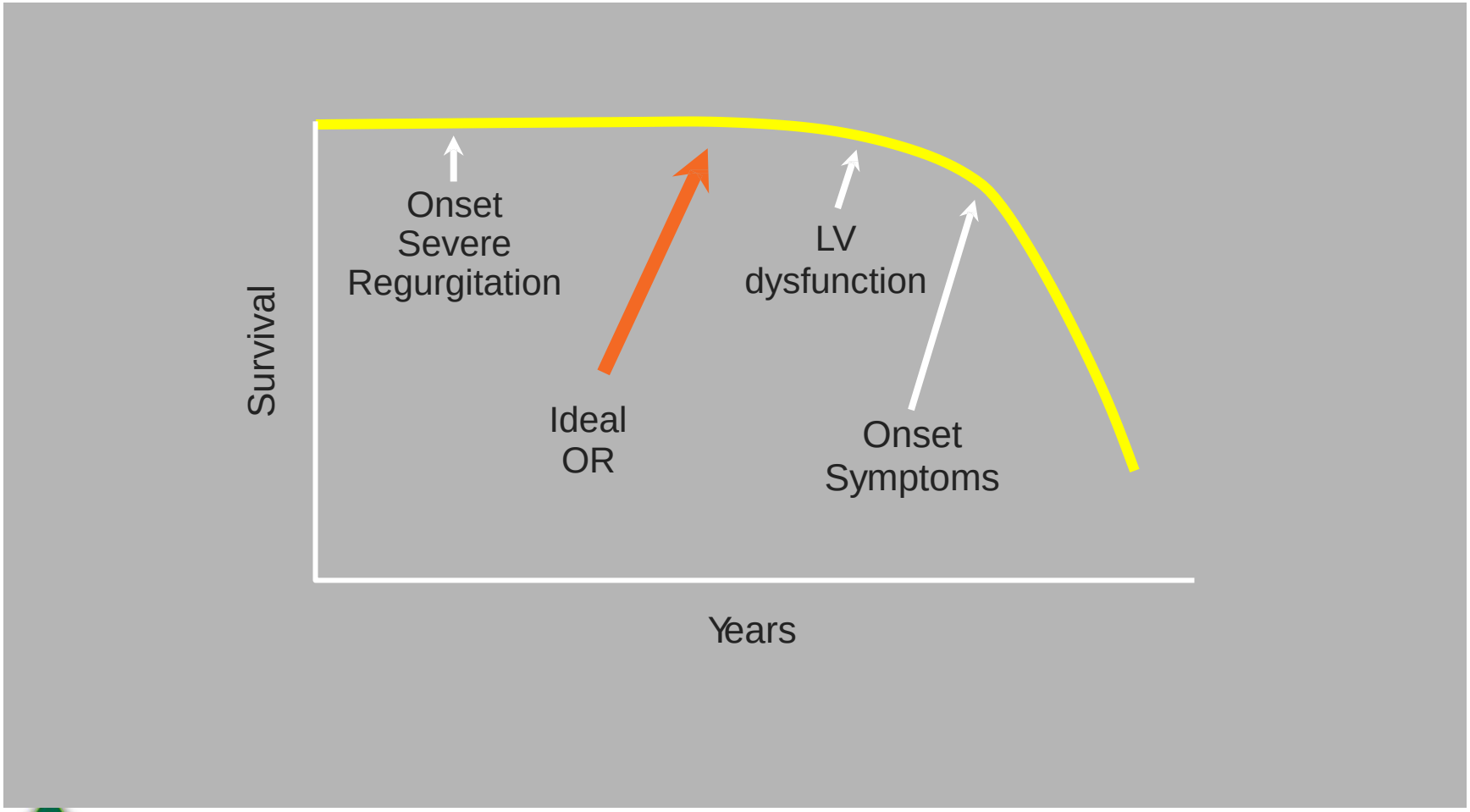
Degree of MR



Jet area and color only are **INACCURATE** ways of grading MR and can be misleading. Especially in eccentric MR

High Index of Suspecion

- In pts with clinical signs of severe mitral regurgitation and “mild” MR by TTE echo ➡ get TEE and/or cath


Survival
Onset
Severe
Regurgitation
Ideal
OR
LV
dysfunction
Onset
Symptoms
Years

Treatment options

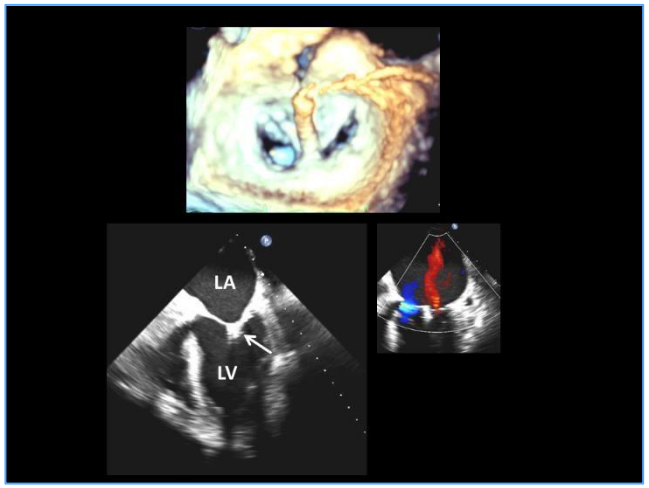
Repair preferred, dependent on surgeon skill

Requires aspirin and warfarin for life (INR 2.5-3.5)

Requires aspirin, last 10-15 years

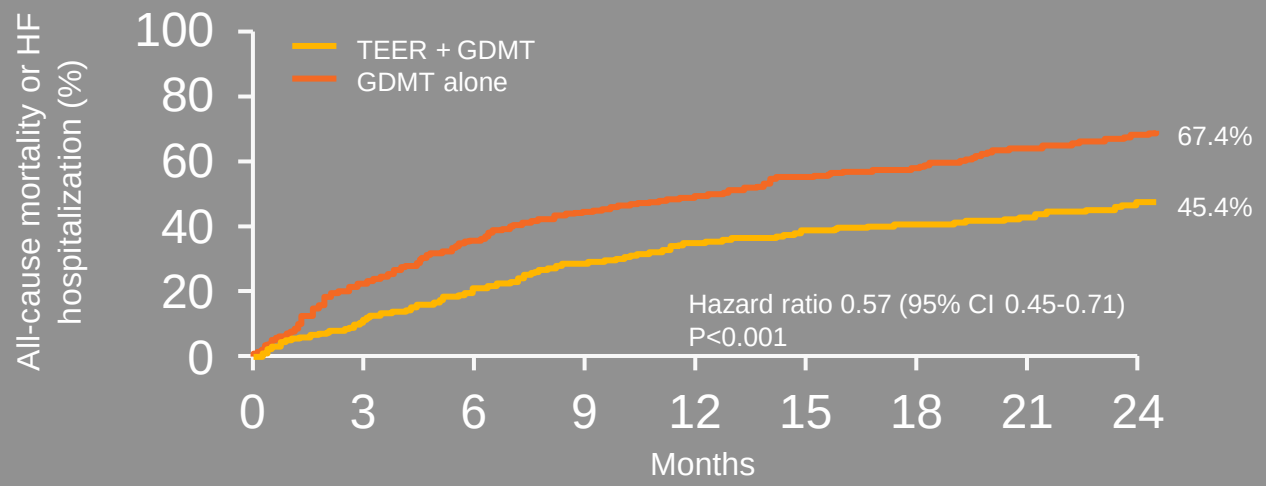
High risk patients Increasing role in functional MR

TEER (transcatheter edge to edge repair) MitraClip / PASCAL



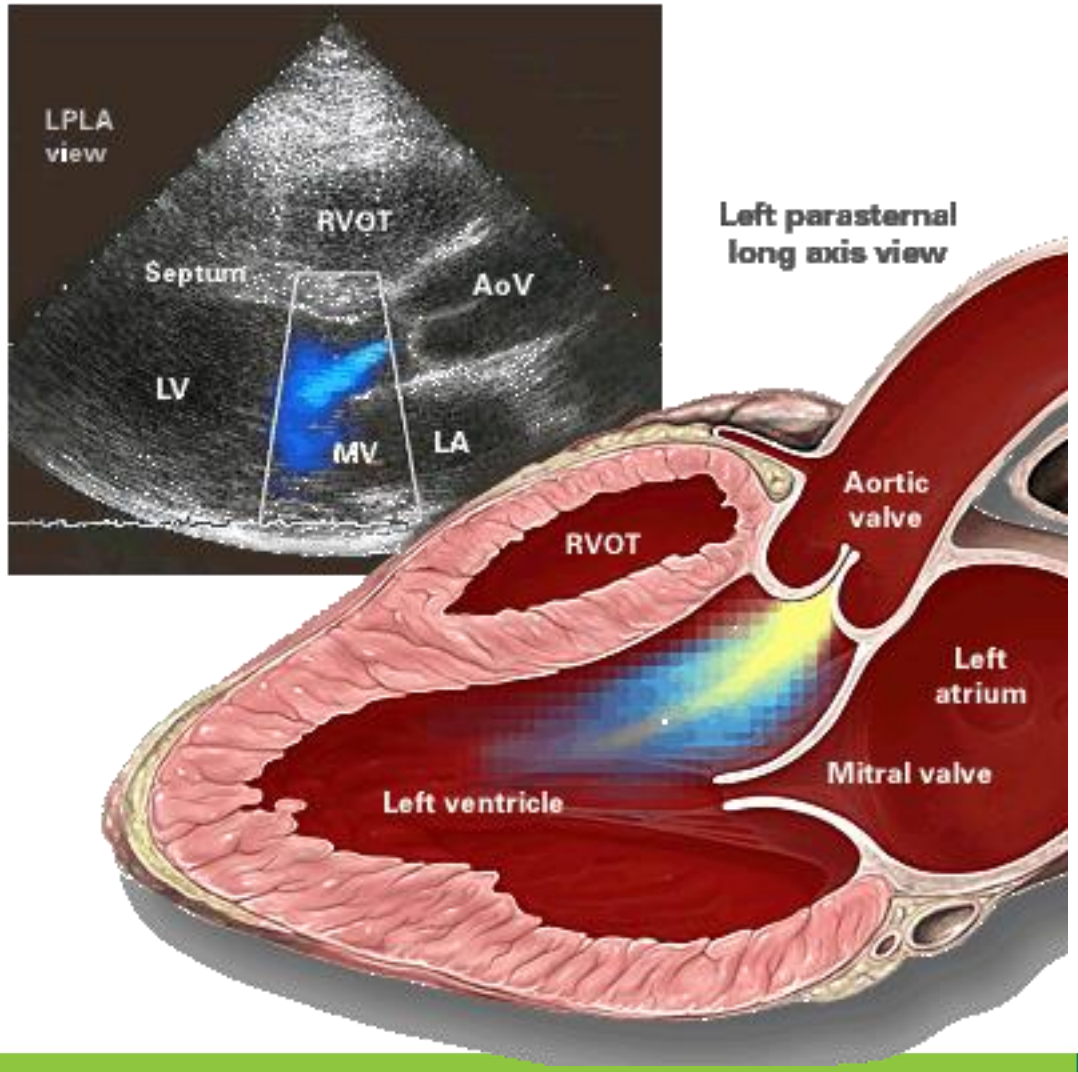
COAPT Trial

Significant benefit for mortality and hospitalization for CHF



No. at risk									
MitraClip + GDMT	302	264	238	215	194	154	145	126	97
DGMT alone	312	244	205	174	153	117	90	75	55

Aortic Regurgitation



Etiology of aortic regurgitation

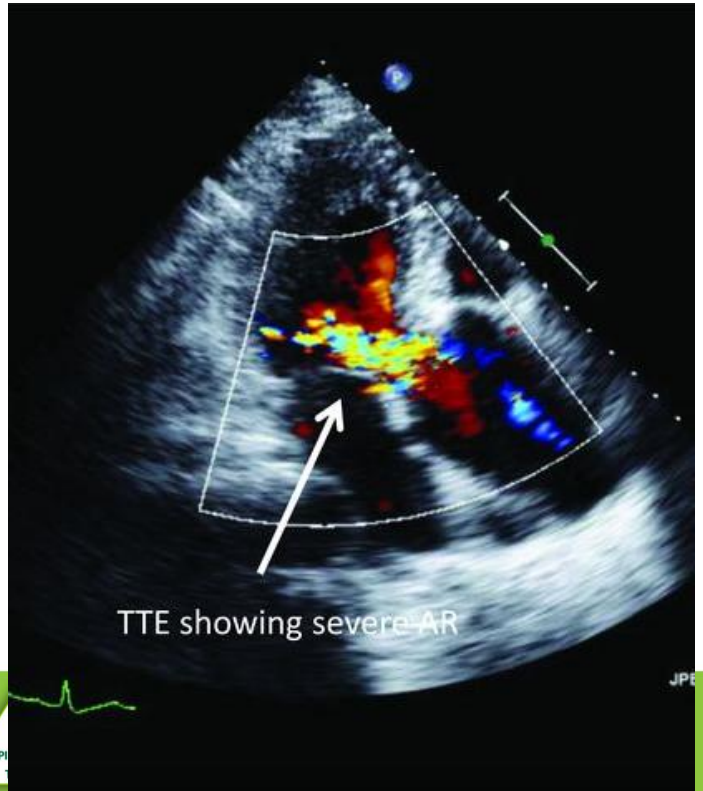
- Acute
  - Aortic dissection
  - Trauma
- Sub-acute or Chronic
  - Endocarditis
  - Bicuspid valve
  - Root dilatation
  - Rheumatic
  - Hypertension
  - Marfan's Syndrome
  - Syphilis

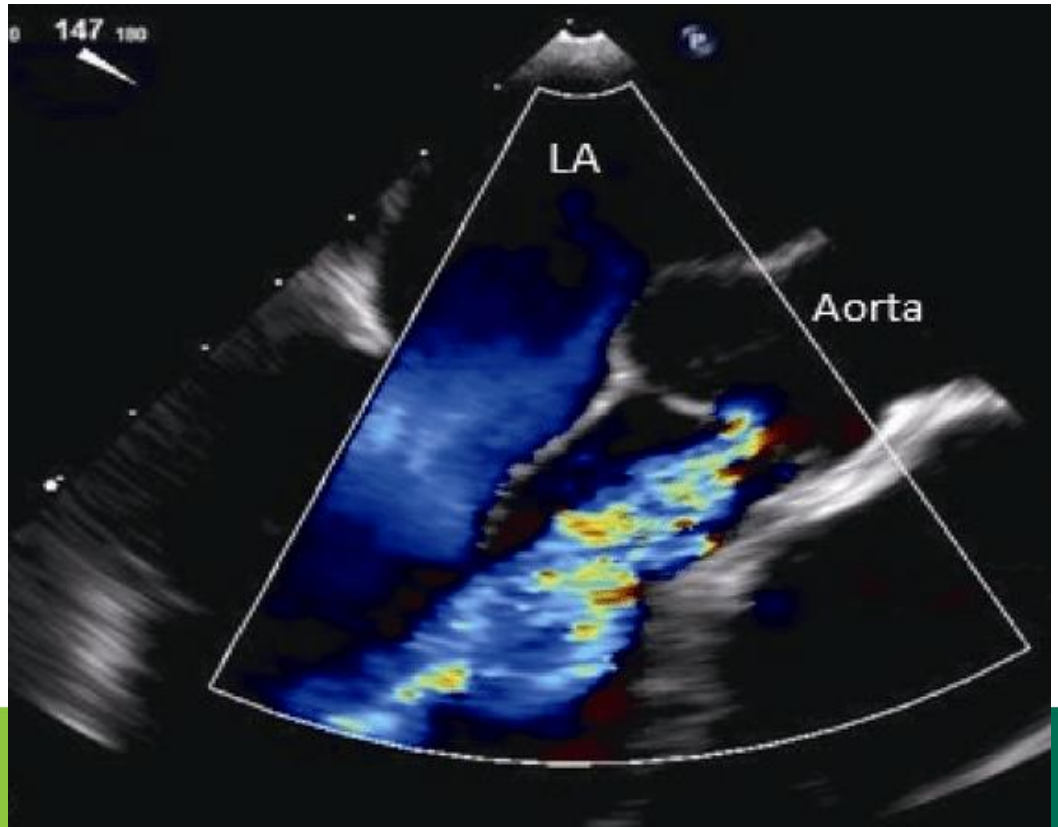
Clinical Presentation

- Acute aortic regurgitation
  - Severe pulmonary edema
  - Cardiogenic shock
- Chronic aortic regurgitation (often tolerated well)
  - Shortness of breath, fatigue
  - Dilation of ventricle over time
  - May have prolonged asymptomatic interval

Testing

- Trans-thoracic echocardiogram
- Trans-esophageal echocardiogram
- Cardiac MR
- Angiography

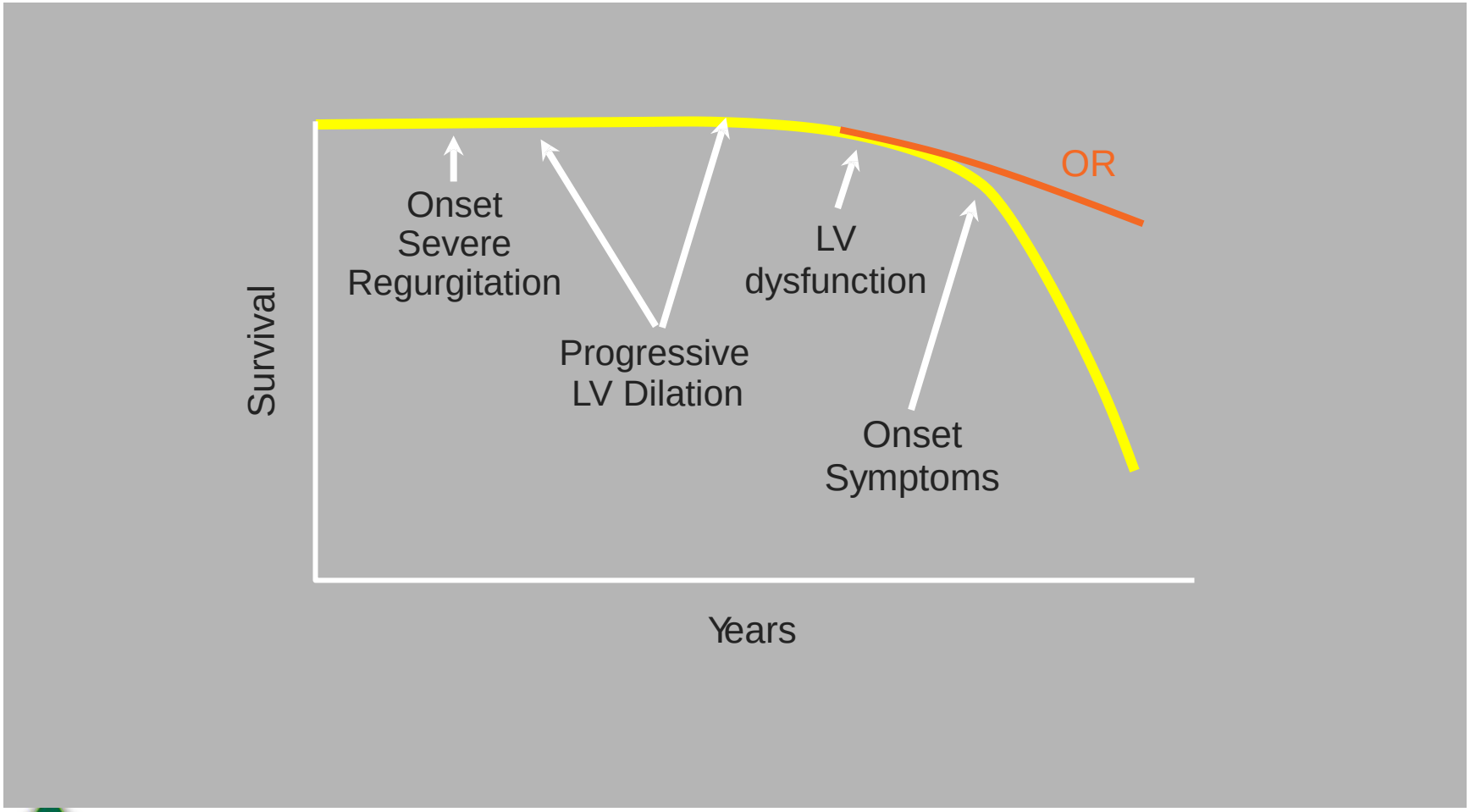




Indications for treatment of AR in a nutshell

- Symptoms
- LV dysfunction
- LV dilatation

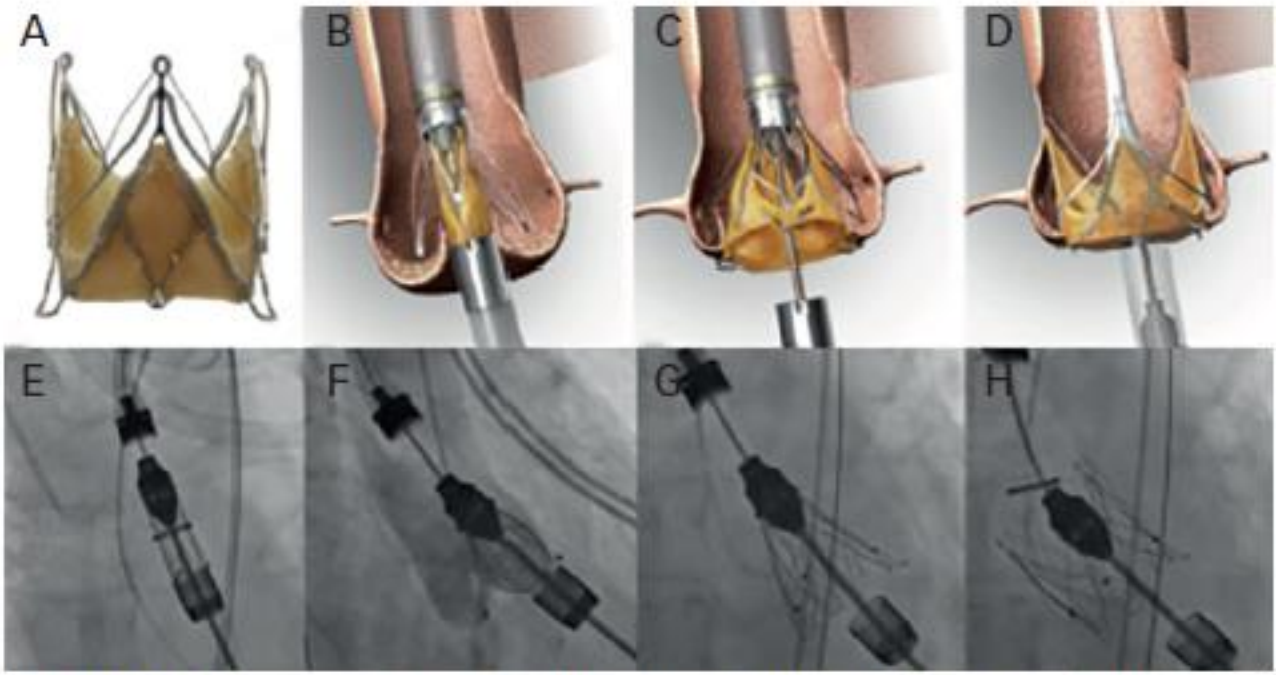
Timing of Treatment



Non-surgical treatment – The Jena Valve (ALIGN-AR Trial)

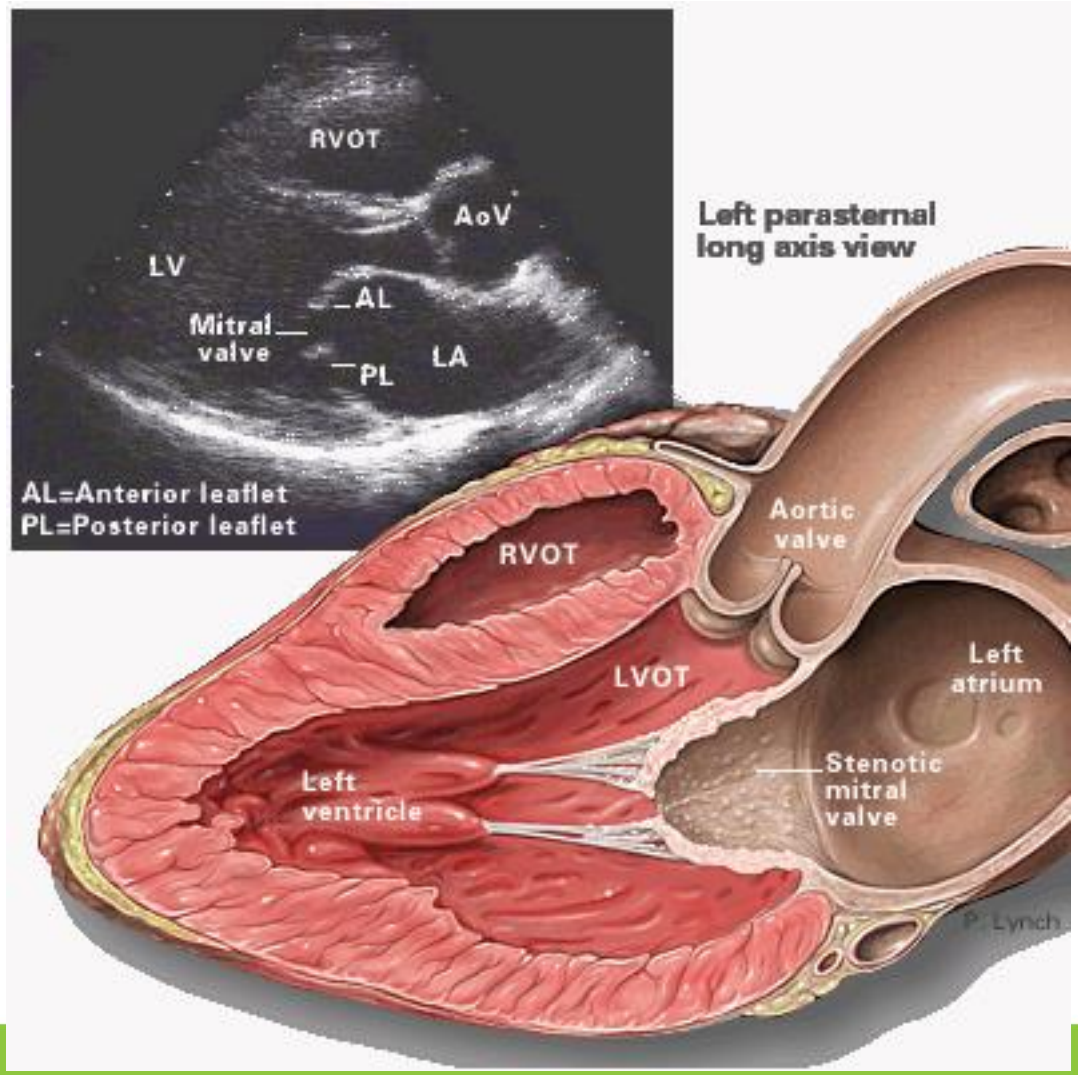
- Off label Edwards Sapien/ Medtronic FX valves is an option in select cases

Figure 2: Jena Valve Deployment



The JenaValve transcatheter heart valve (A) and its implantation in illustration (B to D) and fluoroscopy (E to H). Release of the positioning feelers and placement into the aortic sinuses enables anatomic orientation (B and F). After correct orientation has been verified in two different fluoroscopic angulations, release of the lower stent part facilitates the clipping of the native aortic valve leaflets to the device and expansion of the stent allowing for secure anchoring even in the absence of valve calcium (C and G). Release of the upper stent part completes deployment of the valve prosthesis (D and H). Reprinted with permission from J Am Coll Cardiovasc Interven, *Vol 7, Sieffert et al., Copyright (2014).*

Mitral Stenosis

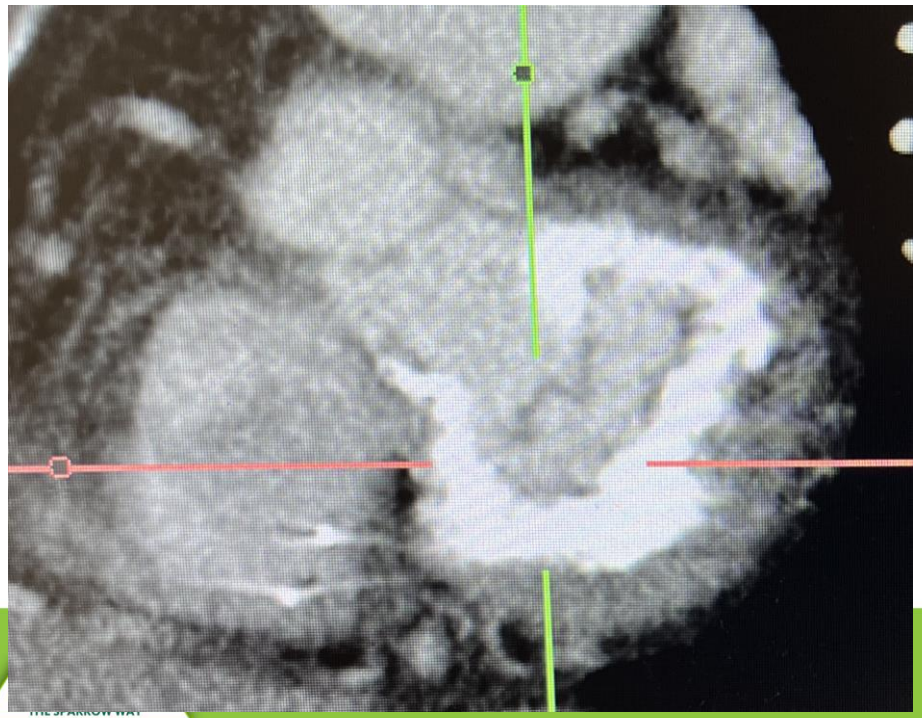


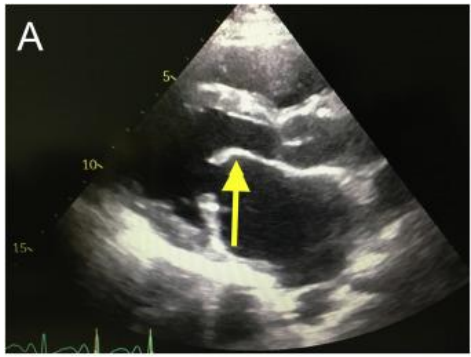
Mitral Stenosis

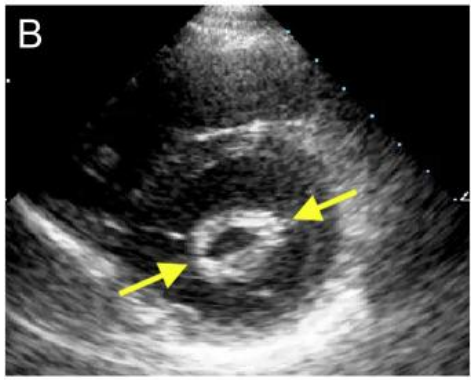
» Almost always rheumatic

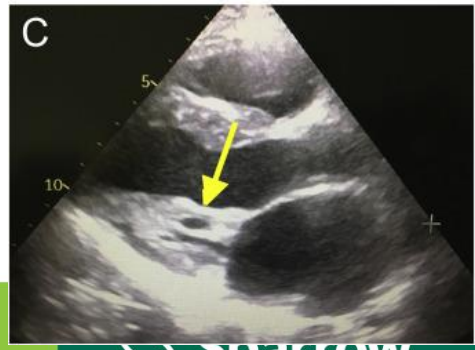
» Calcific (severe mitral annular calcification)

increasing in prevalence 2/2 aging population









Clinical Symptoms

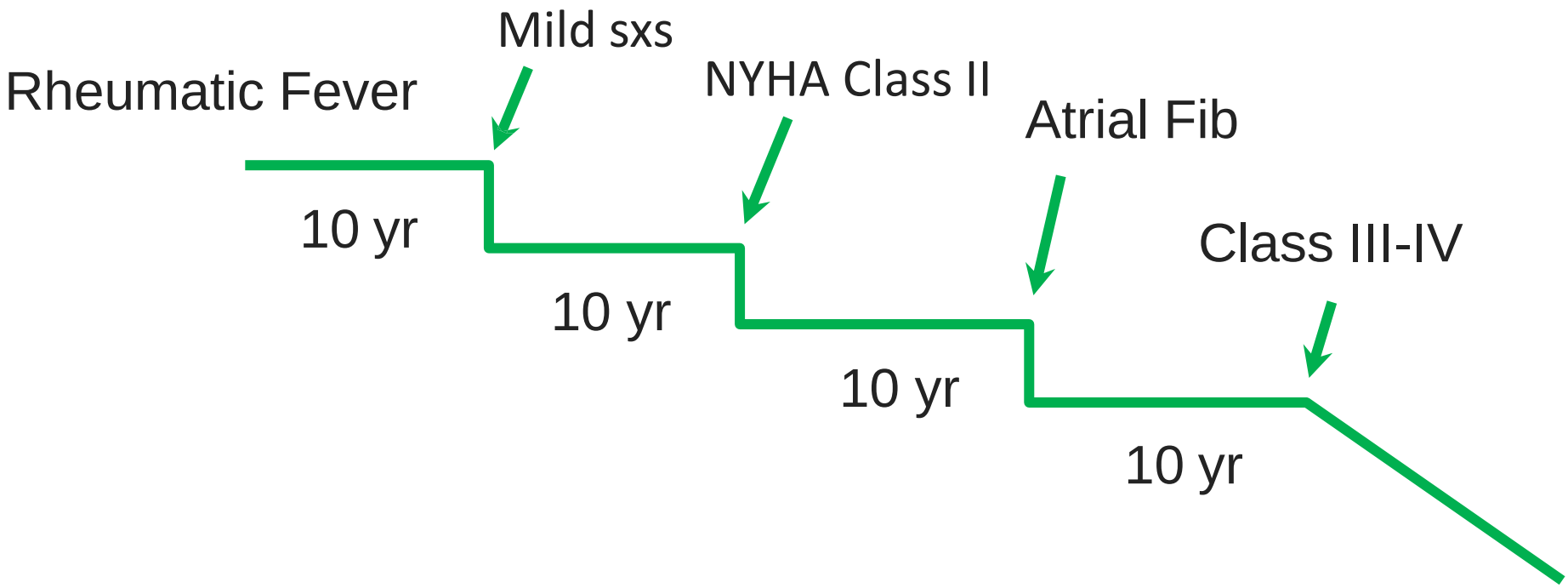
- Dyspnea, PND, orthopnea
  - Slow progressive course
  - May not admit to symptoms
- Hemoptysis
- Palpitations
- Emboli

Echocardiography

- This is the gold standard for diagnosis and grading of MS
- Remember Heart Rate

2D Anatomical features

Doppler Exercise HDs


Rheumatic Fever
Mild sxs
NYHA Class II
Atrial Fib
Class III-IV
10 yr
10 yr
10 yr
10 yr

Treatment

- Remember gradient is heart rate related
  - Control HR with BB
- For Afib
  - CHADSVASc Does NOT apply!
  - Warfarin for all patients (regardless of CHADSVASc)
- Avoid inotropes!

Treatment for Rheumatic MS
Mitral Balloon Valvuloplasty

- For symptomatic patients:
  - For NYHA Class II-IV
  - Atrial fibrillation
  - Pulmonary hypertension
- Pliable Valve (Wilkins Score <8)
- Contraindicated in:
  - Moderate MR (>2+)
  - LA thrombus

Tricuspid Regurgitation

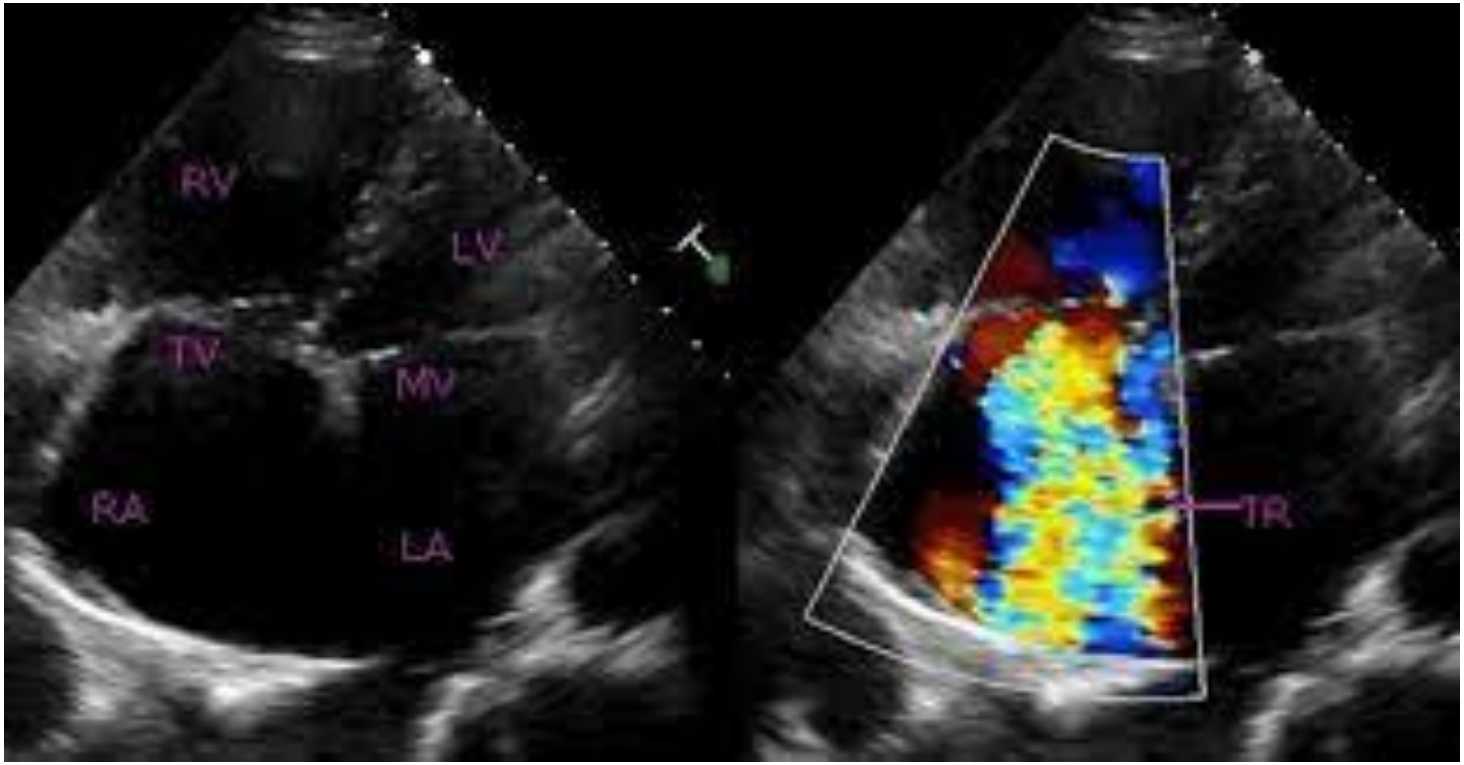
Etiology

- Primary
  - Rheumatic
  - Congenital
  - Endocarditis
  - Carcinoid
  - Pacemaker leads
- Secondary
  - Dilated Cardiomyopathies
  - Pulmonary hypertension
  - Atrial fibrillation with annular dilatation

Clinical Presentation

- Symptoms
  - Fatigue
  - Peripheral edema
  - Ascites
  - Notice it is NOT SOB / DOE
- Physical exam
  - Elevated JVP
  - Hepato-jugular Reflux with enlarged liver

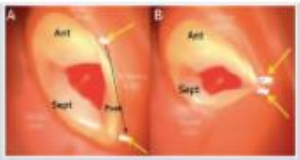
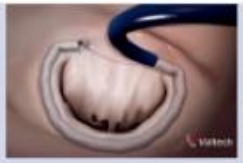
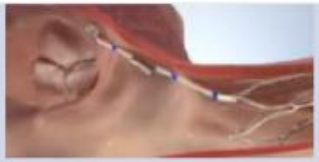
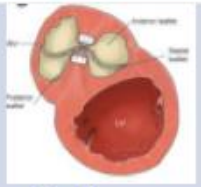
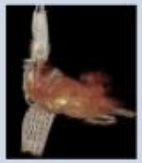
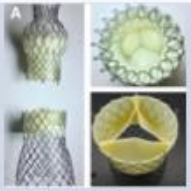
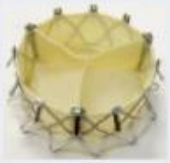
Echo



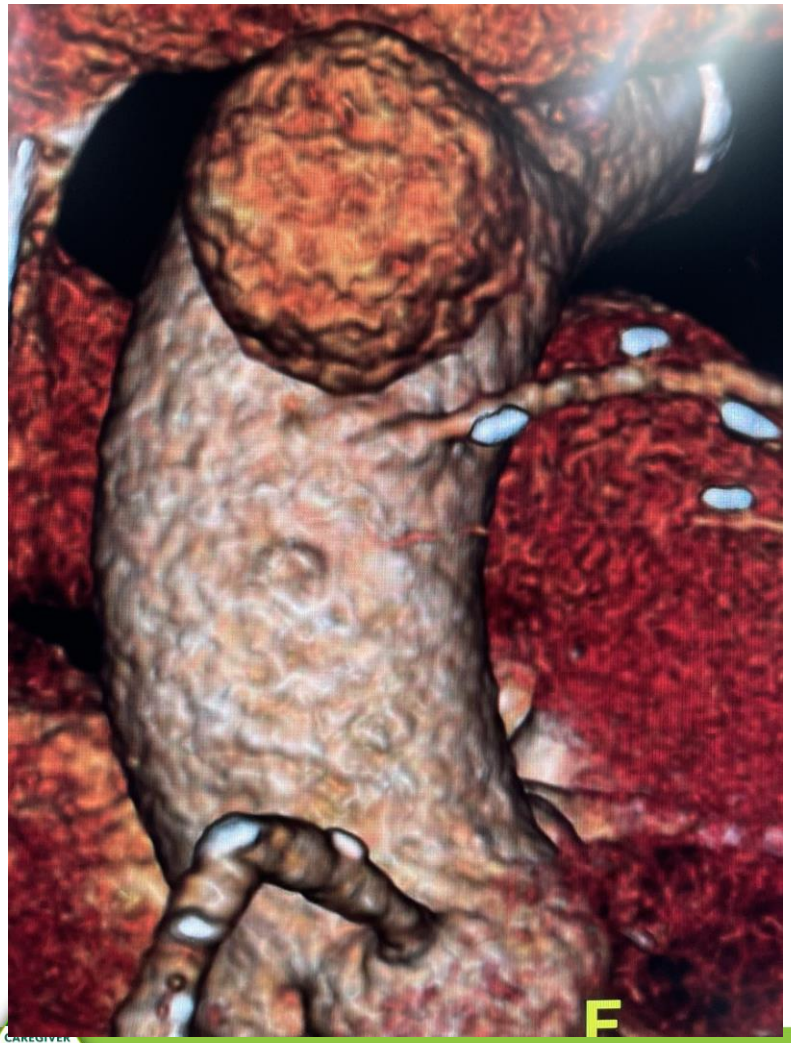
Treatment

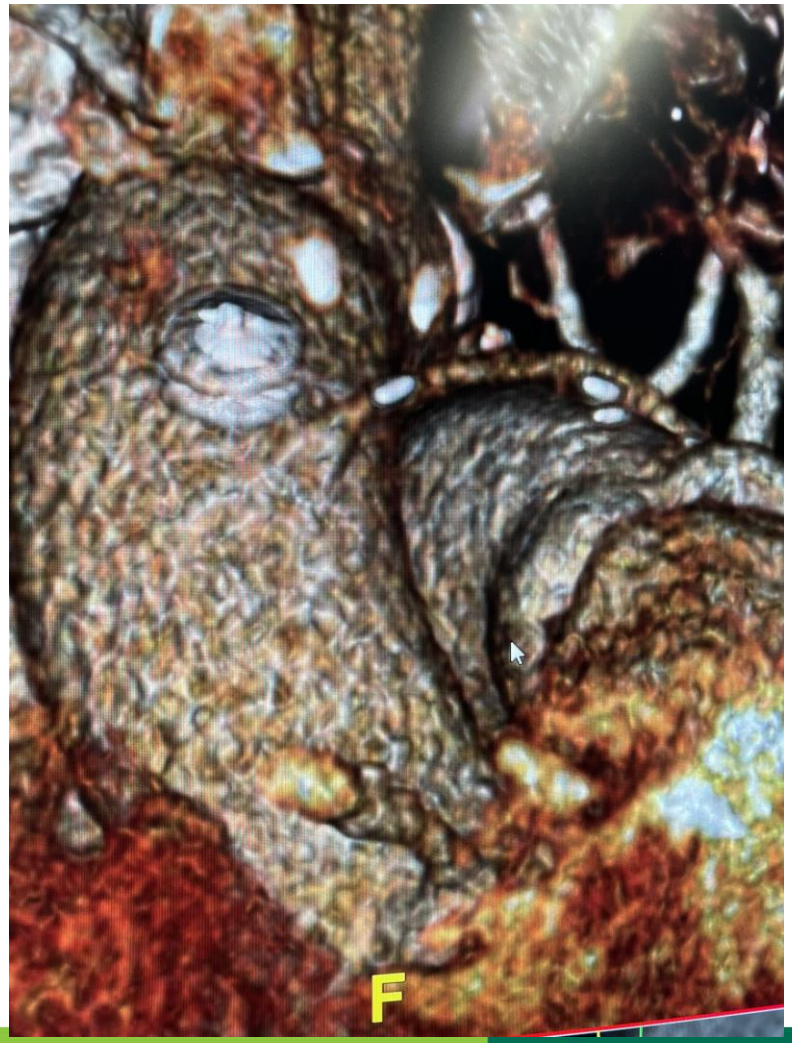
- Medical
  - Observe asymptomatic disease
  - Diuresis
- Surgical
  - Often can repair instead of replace (annuloplasty band)
  - Repair moderate+ TR if other cardiac surgeries
- Trans-catheter options (trials ongoing)

Trans-cathter Options?

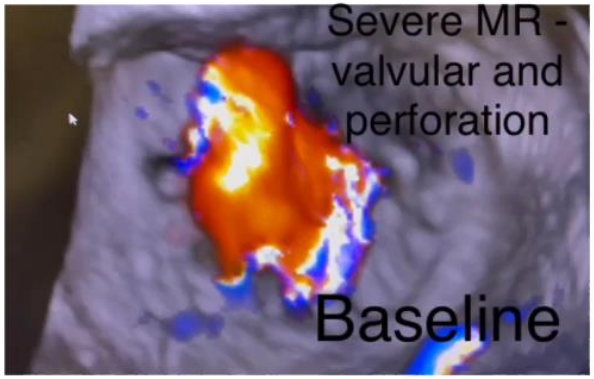
Mechanism	New Technologies
Annuloplasty (Direct and Indirect)	 TriAlign  Cardioband  4Tech  Millepede  Pasta
Leaflet Devices	 Forma  MitraClip  PASCAL
Stented Valves in IVC/SVC	 Trinity /Sapien  TriCentro  TricValve
Valve Replacement	 Navigate  EVOQUE

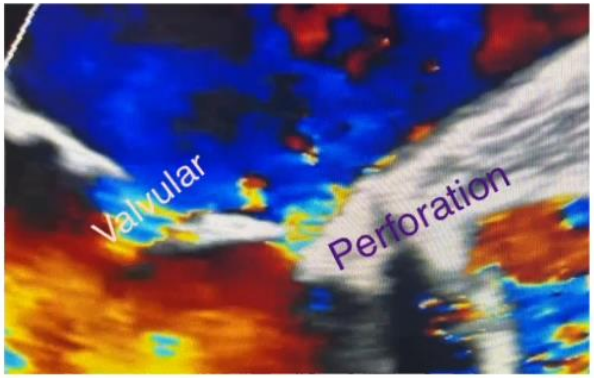
Novel Transcatheter Procedures
Post CABG Ascending Aneurysm Closure

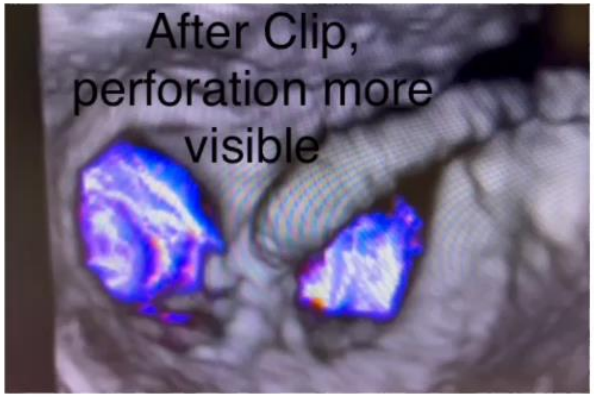


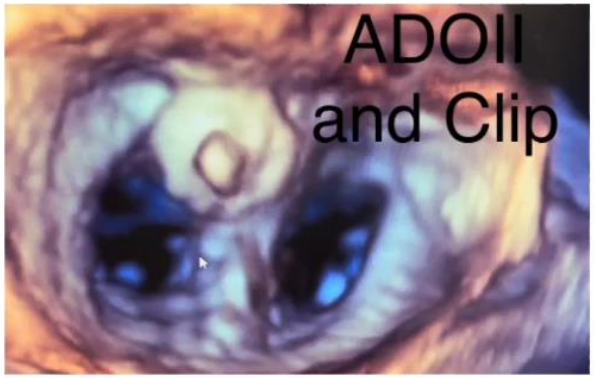


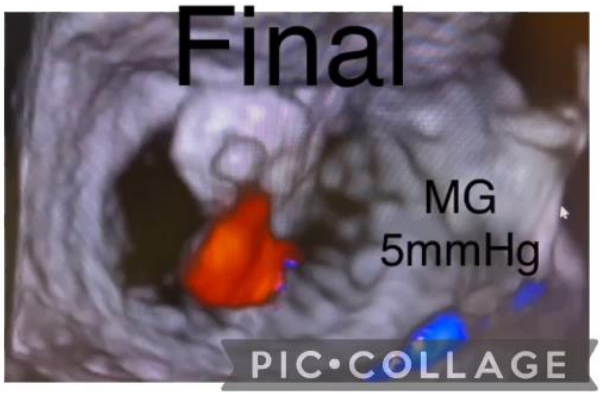
Novel Transcatheter Procedures
Post Dissection Surgery – Repair of Mitral valve leaflet perforation



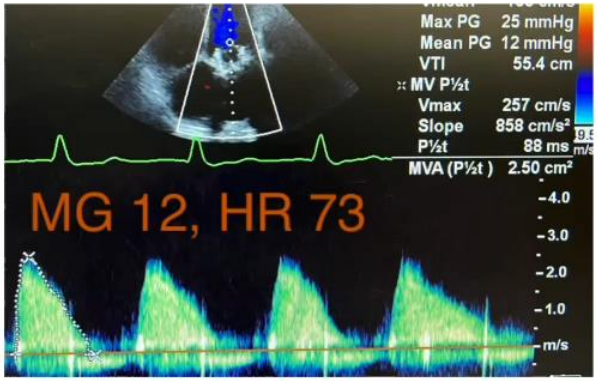


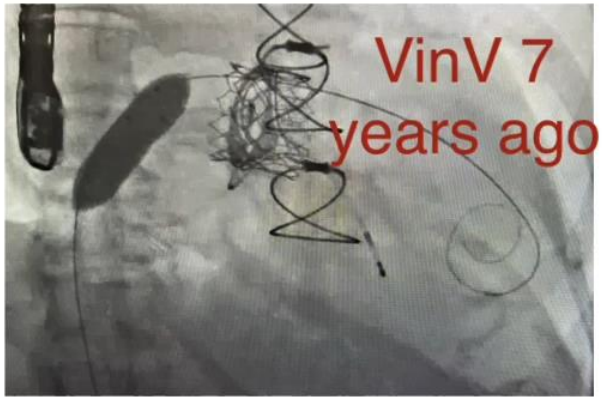


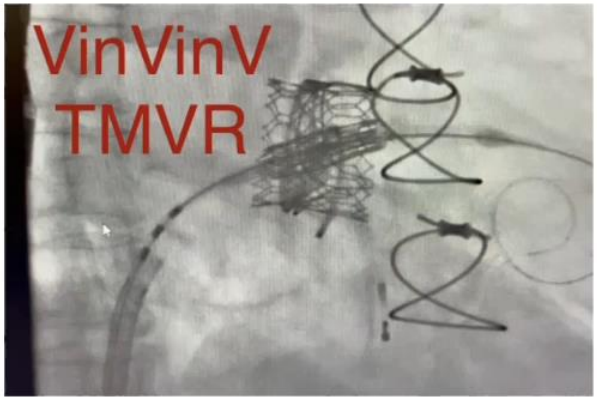


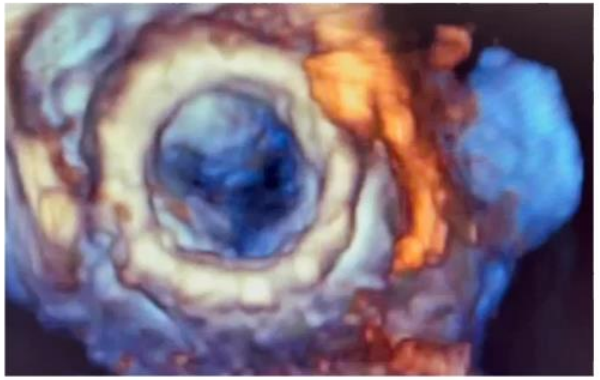


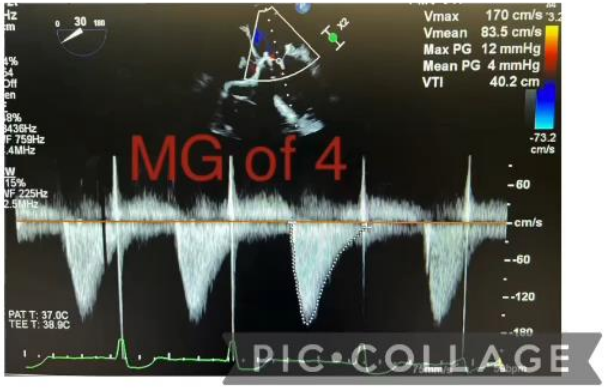
Novel Transcatheter Procedures
Mitral Valve in Valve in Valve Transcatheter Replacement







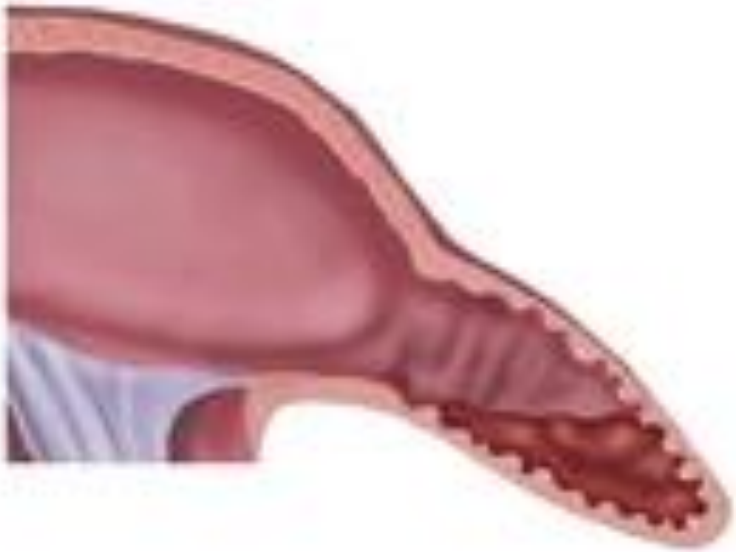


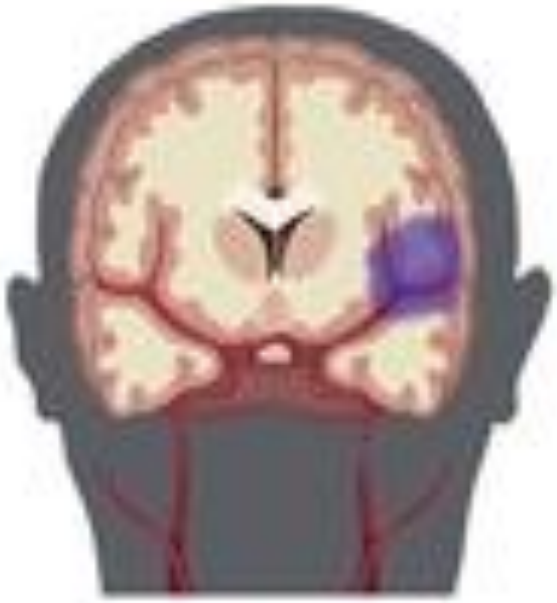


PATIENT
CAREGIVER
VISION
MISSION
VALUES
PILLARS OF EXCELLENCE
THE SPARROW WAY

Sparrow

Stroke Prevention In Atrial Fibrillation: Left Atrial Appendage Occlusion





Left Atrial Appendage Occlusion Candidates

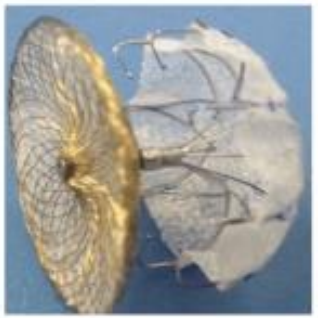




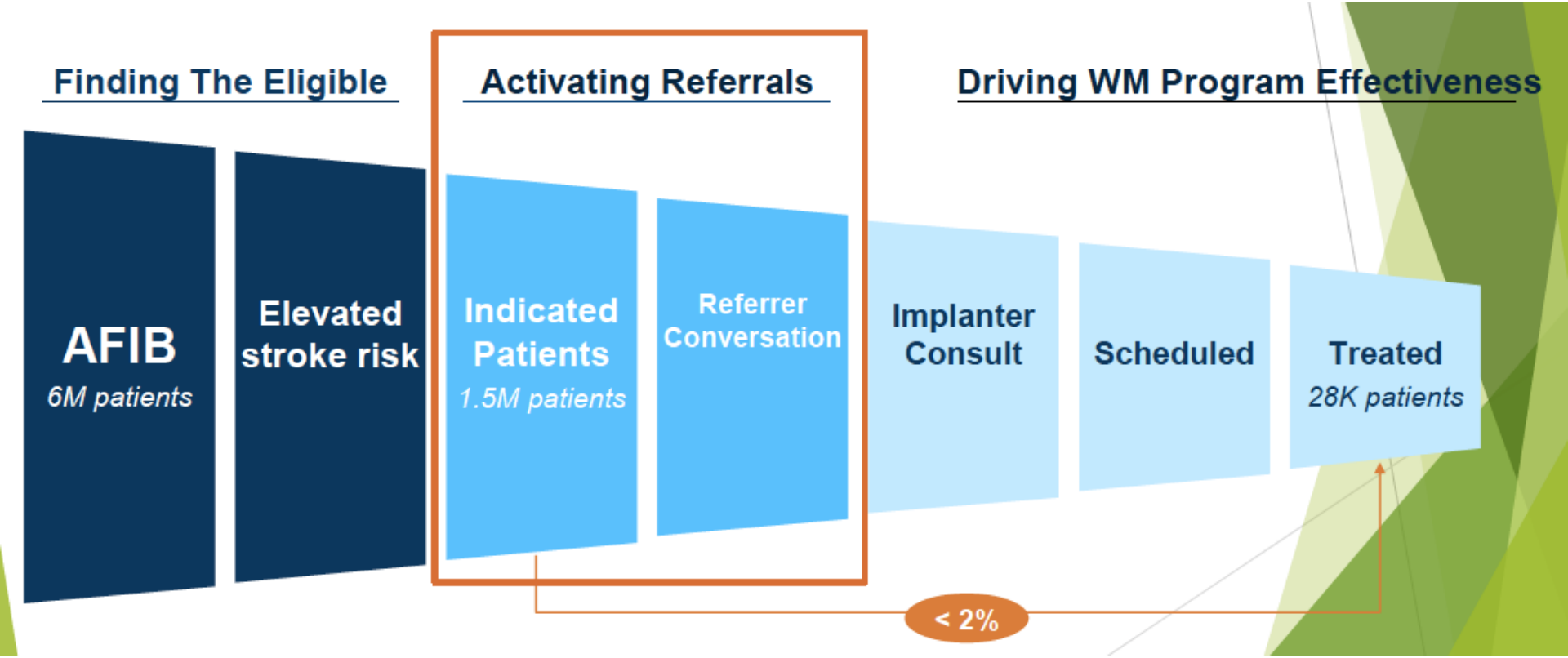
Drug Interactions	Bleeder	Future Bleeder	Non-Compliant	Lifestyle
Not suitable for long-term warfarin use due to other medical treatment needs	History of major and/or non-major bleeding	No prior bleeds but high-risk / include fall risk	Tolerant, but not taking OAC	Patient prefers device over OAC

Left atrial appendage occlusion

» A treatment option for patients with atrial fibrillation who are at high stroke risk and high bleeding risk

	Watchman	Amulet	Lambre	Wavecrest	LARIAT
Design	Parachute-shaped	Lobe and disk	Cover and umbrella connected via a central articulating waist	Umbrella-shaped	Epicardial ligation system guided by an endocardial magnetic-tipped wire
Sizes	5 sizes (21, 24, 27, 30, 33 mm)	8 sizes (16, 18, 20, 22, 25, 28, 31, 34 mm)	11 sizes (16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36 mm)	3 sizes (22, 27, 32 mm)	W40 × H20 × L70 (Lariat+: W45)
Sheath	14 F	12–14 F	8–10 F	12 F	12 F
Image					

LAAO Is Under-utilized for Stroke Prevention



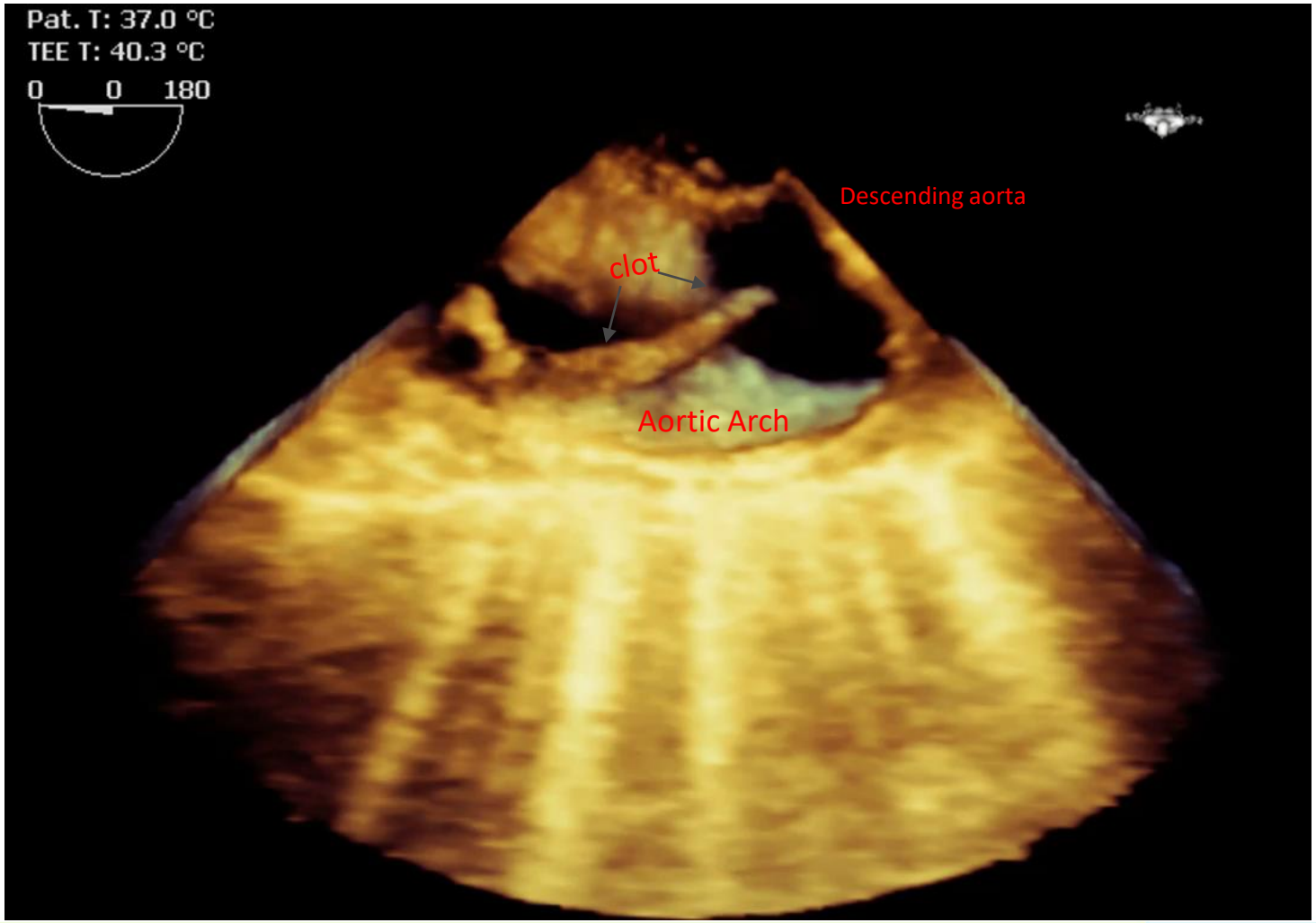
The Left Atrial Appendage Closure Program At Sparrow

- At Sparrow hospital, we are performing LAAO procedures utilizing:
  - CT pre-screening method (eliminating pre-screening with TEE)
  - Intra-procedural ICE (eliminating procedure TEE)
  - Conscious sedation (no general anesthesia required)
- Highest volume program in Michigan (for ICE guided LAAO)

New Frontiers in Cardio-embolic or vascular-embolic

- Case example: 50 y/o F presented with stroke and systemic embolism
- Work up was negative (labs, TTE with contrast, no atrial fibrillation, hematology work up)
- TEE showed the following:

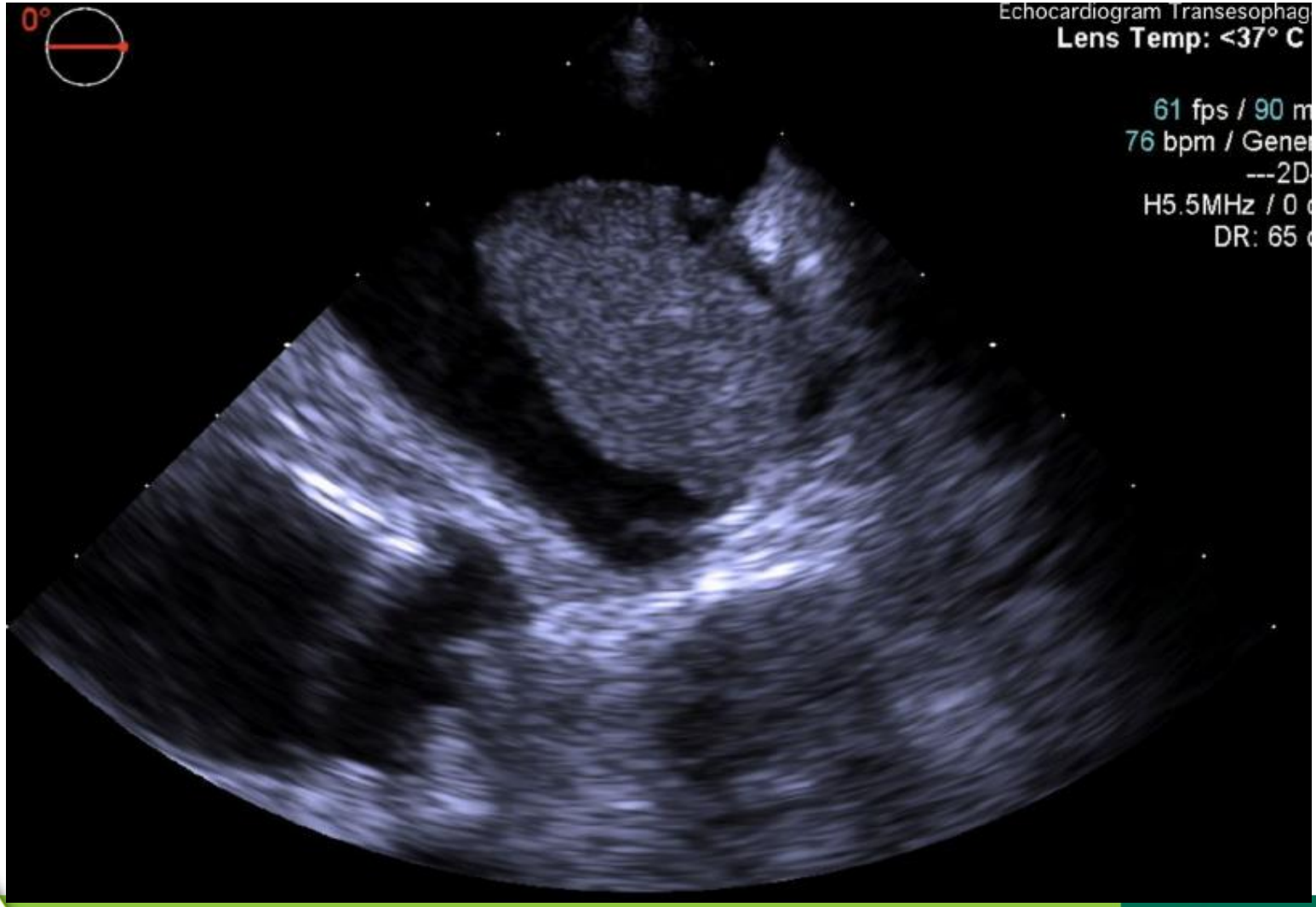
TEE


Pat. T: 37.0 °C
TEE T: 40.3 °C
0 0 180
Descending aorta
clot
Aortic Arch

How would you approach this case?

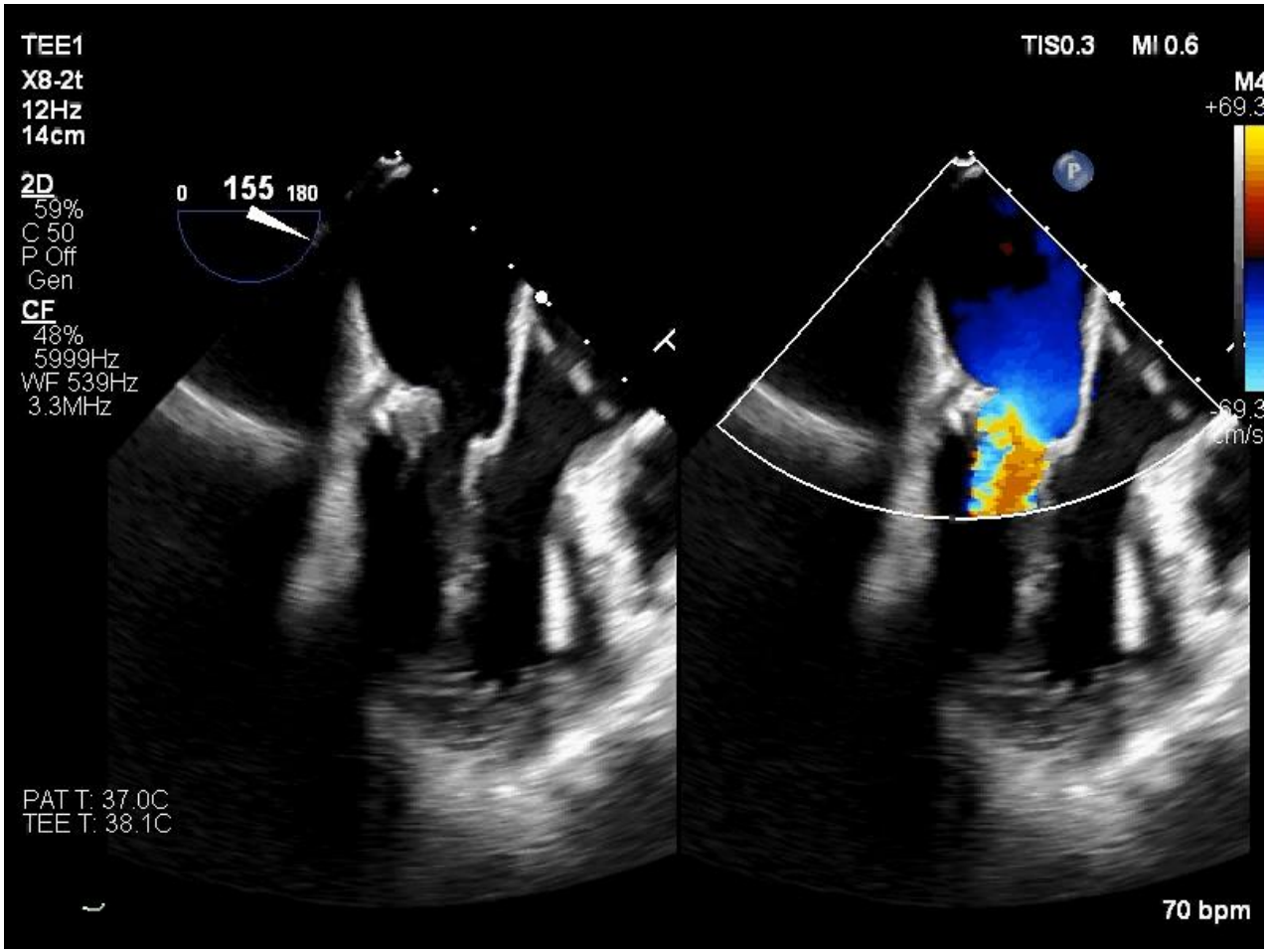
- Medications
- Surgery
- Other options?

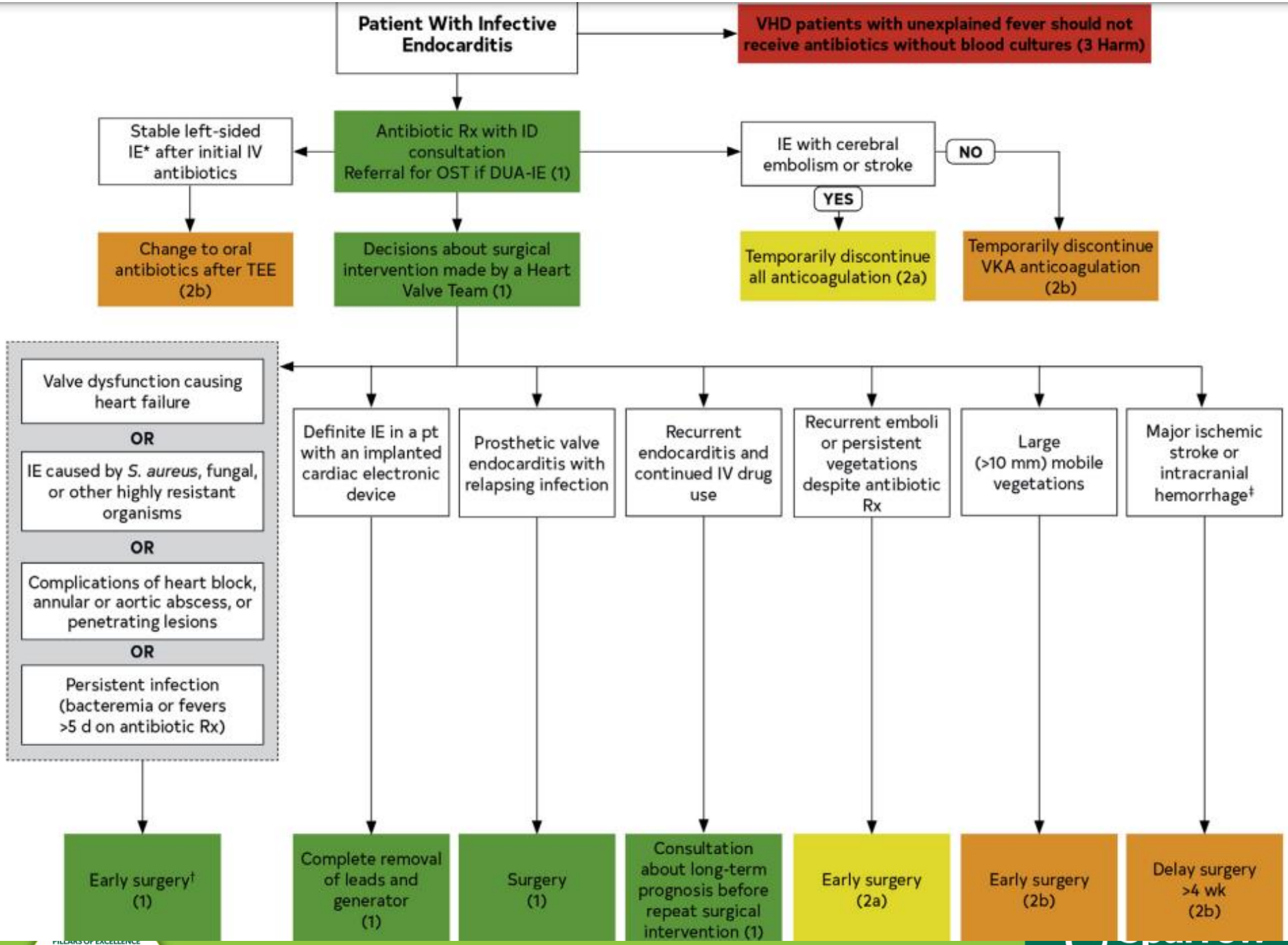
Another case



One More

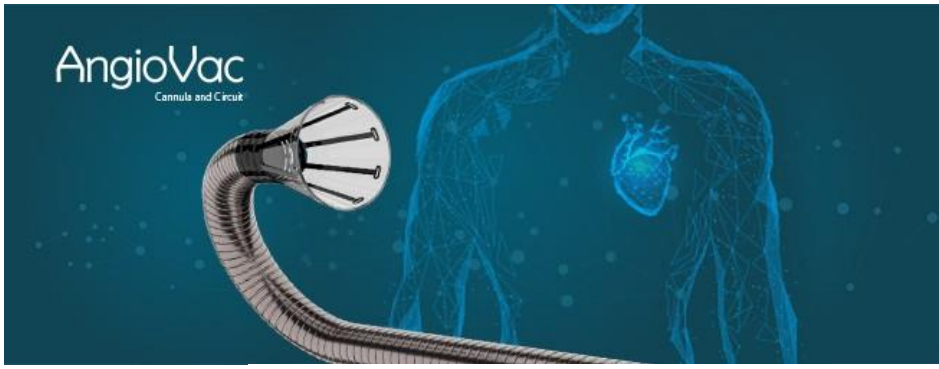
- 65 y/o patient with prior MVr with a ring now coming in with TIA
- Work up is negative
- TEE shows a small mobile mass on the posterior aspect of the mitral ring

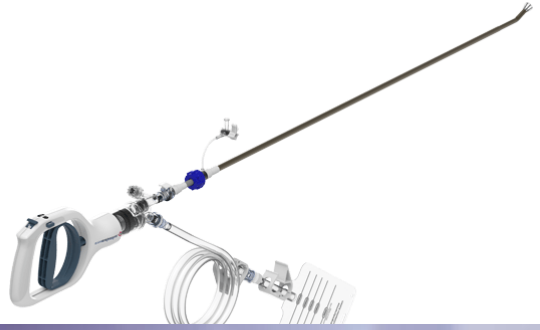

TEE1
X8-2t
12Hz
14cm
2D
59%
C 50
P Off
Gen
CF
48%
5999Hz
WF 539Hz
3.3MHz
0
155
180
TIS0.3
MI 0.6
M4
+69.3
-69.3
cm/s
P
PAT T: 37.0C
TEE T: 38.1C
70 bpm


Patient With Infective Endocarditis
VHD patients with unexplained fever should not receive antibiotics without blood cultures (3 Harm)
Stable left-sided IE* after initial IV antibiotics
Antibiotic Rx with ID consultation
Referral for OST if DUA-IE (1)
IE with cerebral embolism or stroke
NO
YES
Change to oral antibiotics after TEE (2b)
Decisions about surgical intervention made by a Heart Valve Team (1)
Temporarily discontinue all anticoagulation (2a)
Temporarily discontinue VKA anticoagulation (2b)
Valve dysfunction causing heart failure
OR
IE caused by S. aureus, fungal, or other highly resistant organisms
OR
Complications of heart block, annular or aortic abscess, or penetrating lesions
OR
Persistent infection (bacteremia or fevers >5 d on antibiotic Rx)
Definite IE in a pt with an implanted cardiac electronic device
Prosthetic valve endocarditis with relapsing infection
Recurrent endocarditis and continued IV drug use
Recurrent emboli or persistent vegetations despite antibiotic Rx
Large (>10 mm) mobile vegetations
Major ischemic stroke or intracranial hemorrhage‡
Early surgery† (1)
Complete removal of leads and generator (1)
Surgery (1)
Consultation about long-term prognosis before repeat surgical intervention (1)
Early surgery (2a)
Early surgery (2b)
Delay surgery >4 wk (2b)

Trans-catheter Mass Extraction

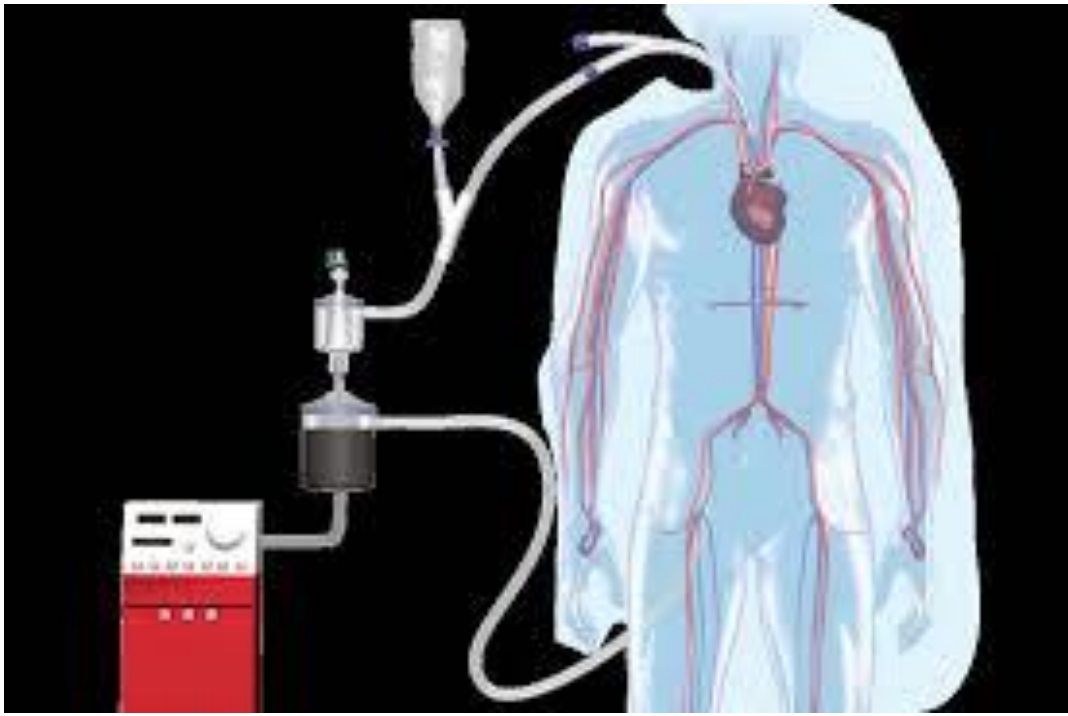
- Angio-vac system
- Alpha Vac
- Pneumbra
- Inari Flowtriever



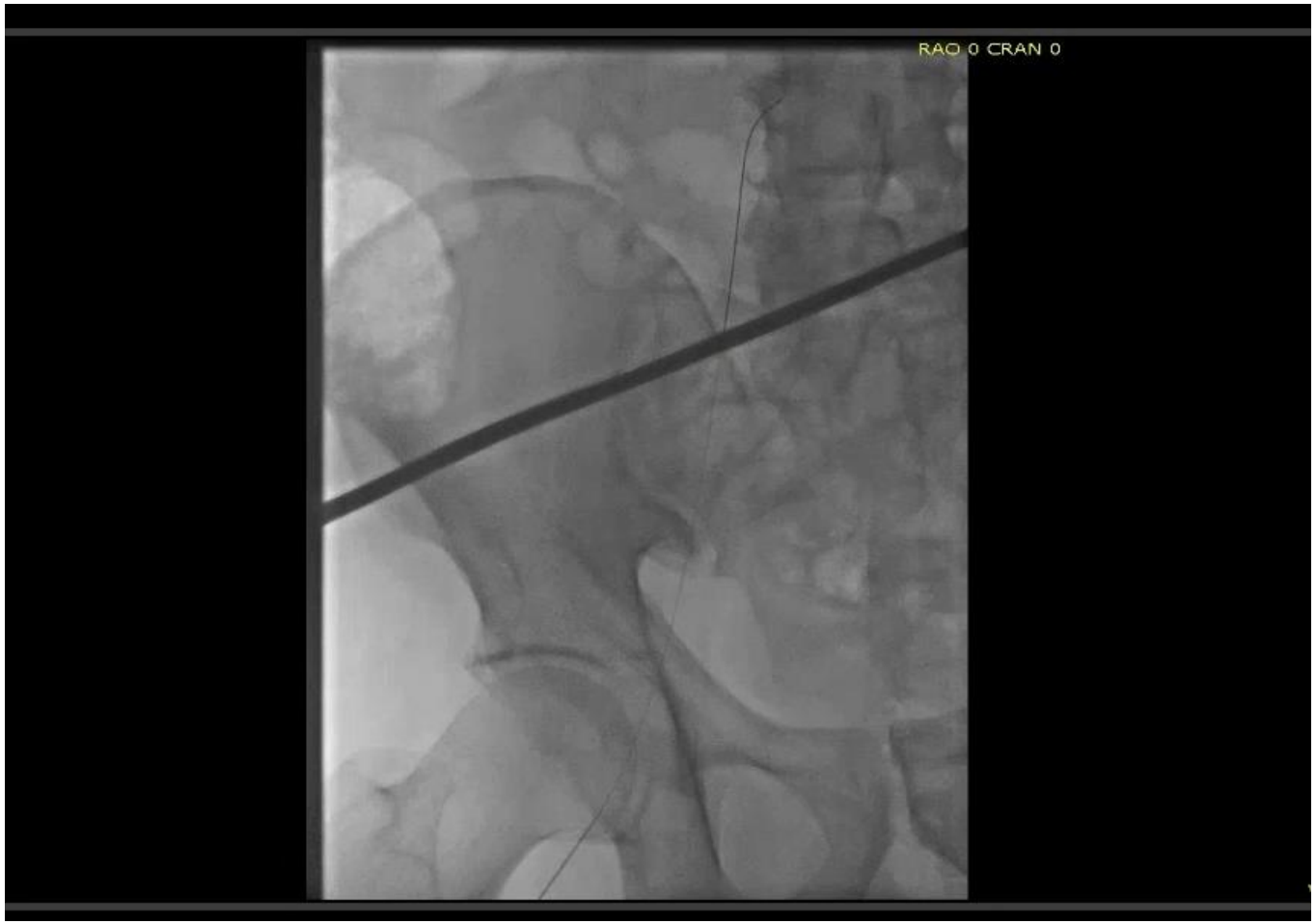


Novel applications – off label use

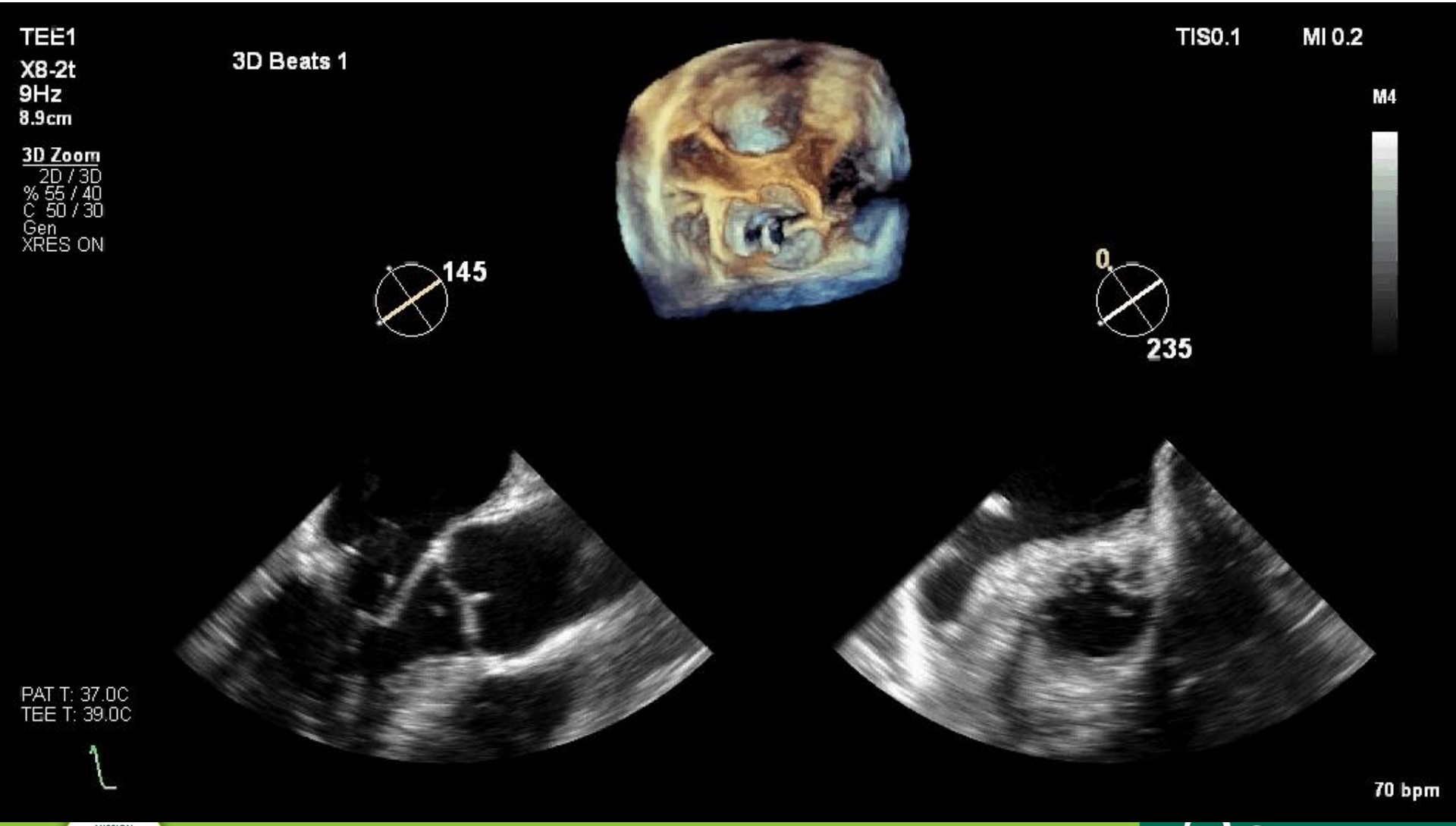
- Indications for right sided heart mass removal
- Off-label, novel application for left sided mass removal



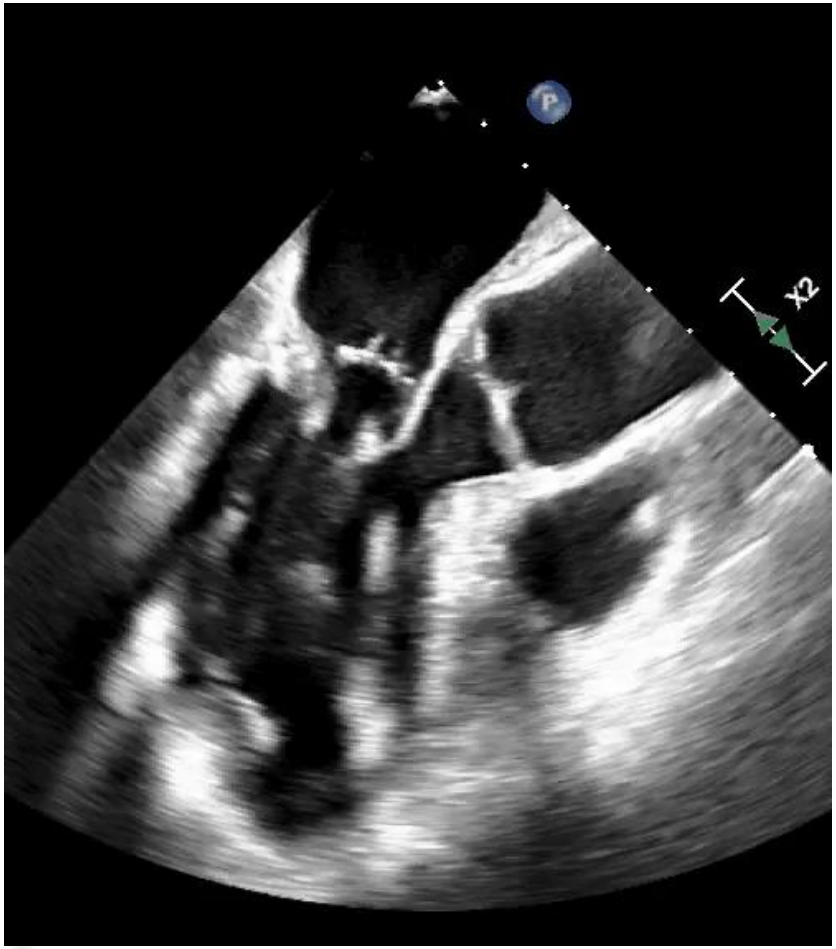
Quick case example – Step by step



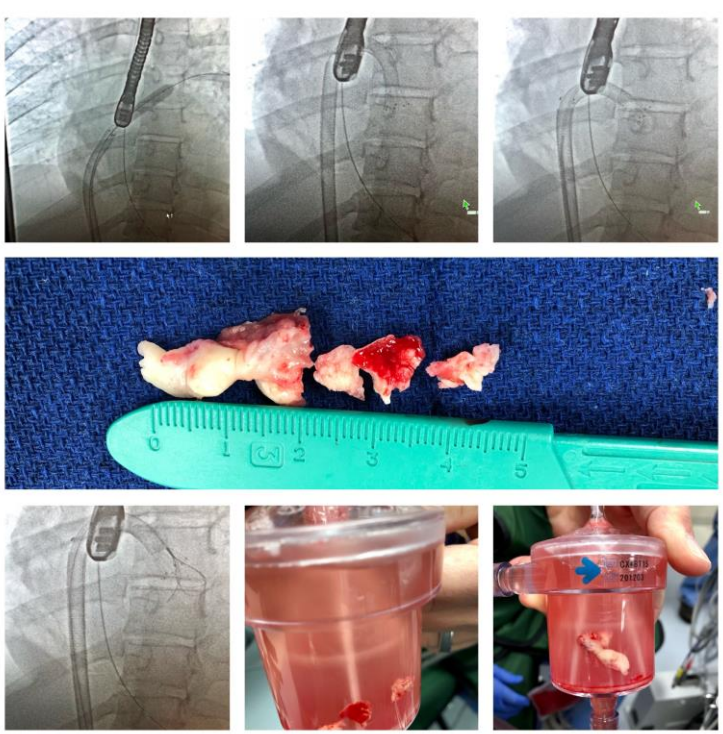
Quick case example – TEE guided

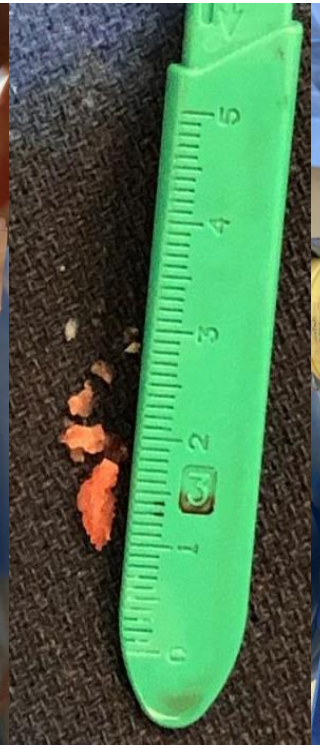


Quick case example – TEE guided

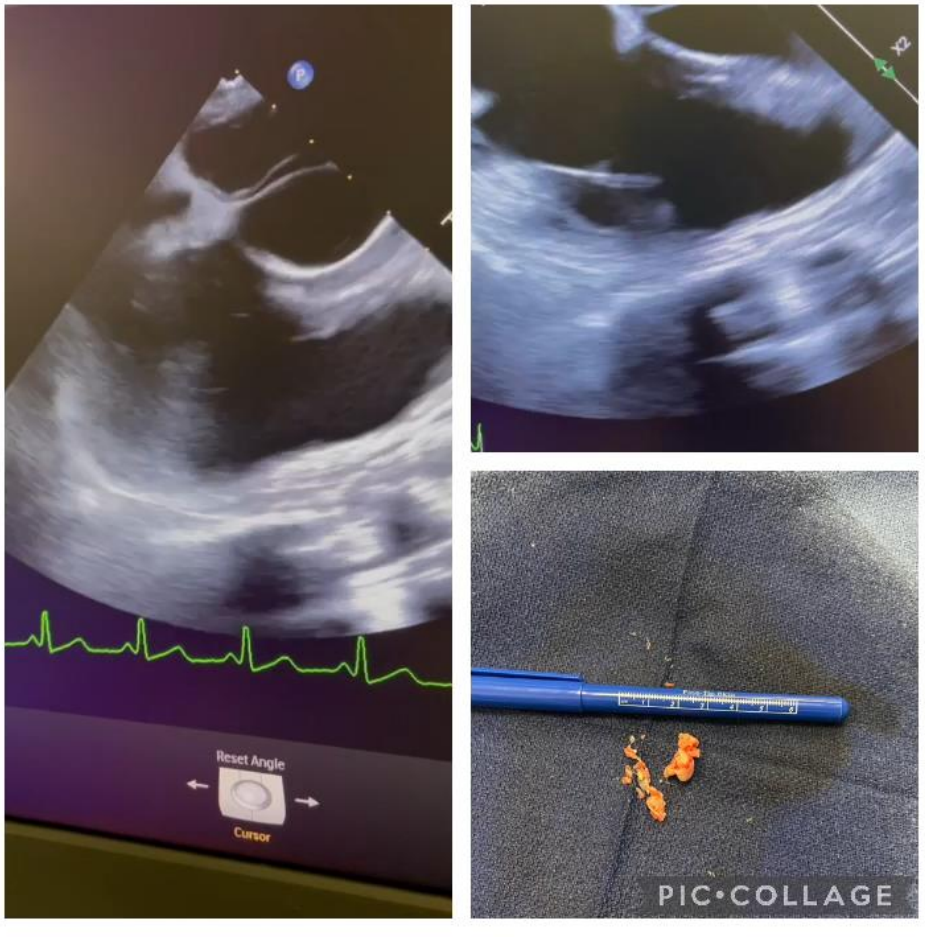


Examples of what can be extracted

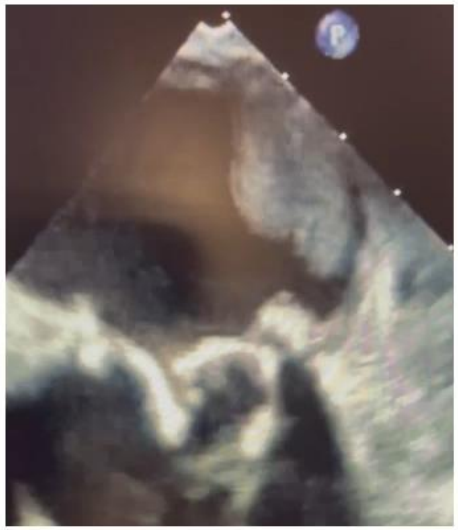


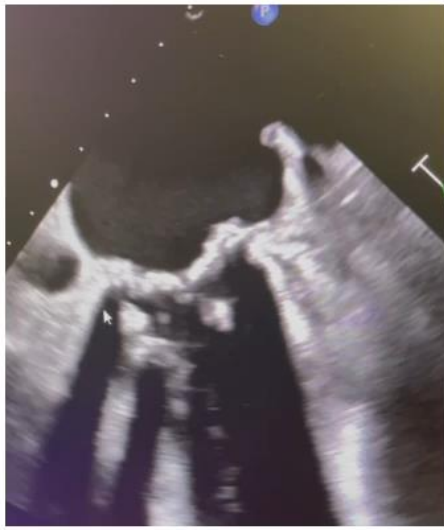


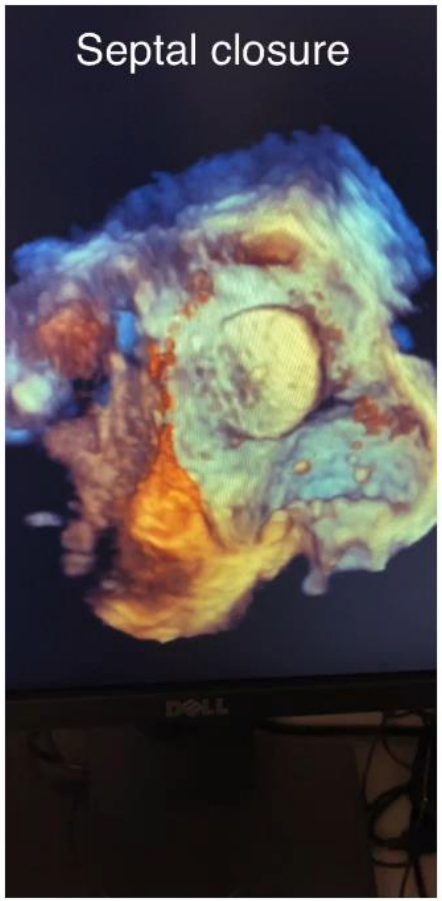
Tricuspid Valve Vegetation with Persistent Bacteremia for >10 days and septic pulmonary emboli

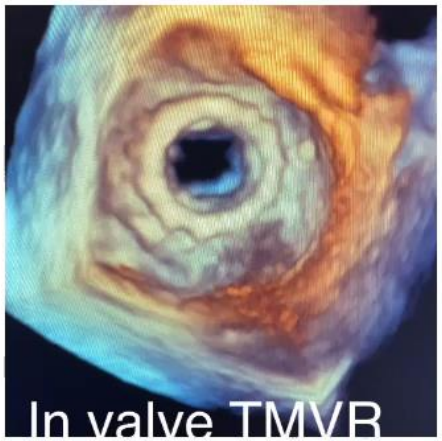


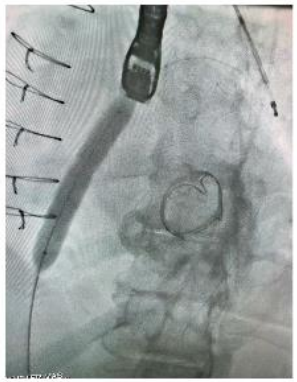
Left atrial thrombus with severe MS from degenerated surgical MV – Combo Angiovac/TMVR ViV

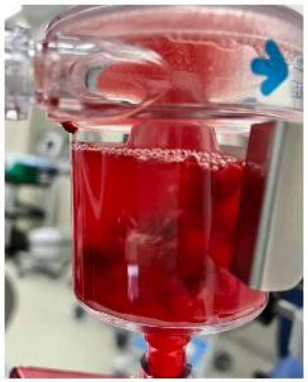


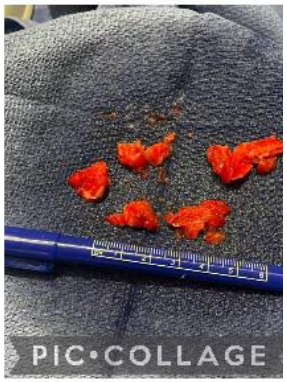




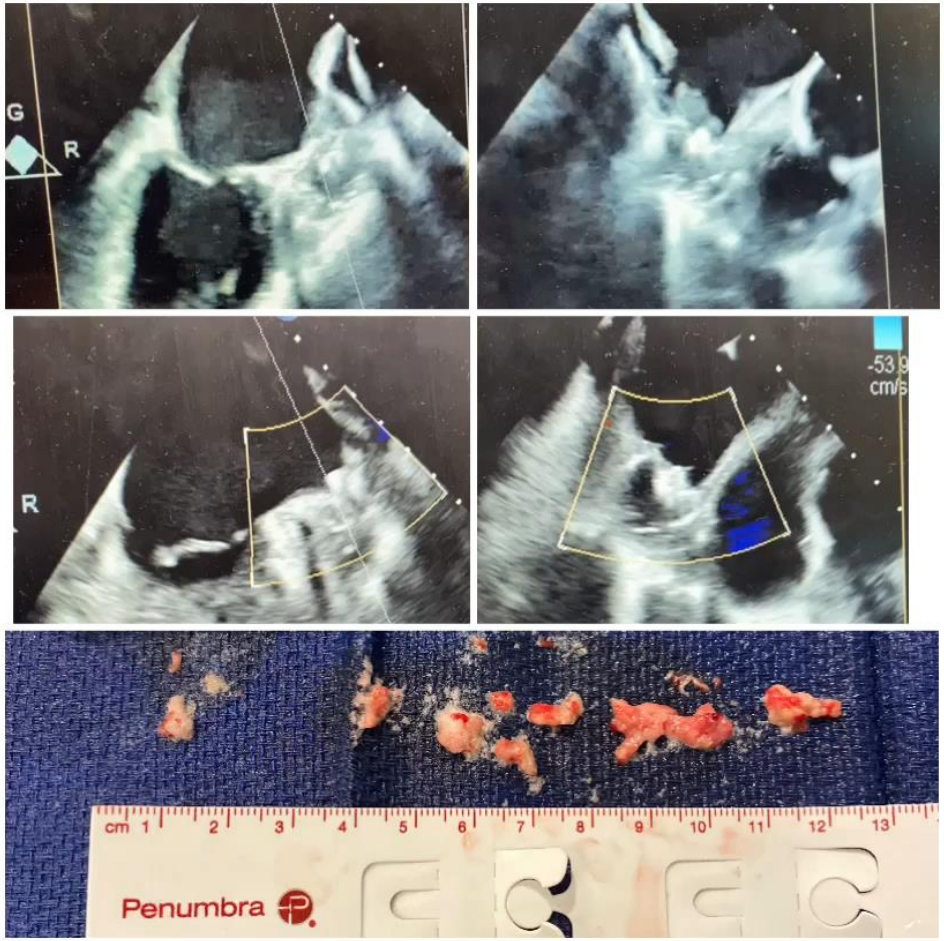






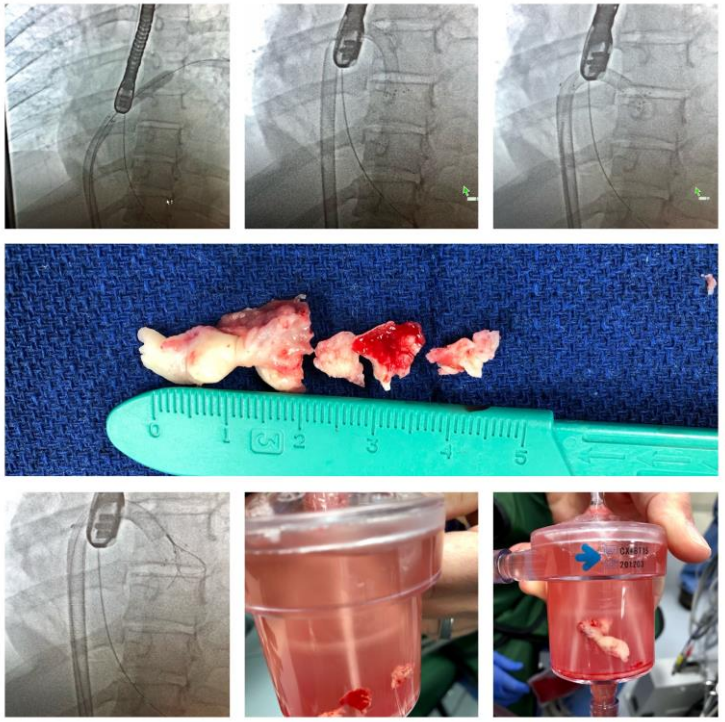


Late device related thrombus on a Watchman from 2015 – Patient unable to tolerate AC 2/2 severe GI bleeding



New Era – data free zone

- Diagnostic tool (the mitral ring mass was a thrombus)
- Therapeutic tool (see table below)



8/30 Blood cx: **MSSA**
8/31 Blood cx: **MSSA**
8/31 Blood cx: **MSSA 2/2**
9/1 Blood cx: **MSSA 4/4**
9/2 Blood cx: **MSSA-1, MSSA-2 2/2**
9/3 Blood cx: **MSSA-1, MSSA-2 2/2**
9/4 Blood cx: **MSSA-1, MSSA-2 2/2**
9/6 Blood cx: **MSSA 4/4**
9/7 Blood cx: **MSSA 2/2**
9/8 Blood cx: **MSSA 2/2**
9/9 Blood cx: **MSSA 2/2**
9/10 Blood cx: **MSSA 4/4**
9/13 Blood cx: **MSSA 2/2**
9/15 Blood cx: **MSSA 1/2**
9/16 Blood cx: **MSSA 2/2**
9/17 Blood cx: **MSSA 2/2**
9/18 Blood cx: **MSSA 2/2**
9/20 Blood cx: **NGTDx2**
9/21 Blood cx: **NGTDx2**
9/22 Blood cx: **NGTD**
9/23 Blood cx: **NGTD**

17 straight bacteremia days

After Angiovac of MV IE

New Era – data free zone

- Case series being collected
- More publications and data to come – stay tuned
- Indications (left sided infective endocarditis, tumors, thrombus)
- Safety
- FDA approval
- Guidelines
- Acceptance by medical community

Summary
Take Home Points

- Echocardiography is the gate-keeper for valvular heart disease
- Have high suspicion for significant valve disease when things are not adding up
  - Very symptomatic patient, mild or moderate valvular disease
  - Use exercise testing often
- Consult Structural Heart Disease service for any questions or concerns (<u>inpatient AND outpatient</u>)

Summary
Take Home Points - 2

- Trans-catheter options exist for:
  - Aortic stenosis
  - Aortic regurgitation (trial only vs off label)
  - Mitral Disease (regurgitation and stenosis)
  - Tricuspid disease (mostly trials vs drive by)
  - HOCM (alcohol septal ablation vs SESAME)
  - Atrial fibrillation (Watchman/Amulet vs trials)
  - Intra-cardiac / vascular masses or thrombi

Multi-disciplinary Structural Meeting

- One stop shop for case discussion; interventional, structural, imaging, CT, CMR, general cardiology experts
- Can be utilized by any physician to discuss cases that benefit from multi-disciplinary expertise
- Can contact the structural heart team for scheduling:
  - Miriam Glardon: Miriam.glardon@sparrow.org
  - Lindsey Montgomery: lindsey.montgomery@sparrow.org
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Questions?

» Thank you for listening


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