Mitral Regurgitation:
Evaluation and Treatment

2020 CHI Cardiology Symposium

8 February, 2020

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Disclosures

None

Objectives:

1. Understand functional vs. degenerative MR
2. Understand MR severity grading
3. Understand indications for surgery/intervention

Outline

Epidemiology/Anatomy

Regurgitation Classification

Myxomatous Degeneration

MR Severity Grading

Guidelines for Management

MitraClip evaluation

COAPT Trial and Secondary MR (sMR)

Epidemiology

Mitral regurgitation

prevalence (any) 70% by TTE

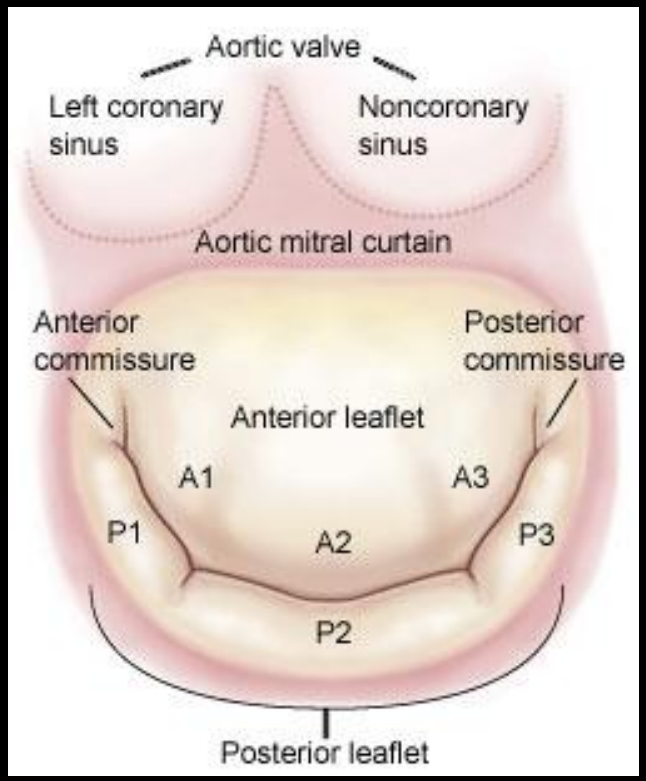
Significant MR (Moderate-Severe)

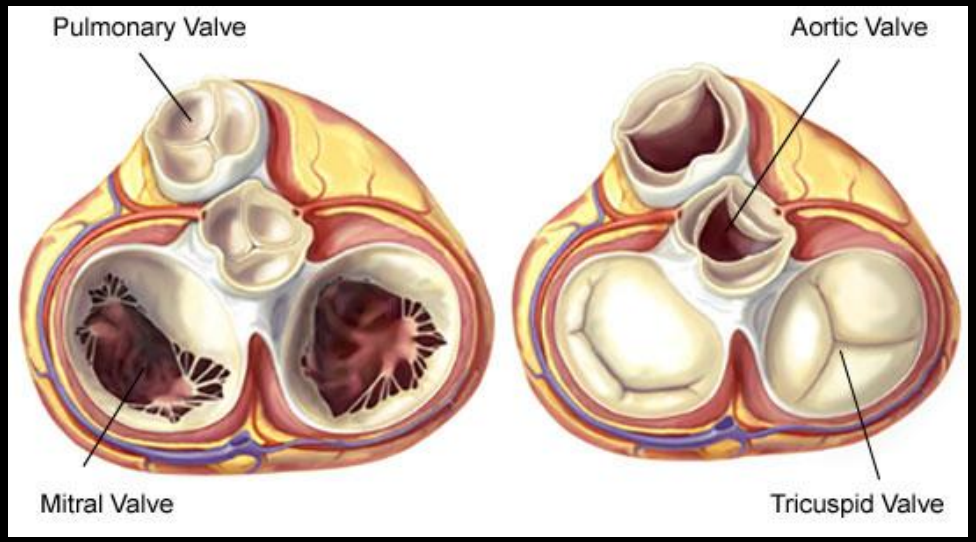
2-3% of general population

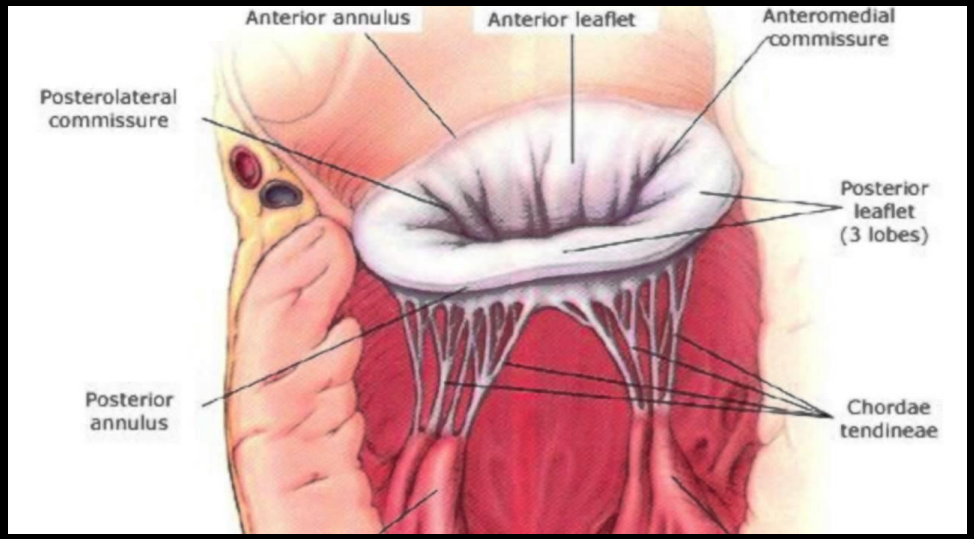
≈ 7-8 million U.S. adults

≈ 150-200 million world wide

Mitral valve anatomy

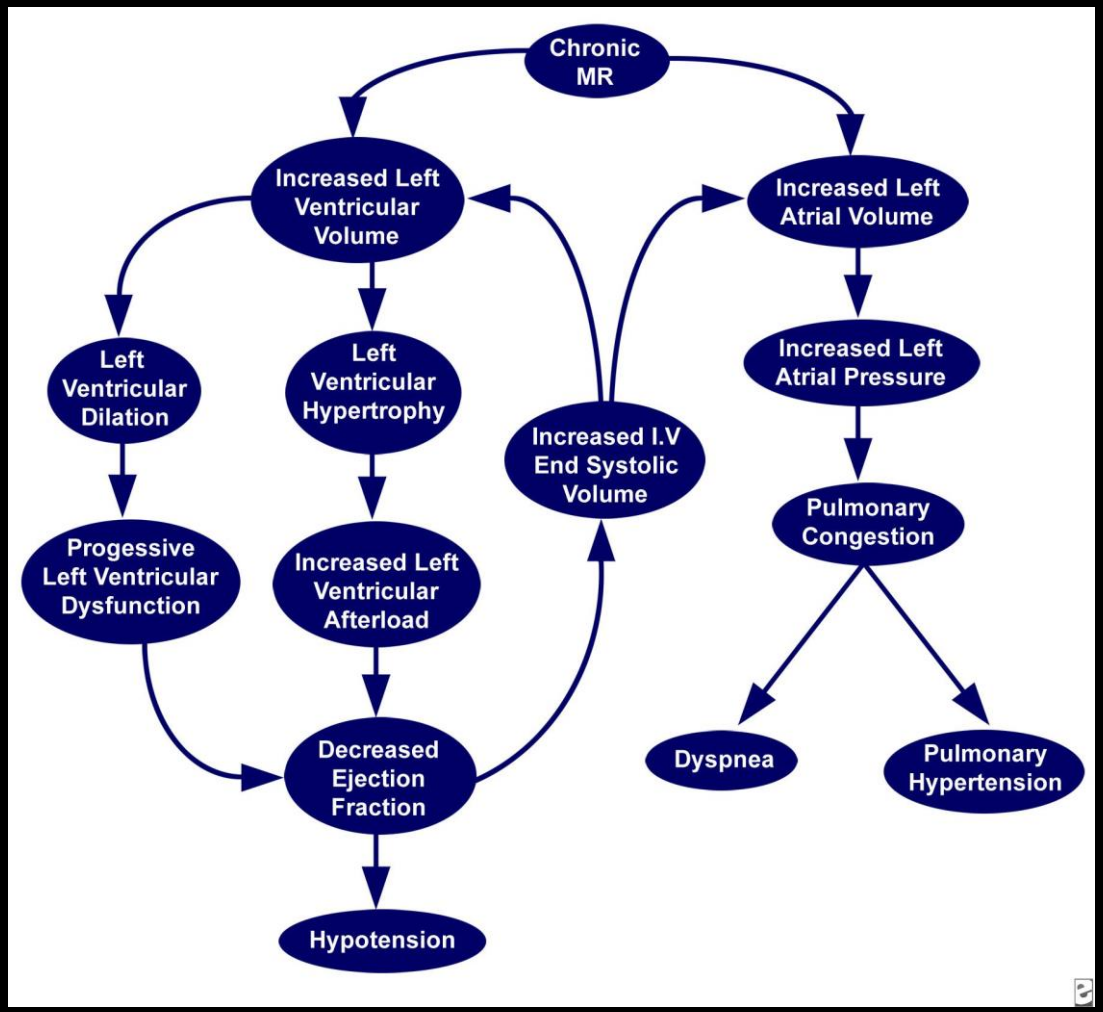






https://www.mitralvalverepair.org/images/mv_anatomy/leaflets.jpg Online access 10/2017.

Pathophysiology



Chronic MR = Volume ↑↑

Insidious process:
Structural Δ's *PRECEDE* sx's

Symptoms:

"Heart Failure"
- Exertional SOB
- Activity Intolerance
- Fatigue
- Edema
- Orthopnea
- Cough

Palpitations (Atrial Fibrillation)

https://emedicine.medscape.com/article/890315-overview#a6

MR Etiology

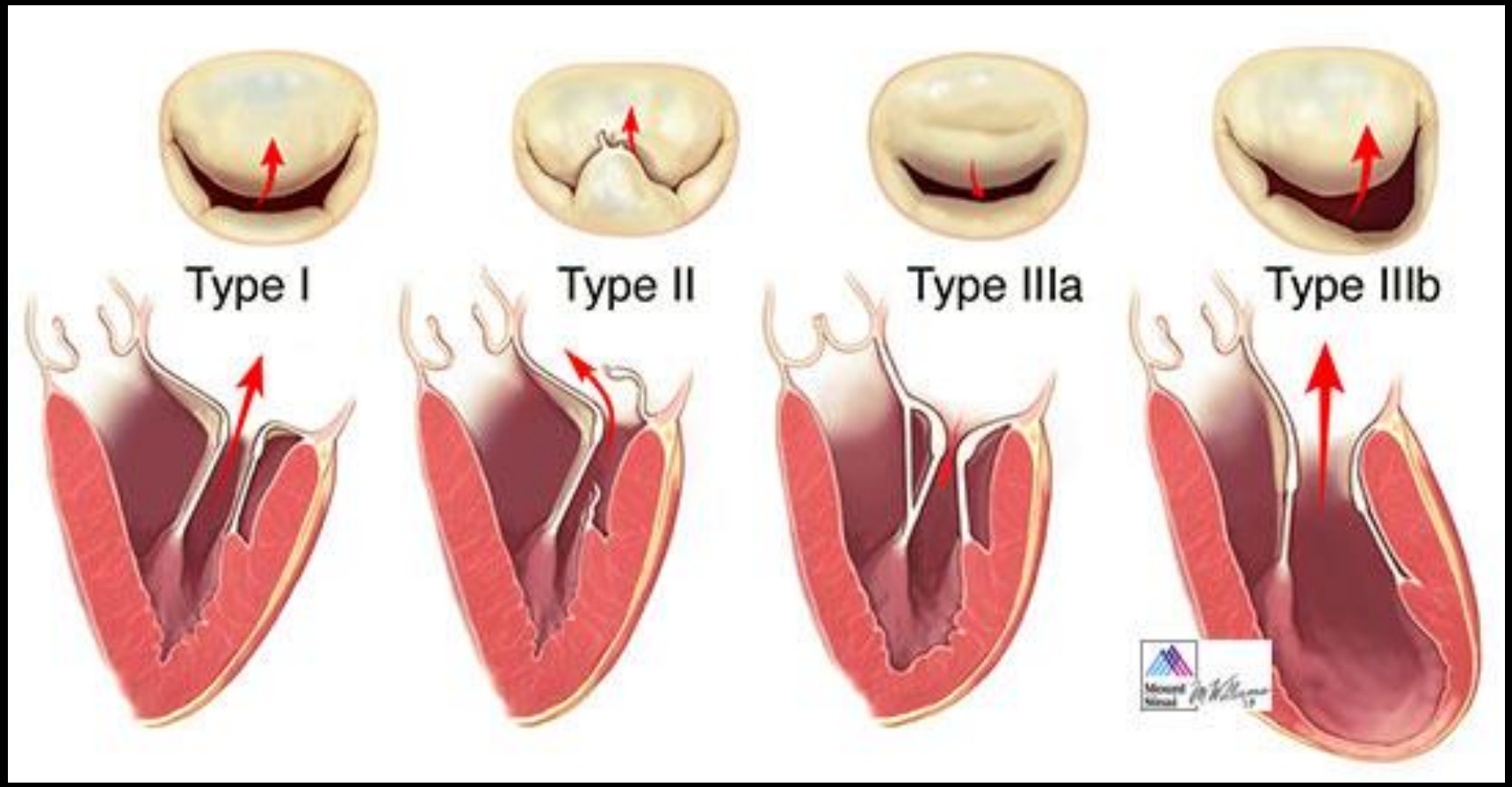
Degenerative (pMR)

- Primary/Organic
- Structural Δ's (prolapse, flail, perforation, etc.)

Functional/Secondary (sMR)

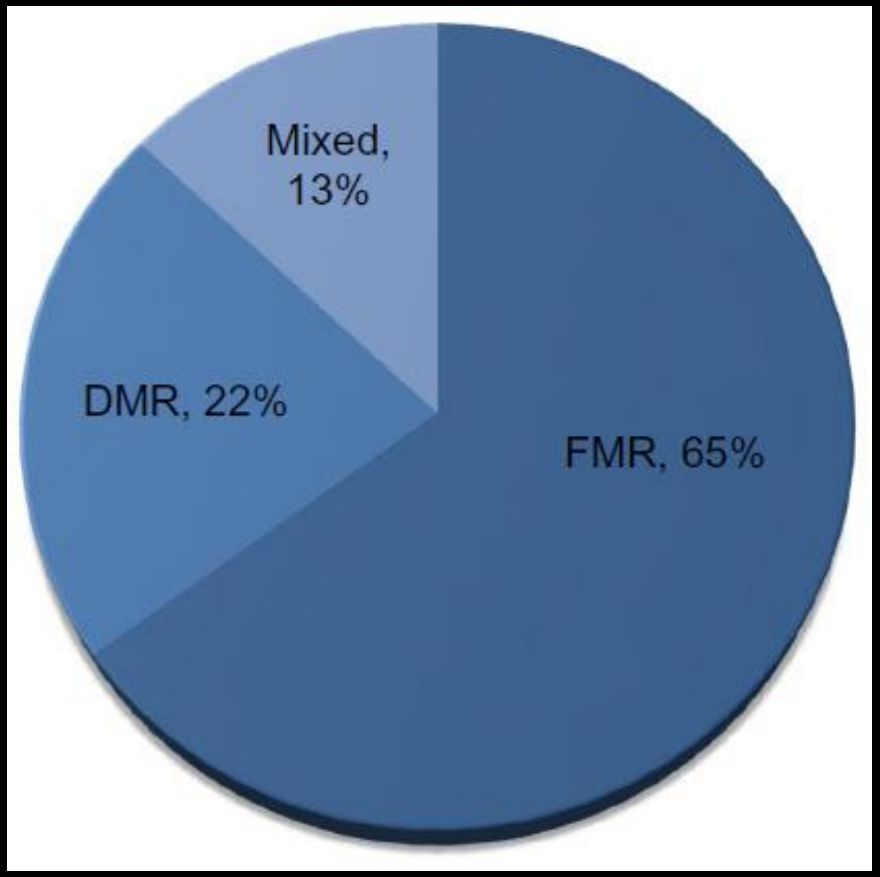
- LV dysfunction/enlargement
- LA/annular dilatation ("Atrial Functional")
- Ca^{++}/Rheumatic degeneration

Carpentier Classification



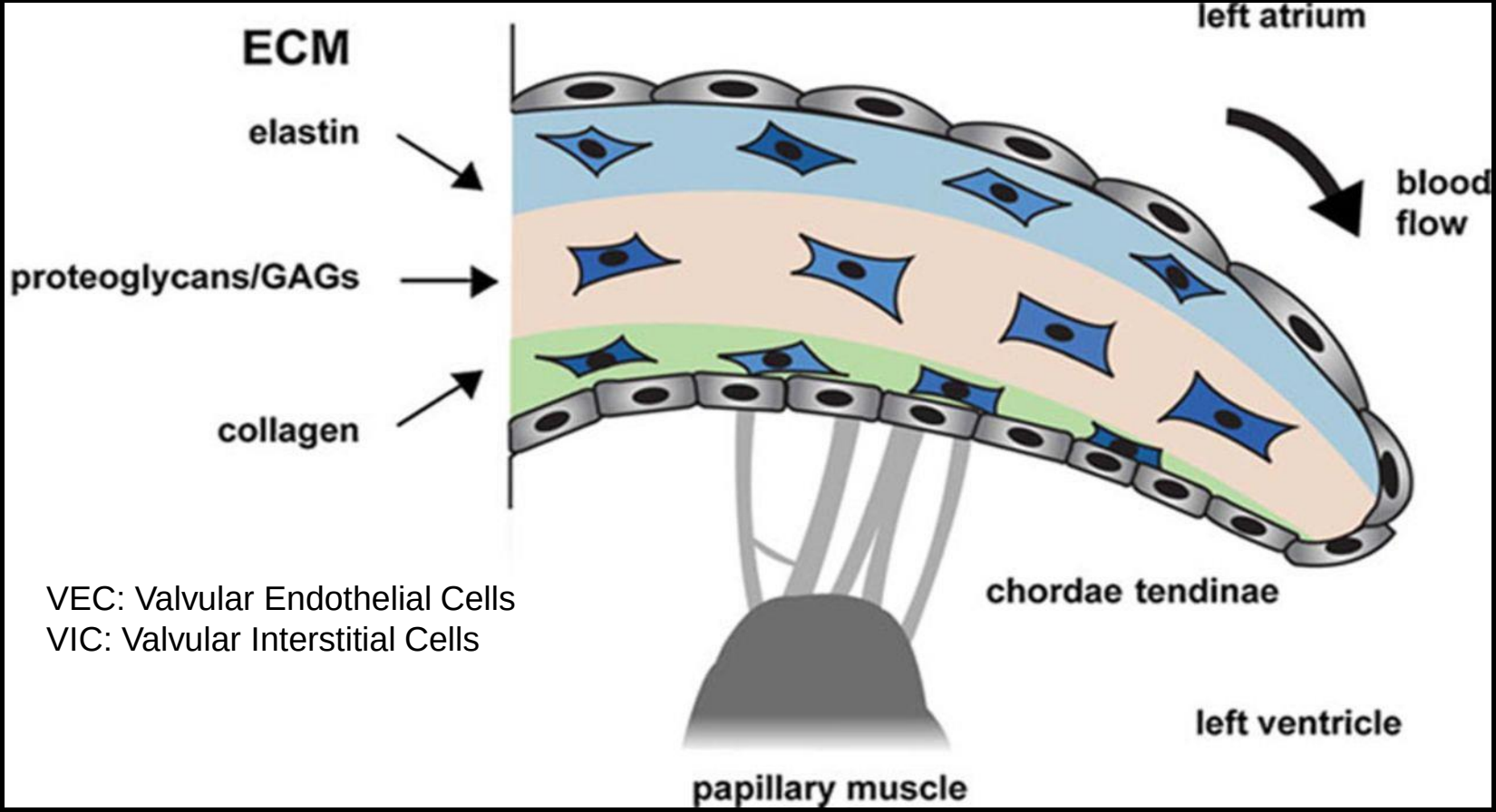
https://www.mitralvalverepair.org/content/view/58/ Access online 10/2017

MR Etiology



> 30,000 pts from 463 centers, Abott 2015

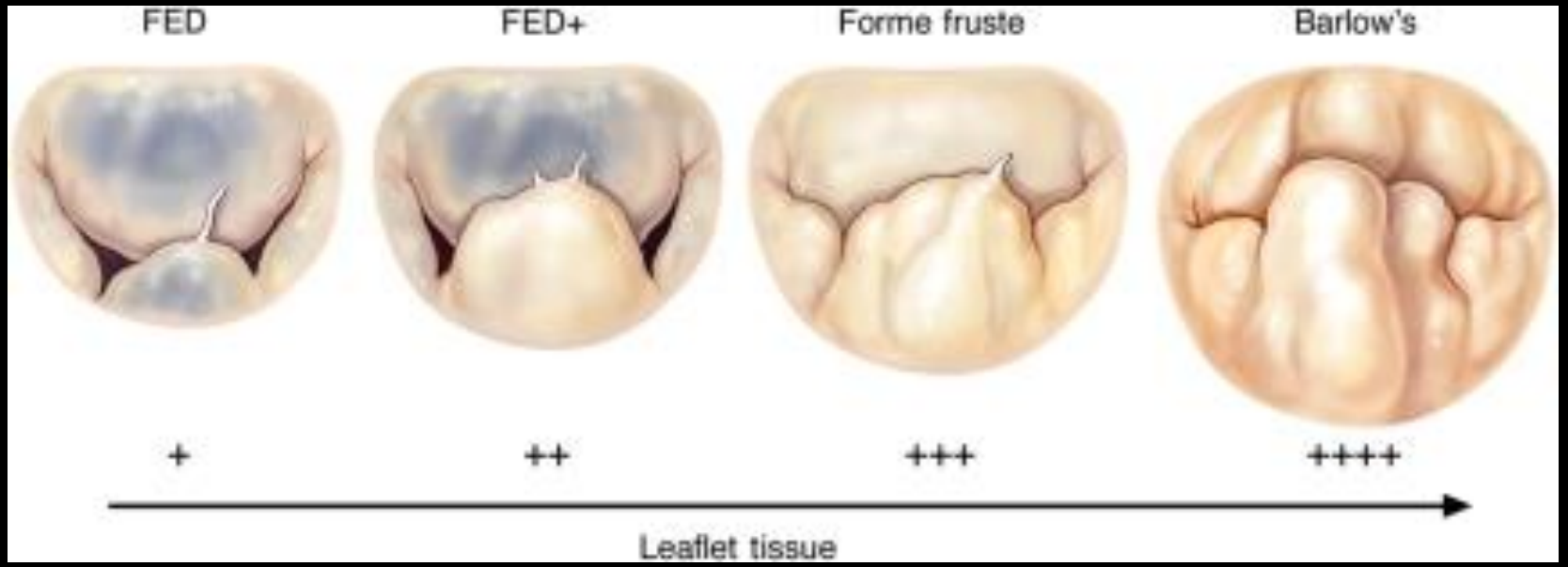
Myxomatous Degeneration: Fibroelastic Deficiency (FED)



VEC: Valvular Endothelial Cells
VIC: Valvular Interstitial Cells

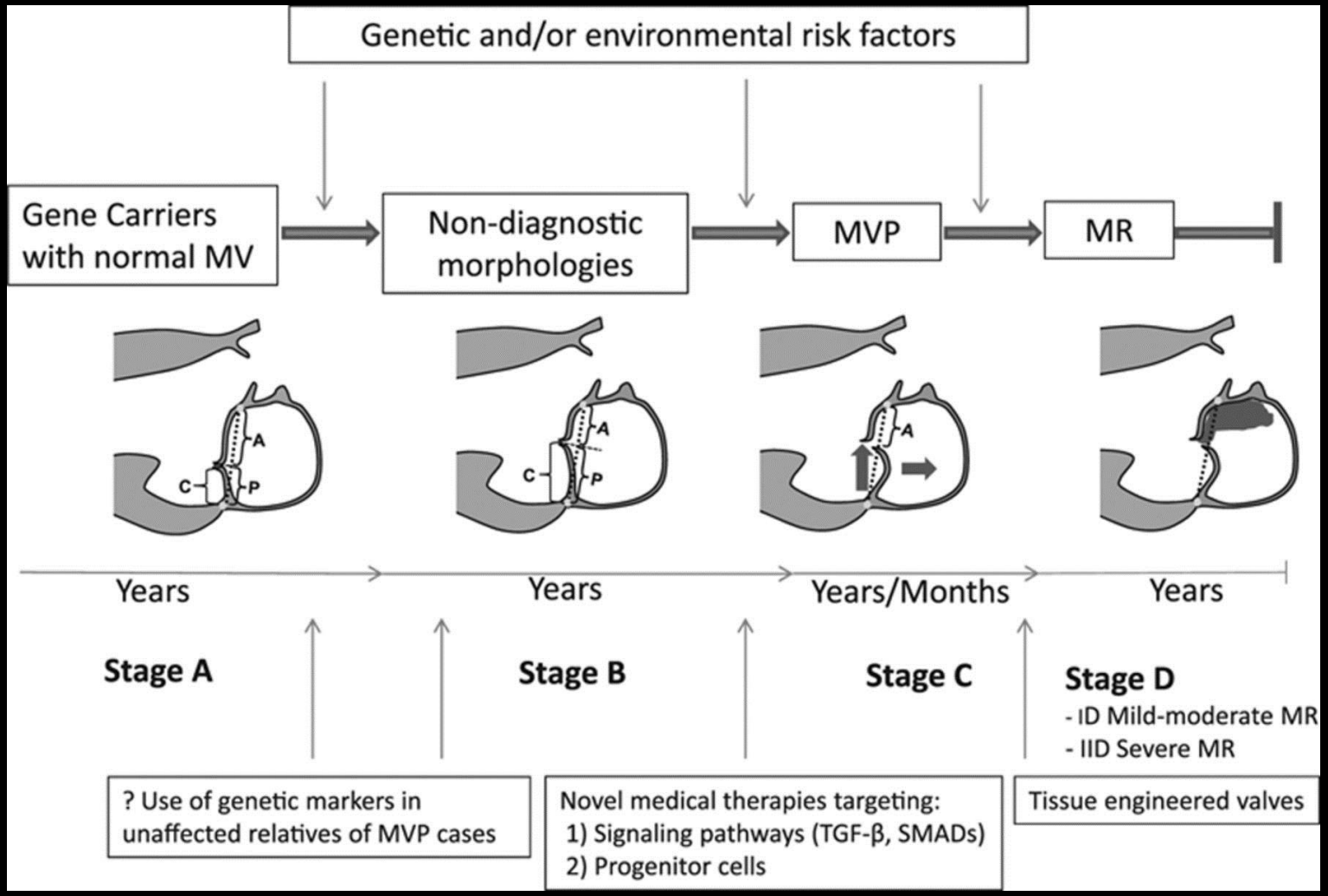
Francesca N. Delling, and Ramachandran S. Vasan
Circulation. 2014;129:2158-2170

Myxomatous Degeneration: Spectrum of Disease



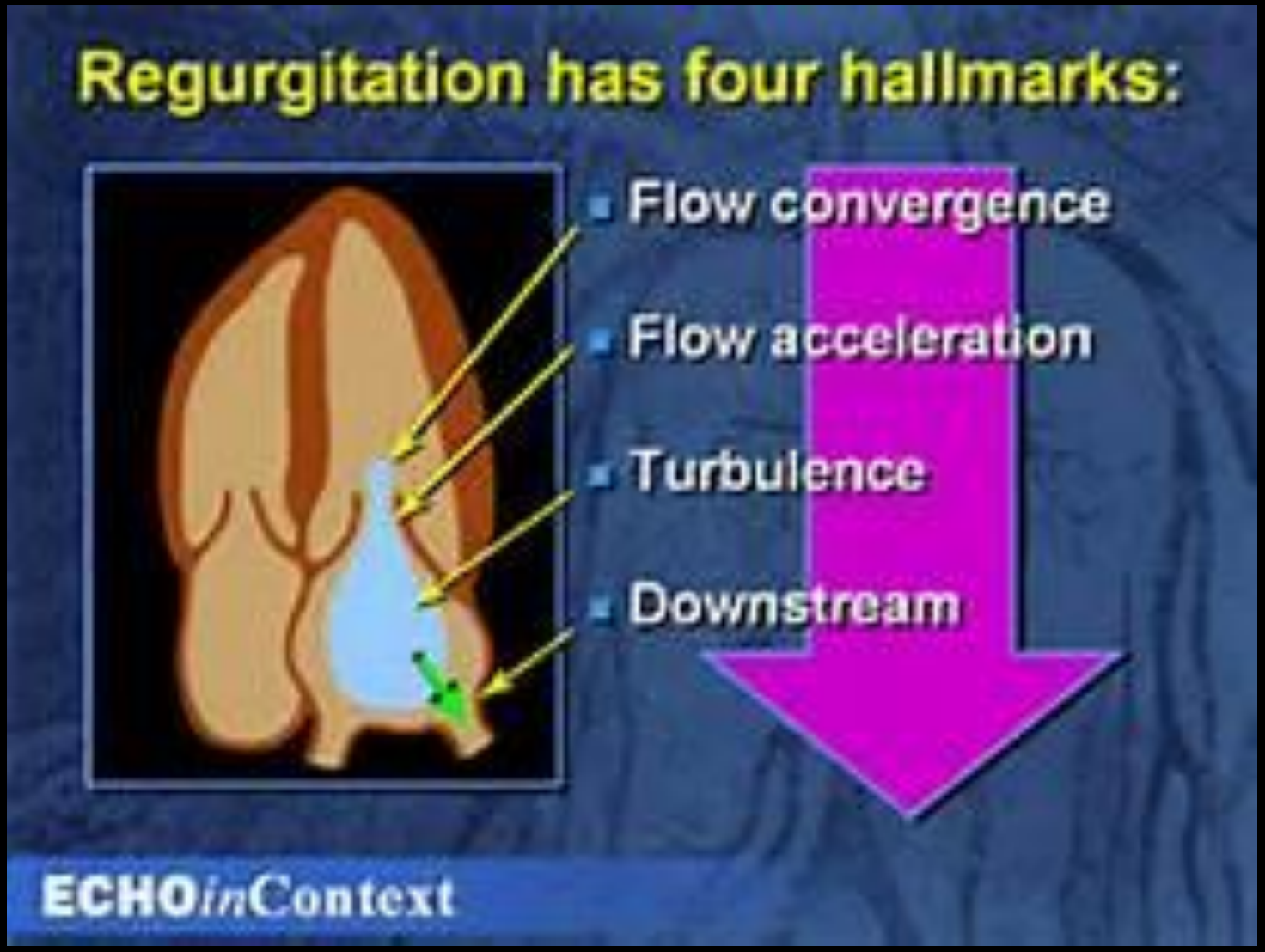
https://openi.nlm.nih.gov/detailedresult.php?img=PMC2921508_ehq22201&req=4. Access online 10/2017.

Myxomatous Degeneration: Progression of Disease



Francesca N. Delling, and Ramachandran S. Vasan
Circulation. 2014;129:2158-2170

MR Severity- Echo



MR Severity- Echo

Mitral Regurgitation			
	Mild	**Moderate**	**Severe**
Qualitative			
Angiographic grade	1+	2+	3-4+
Color Doppler jet area	Small, central jet (less than 4 cm^2 or less than 20% LA area)	Signs of MR greater than mild present, but no criteria for severe MR	Vena contracta width greater than 0.7 cm with large central MR jet (area greater than 40% of LA area) or with a wall-impinging jet of any size, swirling in LA
Doppler vena contracta width (cm)	Less than 0.3	0.3 – 0.69	Greater than or equal to 0.70
Quantitative (cath or echo)			
Regurgitant volume (ml/beat)	Less than 30	30-59	Greater than or equal to 60
Regurgitant fraction (%)	Less than 30	30-49	Greater than or equal to 50
Regurgitant orifice area (cm^2)	Less than 0.20	0.2-0.39	Greater than or equal to 0.40
Additional Essential Criteria			
Left atrial size			Enlarged
Left ventricular size			Enlarged

Follow-up: ASE Guidelines

Mild MR

- Echo: q3-5 years

Moderate MR

- Echo: annual

Severe MR

- Referral (3D TEE +/- intervention)

** Echo for any Δ murmur or symptoms*

Treatment- Med Rx

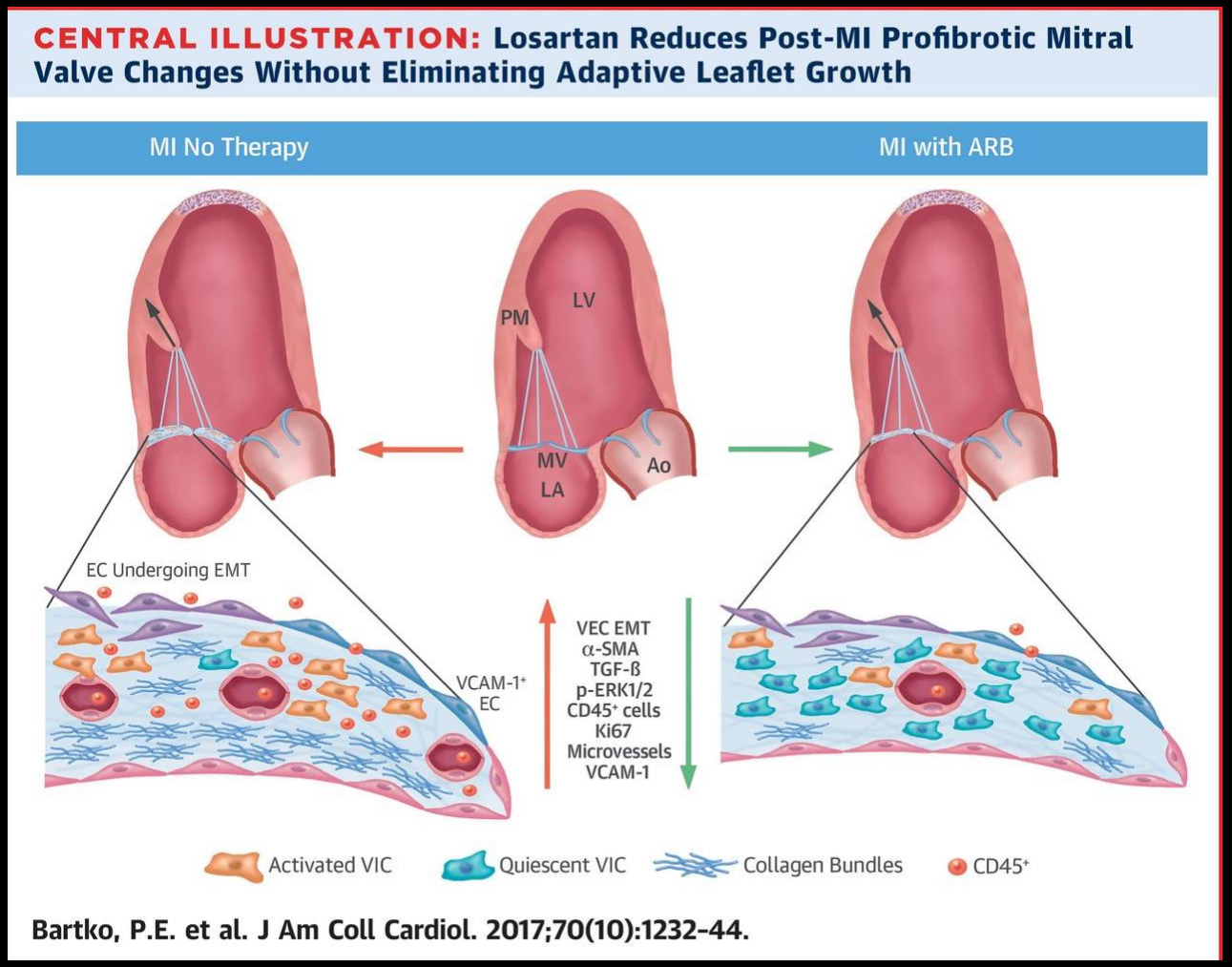
Primary MR

- BP mgmt. (ARB/ACE-I)
    * MR is dynamic
- diuretics

Secondary MR

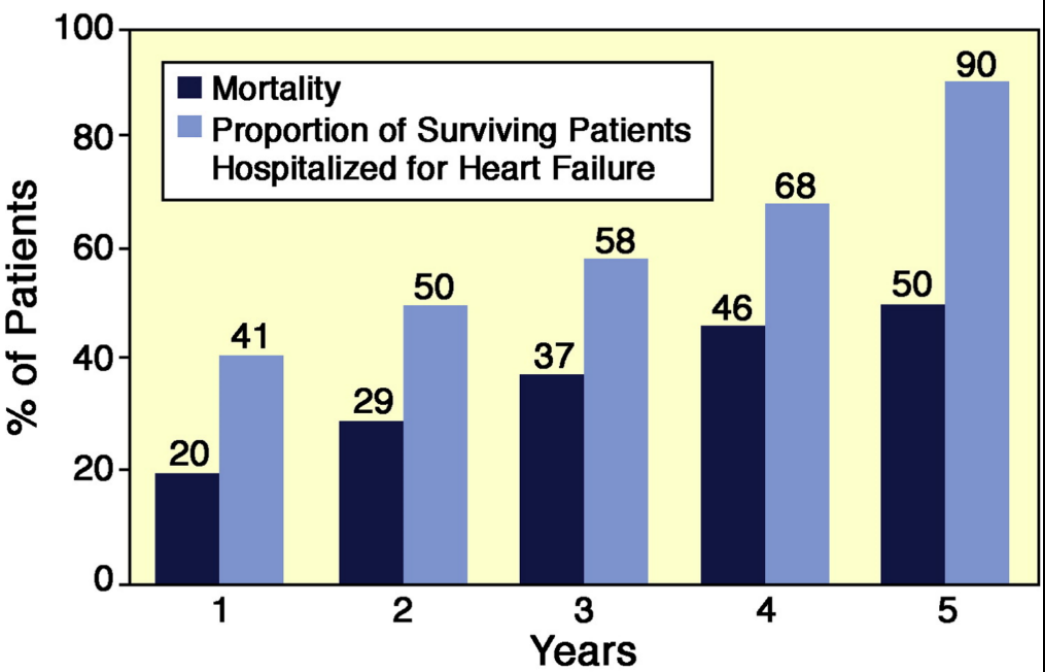
- β-blocker
- Revascularization
- CRT

Treatment: ARB?



Animal study with ARB = protective antifibrotic/anti-inflammatory effect.
EMT- endothelial to mesenchymal transition.

Clinical Outcomes: Med Rx



1095 patients with Severe MR and HF

FMR 74%, DMR 21%, Other 5%

53% Medical Therapy and 47% Surgery

Journal of the American College of Cardiology Jan 2014, 63 (2) 185-186; DOI: 10.1016/j.jacc.2013.08.723

Treatment

Surgical

- Valve replacement
    - Mechanical (warfarin)
    - Bioprosthetic (90%, warfarin 3-6mo. then ASA)
- Valve repair
    - Ring +/- resection
    - Alfieri stitch

* DMR- prohibitive surgical risk

- Transcatheter repair (MitraClip)

ACC Guidelines: Surgery

Table 1 Guideline Recommendations for Surgery for Degenerative Mitral Regurgitation

Indication	ACC/AHA	ESC/EACTS
Symptomatic patients	Class I	Class I
Asymptomatic patients		
LV systolic dysfunction*	Class I	Class I
Pulmonary hypertension		
PASP >50 mm Hg at rest	Class IIa	Class IIa
PASP >60 mm Hg with exercise	Class IIa	Class IIb
Atrial fibrillation	Class IIa	Class IIa
Normal LV function, repair feasible	Class IIa	Class IIa†

This is a simplified table. See full guidelines (1,2) for complete recommendations. *Defined as ejection fraction ≤60% or elevated end-systolic diameter (≥40 mm in ACC/AHA guidelines; >45 mm in ESC/EACTS guidelines). †Specifically for patients with flail leaflet and end-systolic dimension ≥40 mm; there is a separate class IIb recommendation for such patients with left atrial volume index ≥60 ml/m^2.

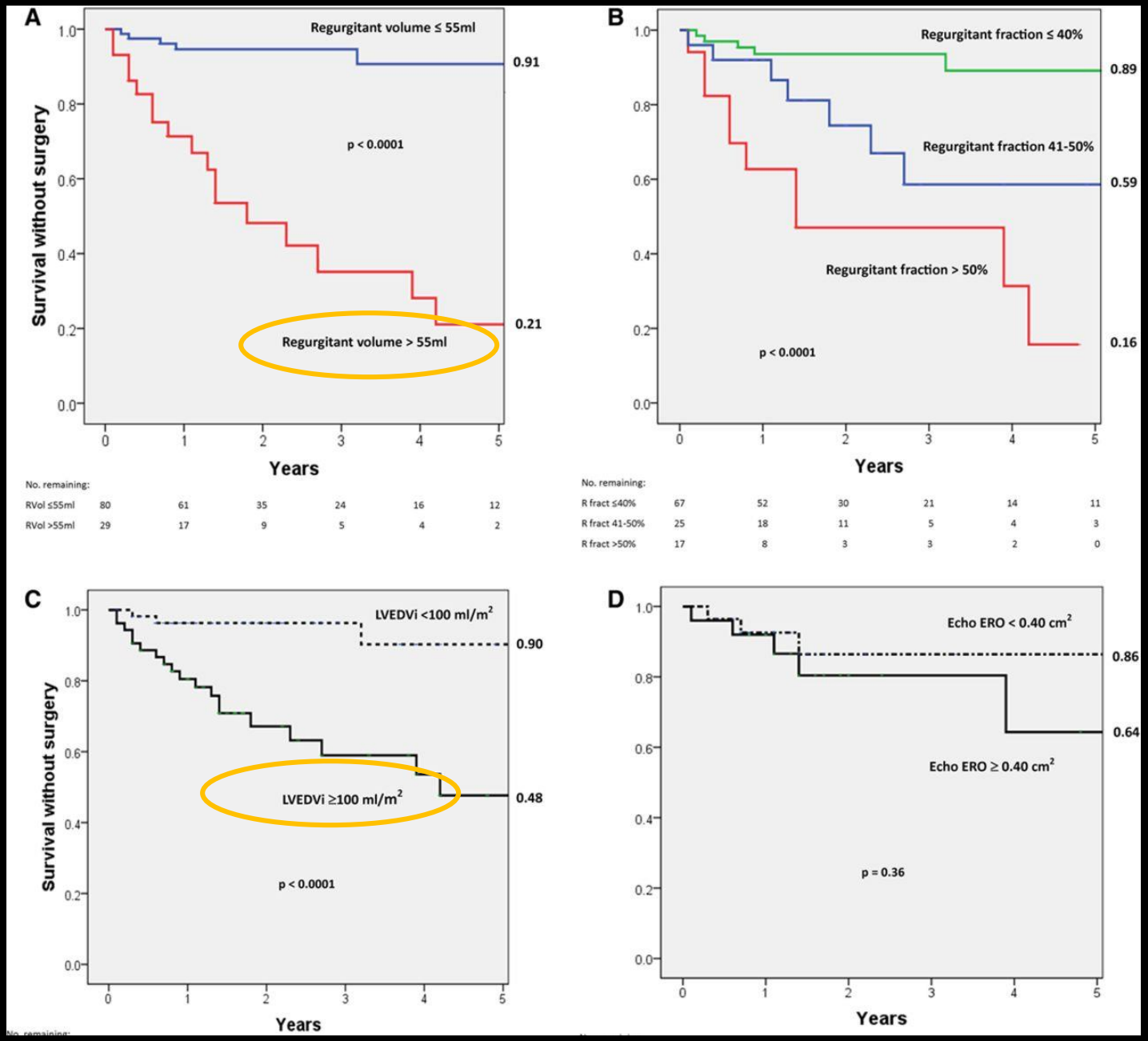
LV Dysfxn:

EF < 60%

ESd > 4cm

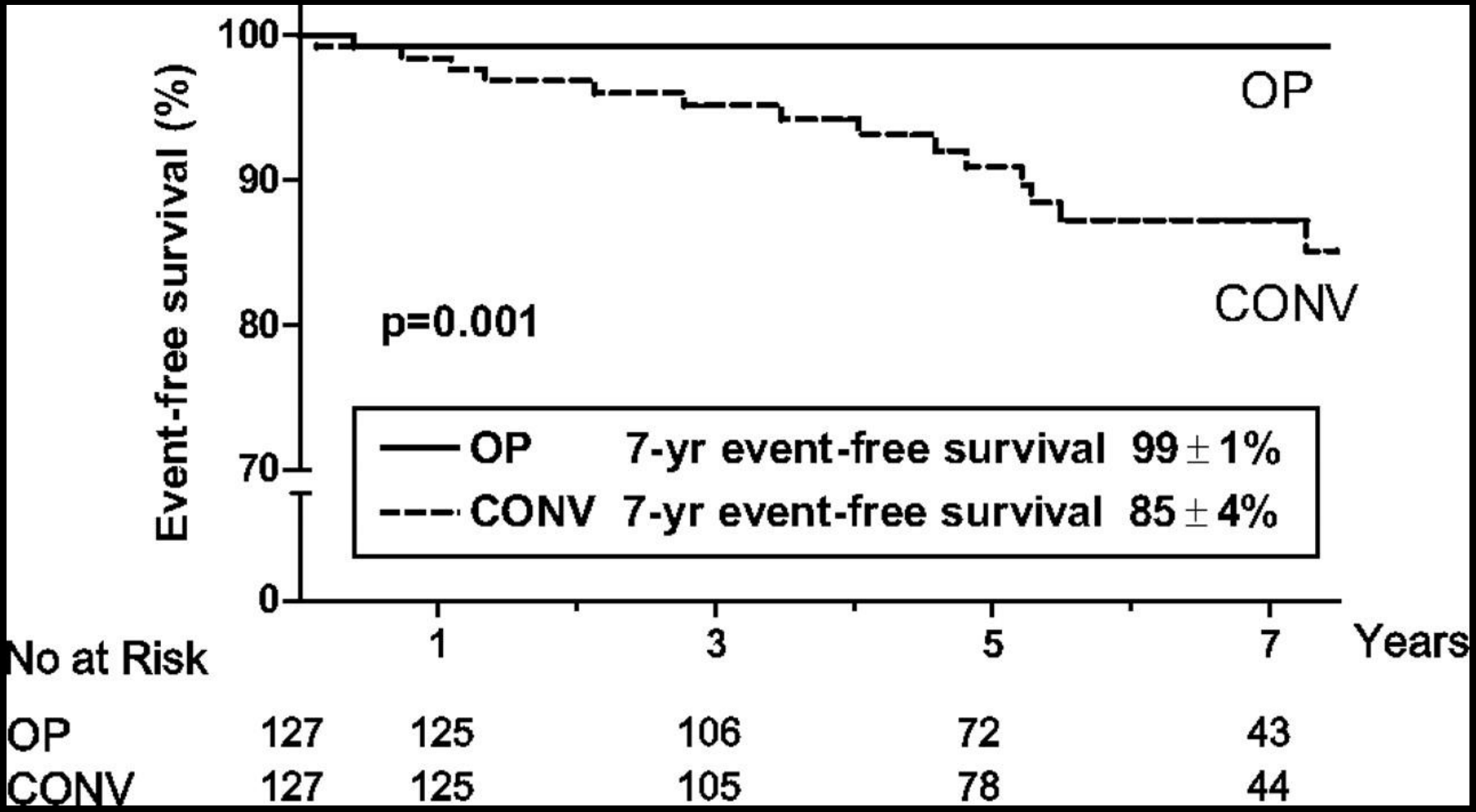
EF < 30% or ESd > 5.5 cm = Med Rx

IIb- Left Atrial Enlargement



109 Pts with Asymptomatic MR: Quantified by cMRI

Early Surgery: Asymptomatic Severe MR



Duk-Hyun Kang et al. Circulation. 2009;119:797-804

? Surgical Risk

High/prohibitive risk patients

- advanced age
- frail
- multiple medical comordities:
    - ↓ EF, CKD/ESRD, PHTN, TR
- prior chest/cardiac surgery
- STS and EuroSCORE II risk calculation

Options ?

Transcatheter “edge-edge” MV repair

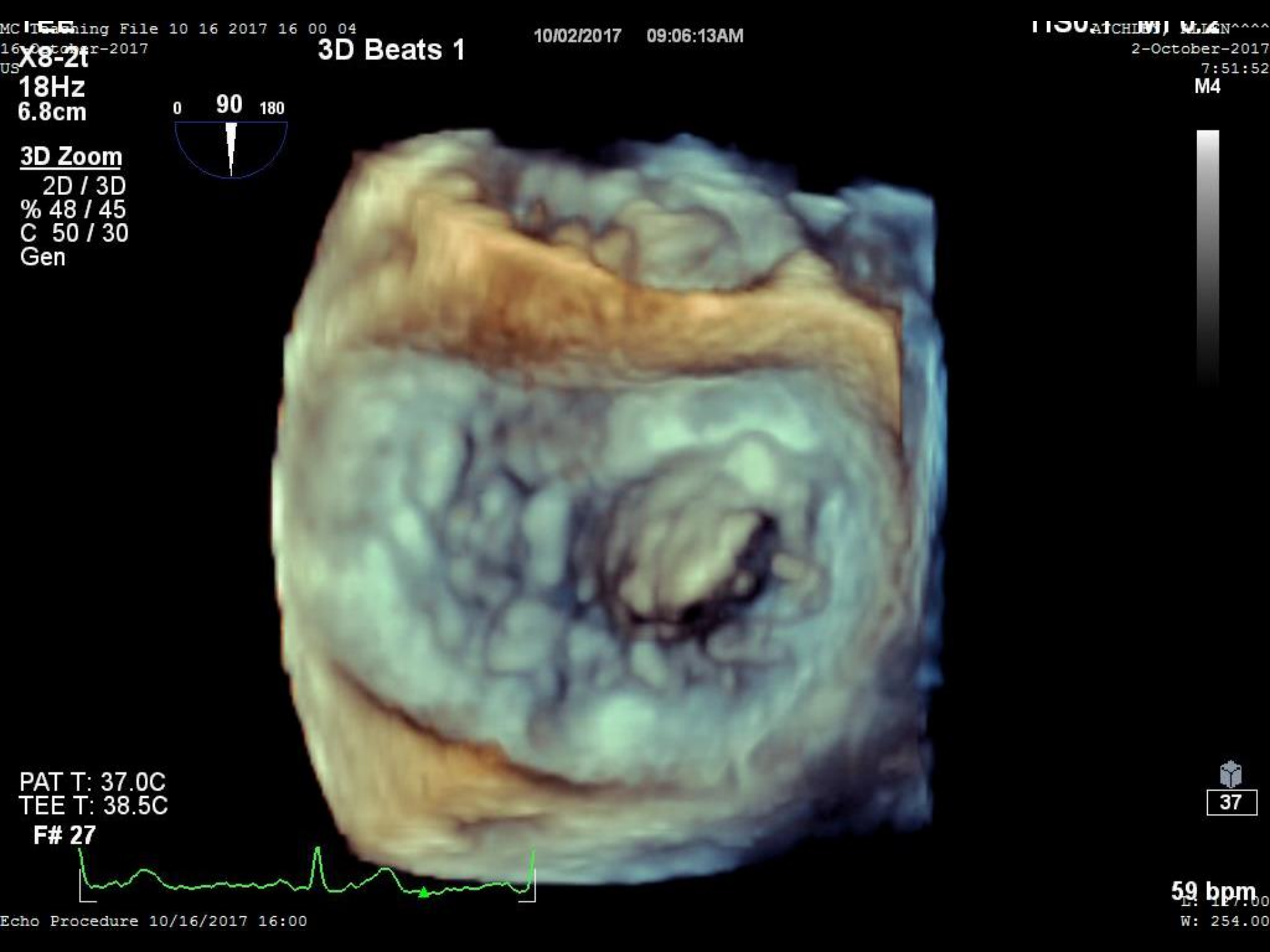
- MitraClip
  - High/prohibitive risk patients
  - Mod-Severe/Severe (3-4+) MR
  - Degenerative etiology (currently…)

COAPT Trial for functional MR

Evaluation

CHI Mitral Valve Clinic

- Coordinator screening and education
- MD H&P, TTE review
- TEE + 3D
- R/L heart catheterization
- Carotid duplex
- 6 min walk test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US
TEE
X8-2t
18Hz
6.8cm
3D Beats 1
10/02/2017 09:06:13AM
2-October-2017
7:51:52
M4
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2D / 3D
% 48 / 45
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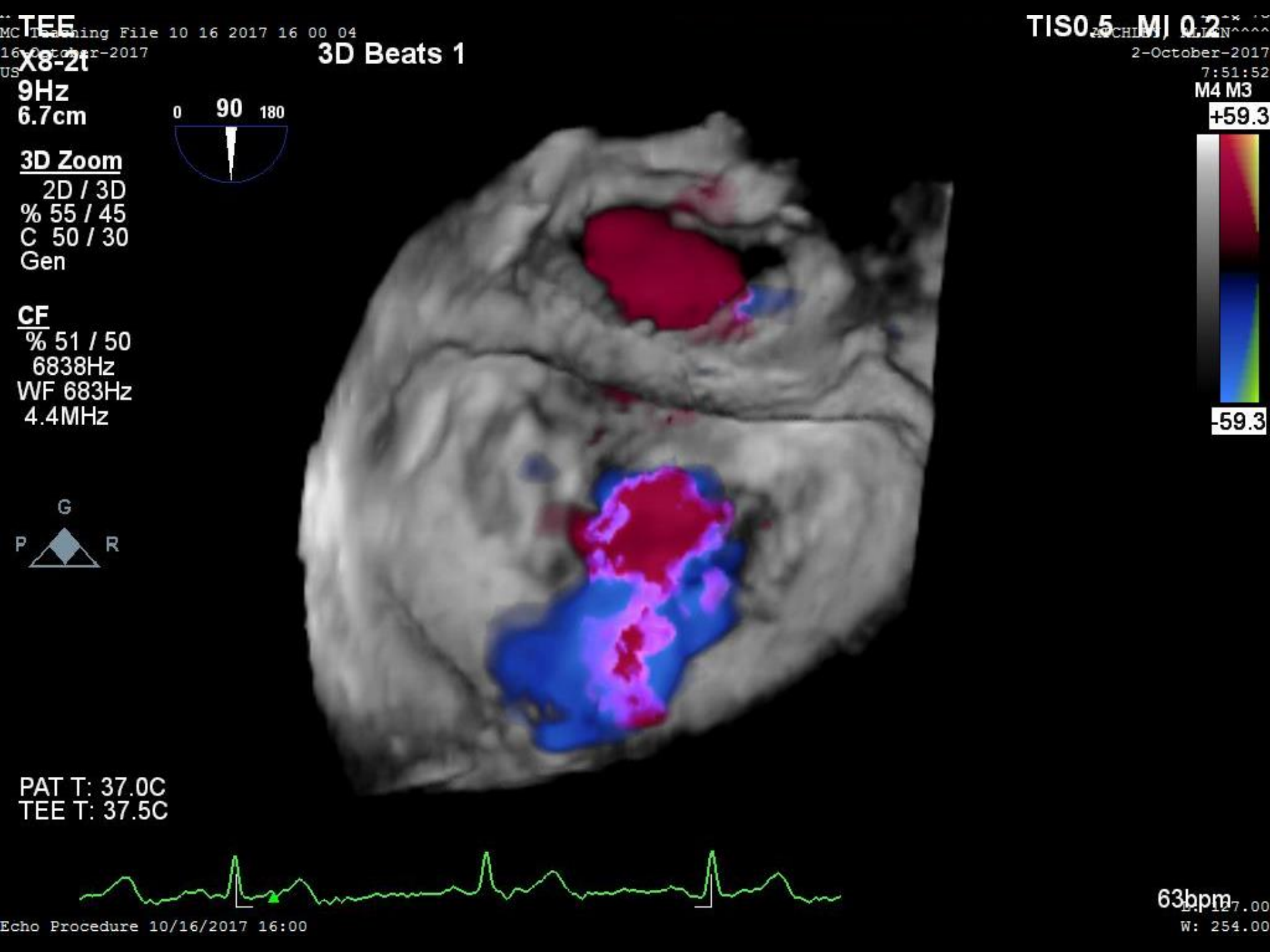
PAT T: 37.0C
TEE T: 38.5C
F# 27
37
59 bpm
Echo Procedure 10/16/2017 16:00
W: 254.00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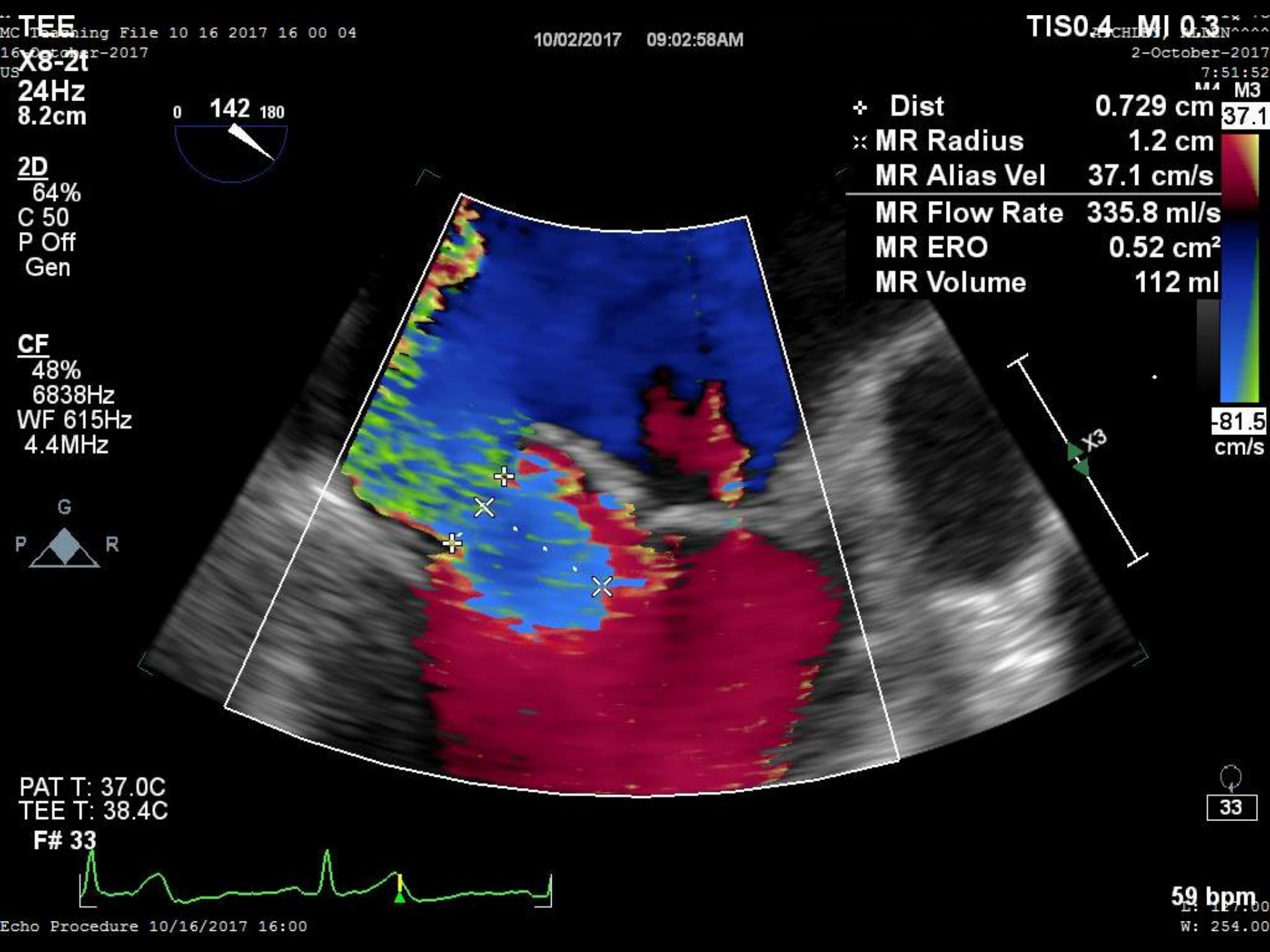
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MR Radius 1.2 cm
MR Alias Vel 37.1 cm/s
MR Flow Rate 335.8 ml/s
MR ERO 0.52 cm²
MR Volume 112 ml
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TEE T: 38.4C
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59 bpm
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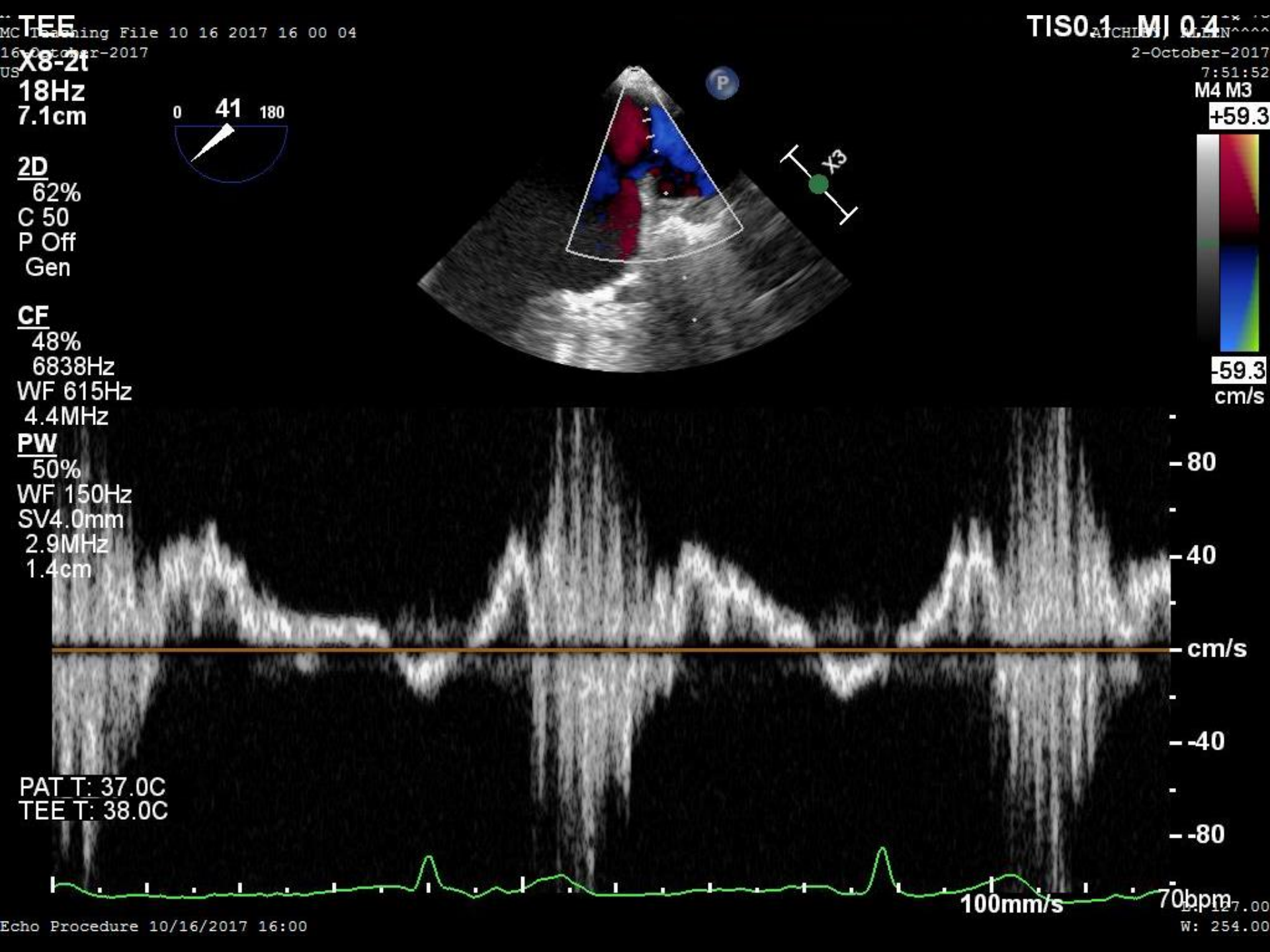
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W: 254.00

Evalutation

CT Surgery H&P (Dr. Clements)

Multidisciplinary Team Case Review

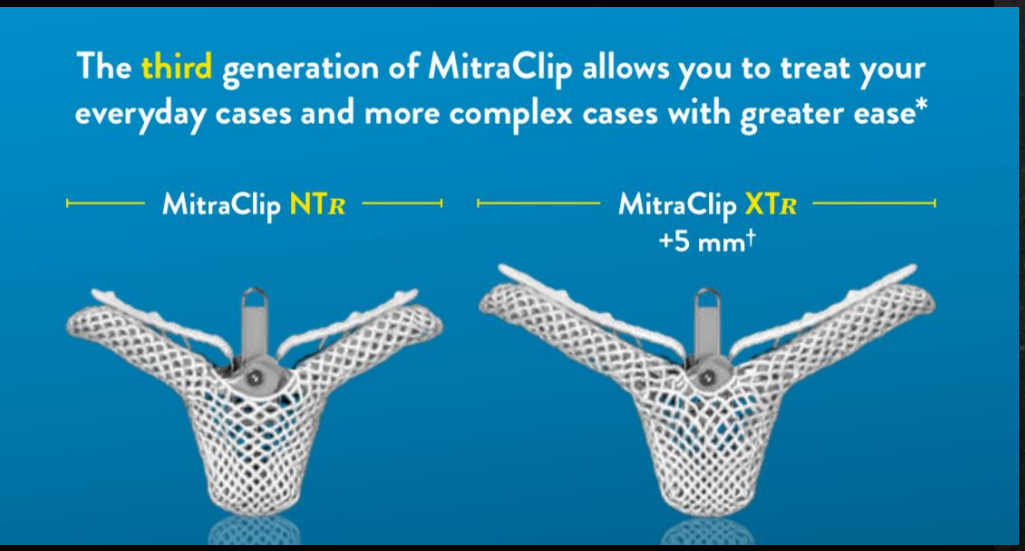
If appropriate for MitraClip:

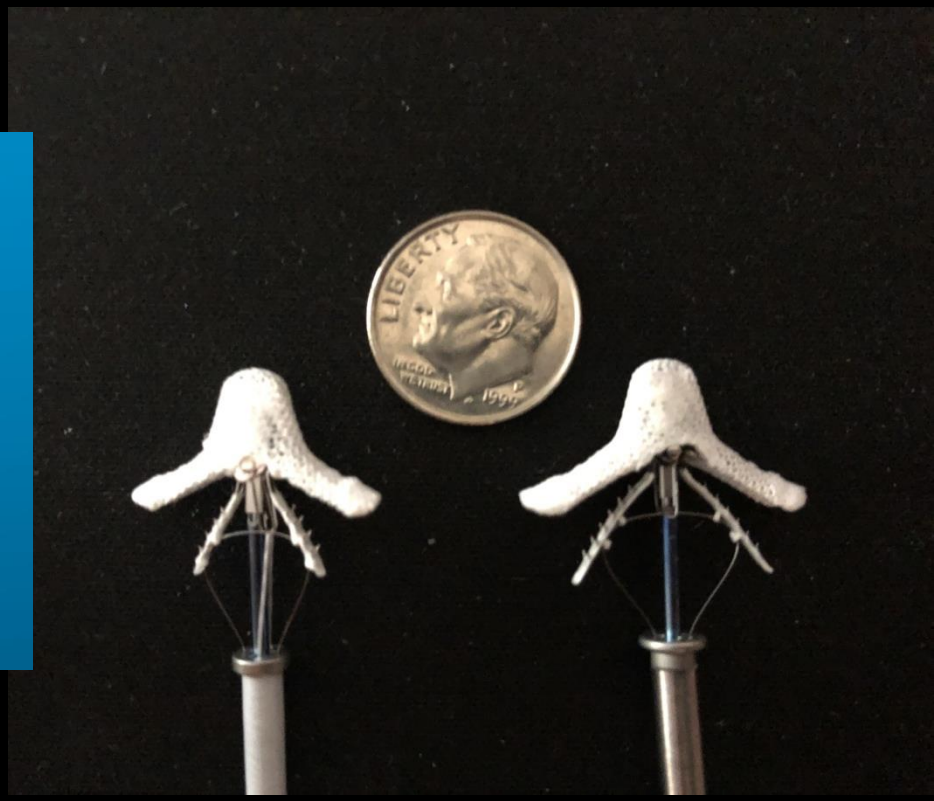
Interventional MD H&P (Drs. Ledford and Thel)

Procedure scheduled

≈ 6-8 week process

Device(s)


The third generation of MitraClip allows you to treat your everyday cases and more complex cases with greater ease*
MitraClip NTR
MitraClip XTR
+5 mm†


LIBERTY

Procedure

Cardiac cath lab vs. hybrid OR

General anesthesia

1.5-4 hours (typical 2-2.5 hours)

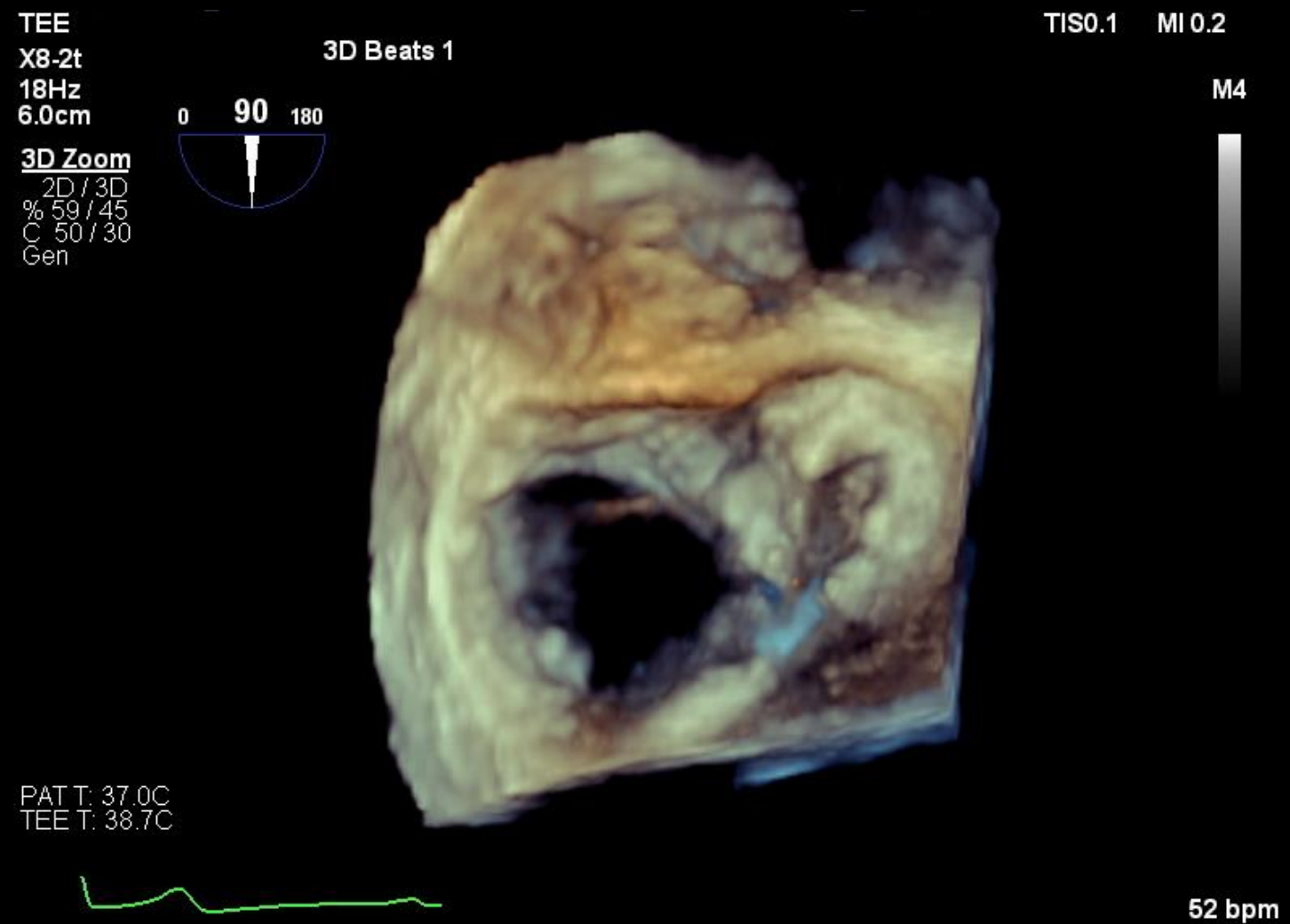
Femoral venous access (24 fr device)

PACU recovery

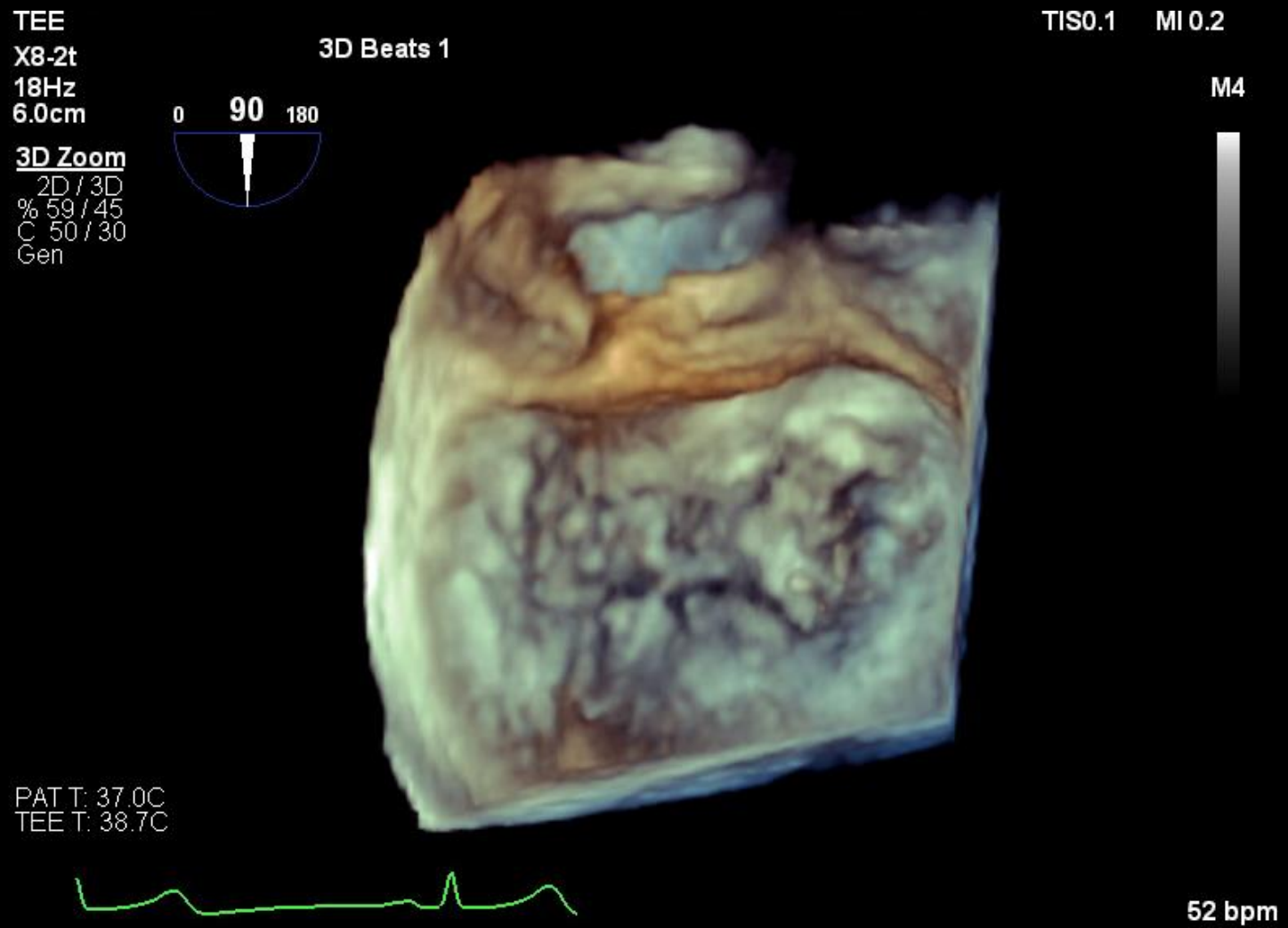
CSSU overnight obs.

LoS 24-36 hours

Post MitraClip

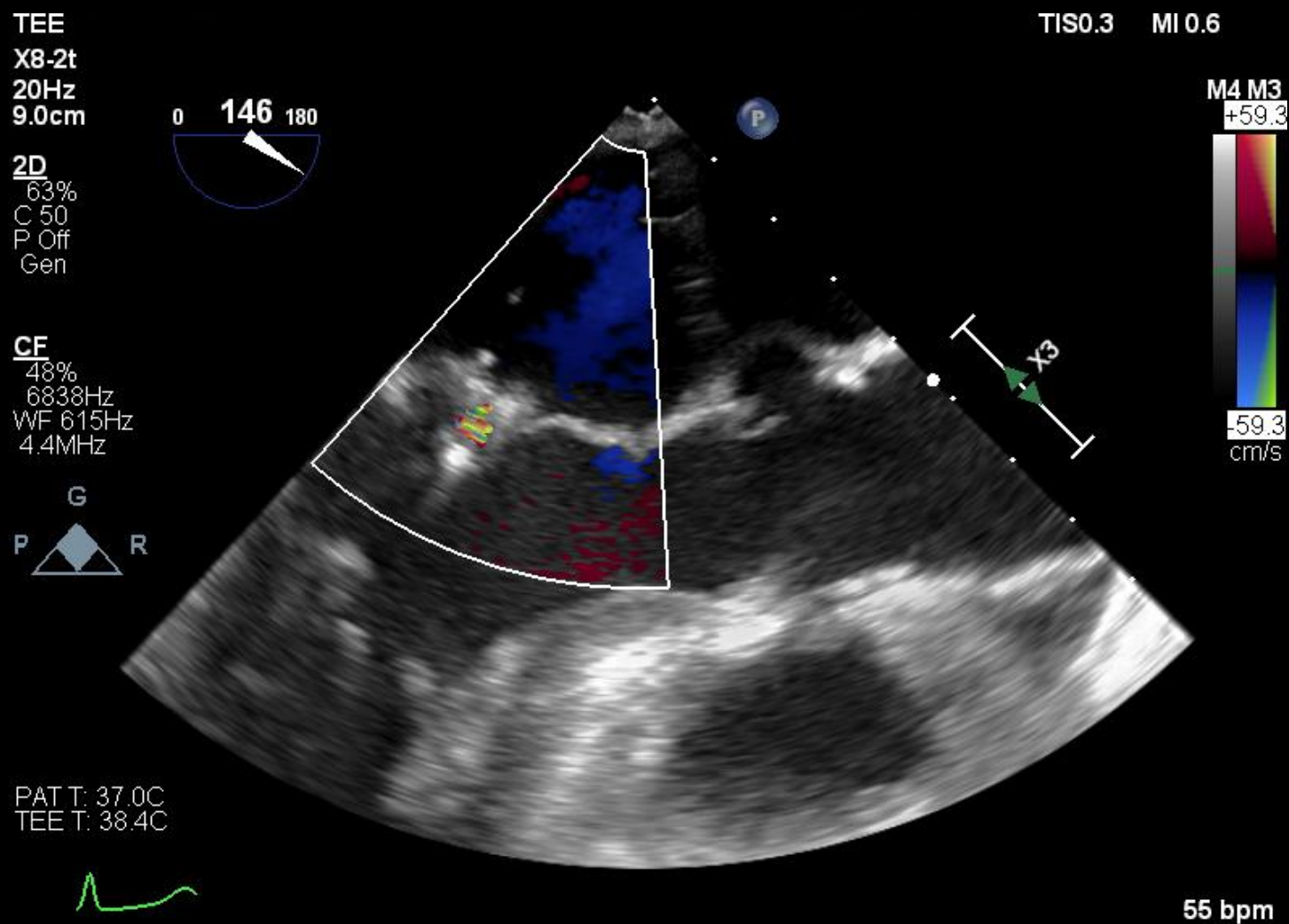


Post MitraClip

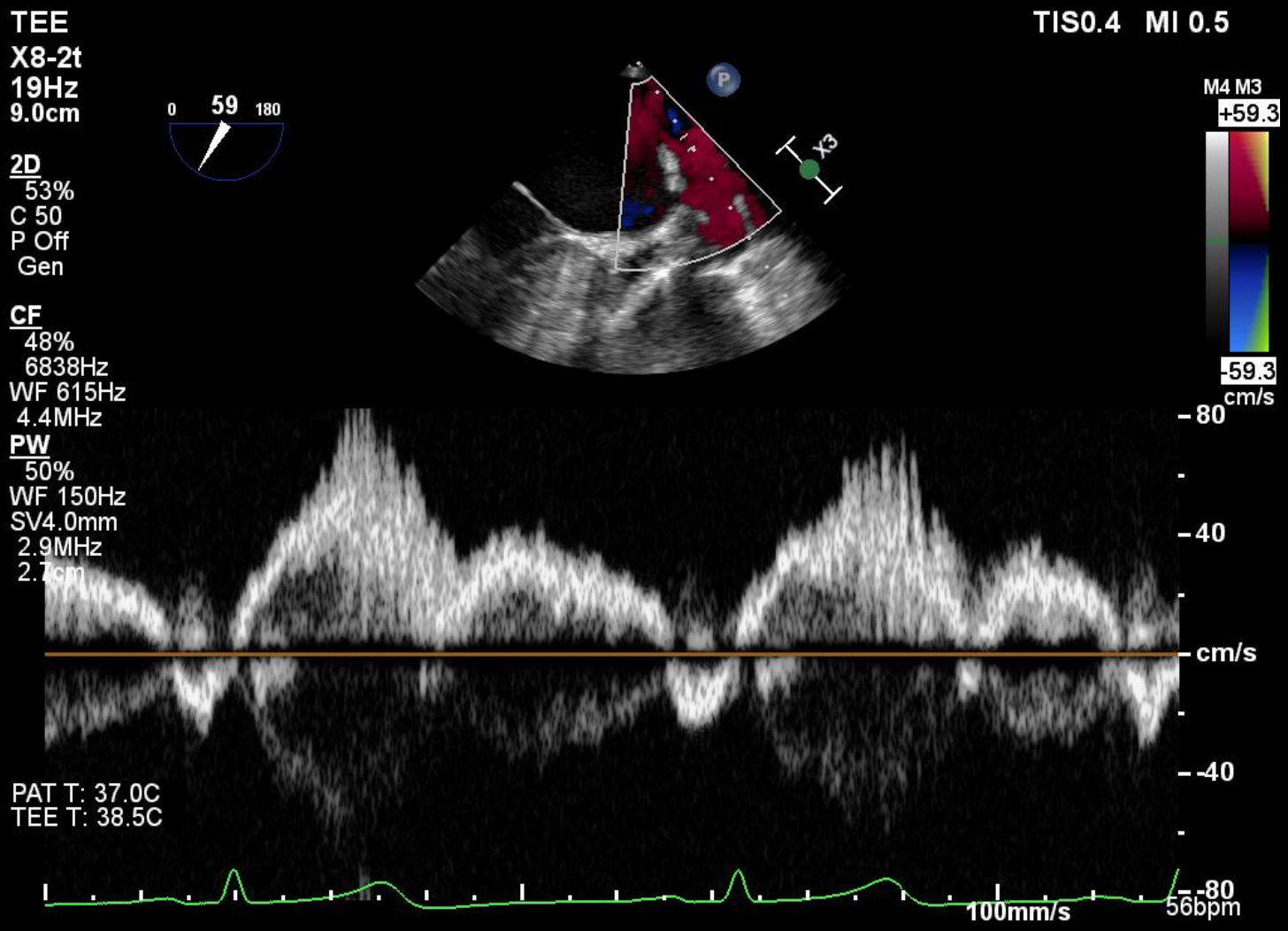


Post MitraClip

Post MitraClip



Post MitraClip



Follow-Up

TTE post-op day 1

Plavix + ASA for 3-6 months

- OAC + Plavix if afib or other indication

Diuretics + GDMT as indicated

Procedural antibiotic prophylaxis 1 year

F/U 30 day and 1 year

- TTE + Mitral Clinic office visit

COAPT Trial

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Transcatheter Mitral-Valve Repair in Patients with Heart Failure

G.W. Stone, J.A. Lindenfeld, W.T. Abraham, S. Kar, D.S. Lim, J.M. Mishell, B. Whisenant, P.A. Grayburn, M. Rinaldi, S.R. Kapadia, V. Rajagopal, I.J. Sarembock, A. Brieke, S.O. Marx, D.J. Cohen, N.J. Weissman, and M.J. Mack, for the COAPT Investigators*

Cardiovascular Outcomes Assessment of the MitraClip Percutaneous Therapy for Heart Failure Patients With Functional Mitral Regurgitation - COAPT

Stone GW, Lindenfeld JA, Abraham WT, et al., on behalf of the COAPT Investigators. Transcatheter Mitral-Valve Repair in Patients With Heart Failure. *N Engl J Med* 2018;379:2307-18.

COAPT Trial

N = 614 with 3-4+ functional MR and HF

On maximally tolerated GDMT (by HF MD)

- 91% βb, 66% ACE/ARB/ARNI, 50% MRA, 36% CRT

302 Clip + GDMT vs. 312 GDMT alone

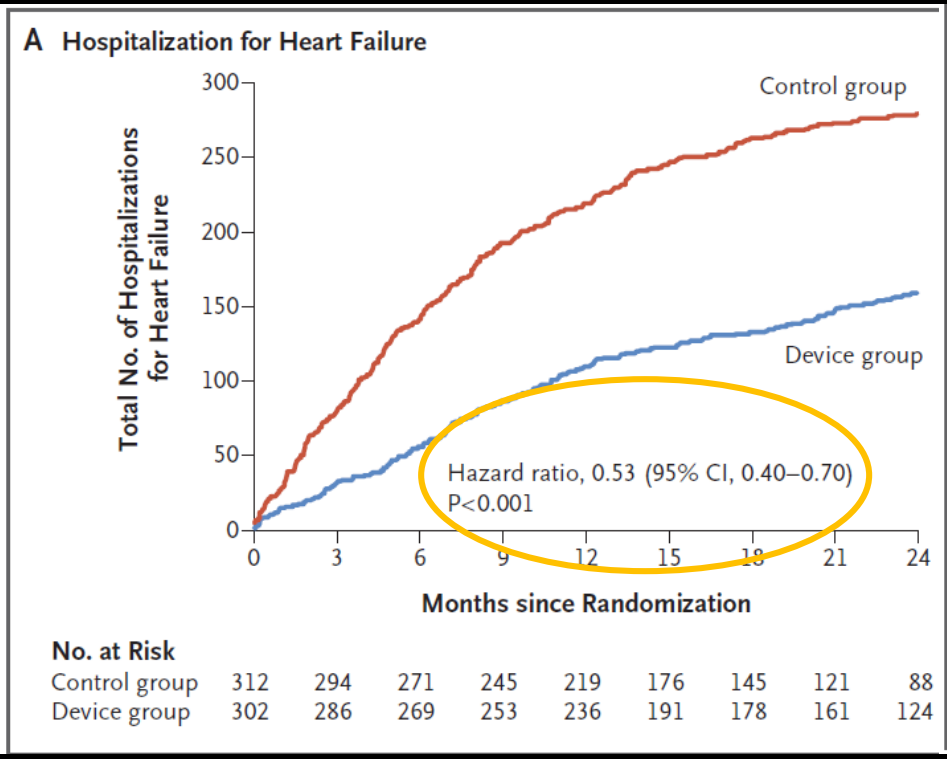
LVEF 20-50% (31%)

LVESd < 7cm (6.2cm)

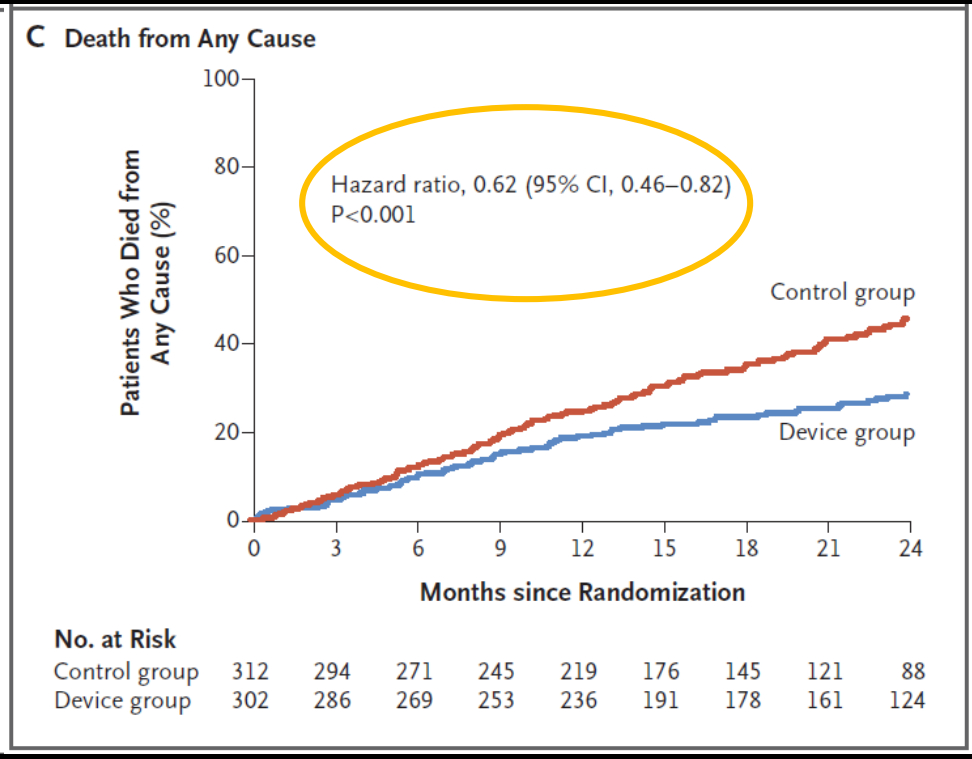
Excluded: life exp < 1 year, NYHA Class IV/Stage D, COPD + O^2 or chronic steroids, severe PHTN, Mod-Severe RV dysfxn, Severe AR or TR

COAPT Trial- Outcomes

Primary Outcome



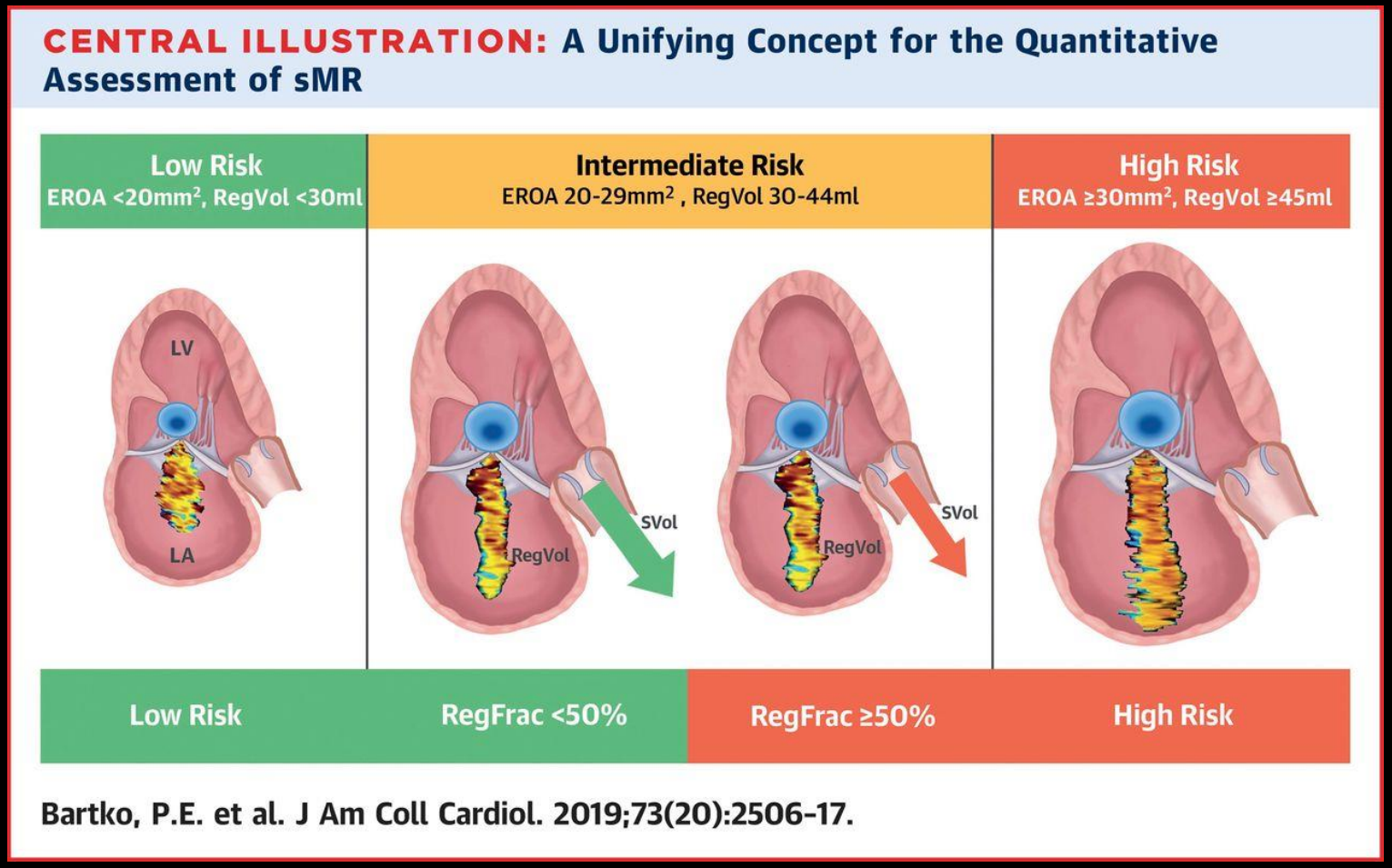
Secondary Outcome



Freedom from device related complications: 96.6% @ 1 year

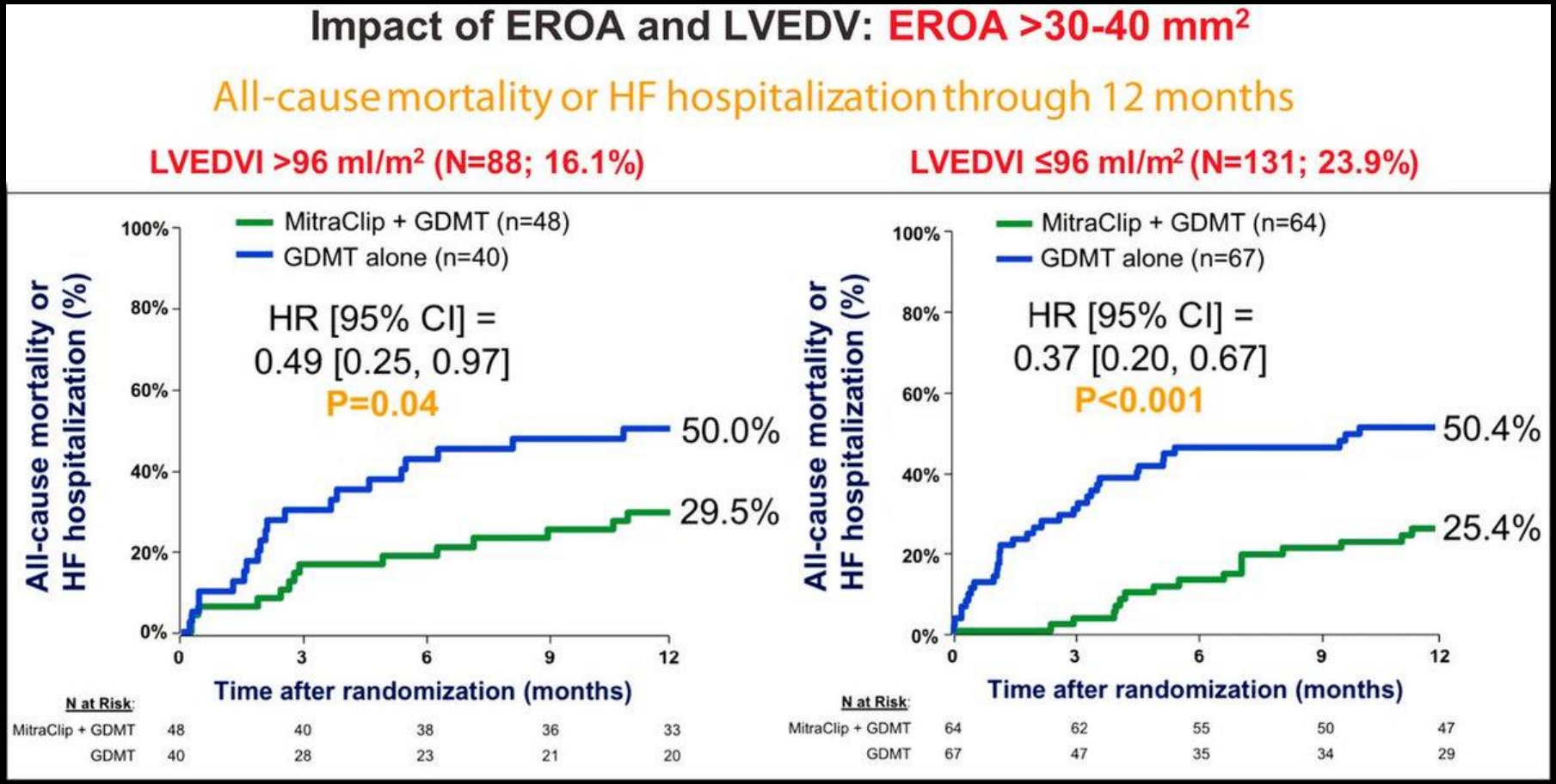
Stone GW, Lindenfeld JA, Abraham WT, et al., on behalf of the COAPT Investigators. Transcatheter Mitral-Valve Repair in Patients With Heart Failure. *N Engl J Med* 2018;379:2307-18.

3+ sMR (Moderate-Severe?)



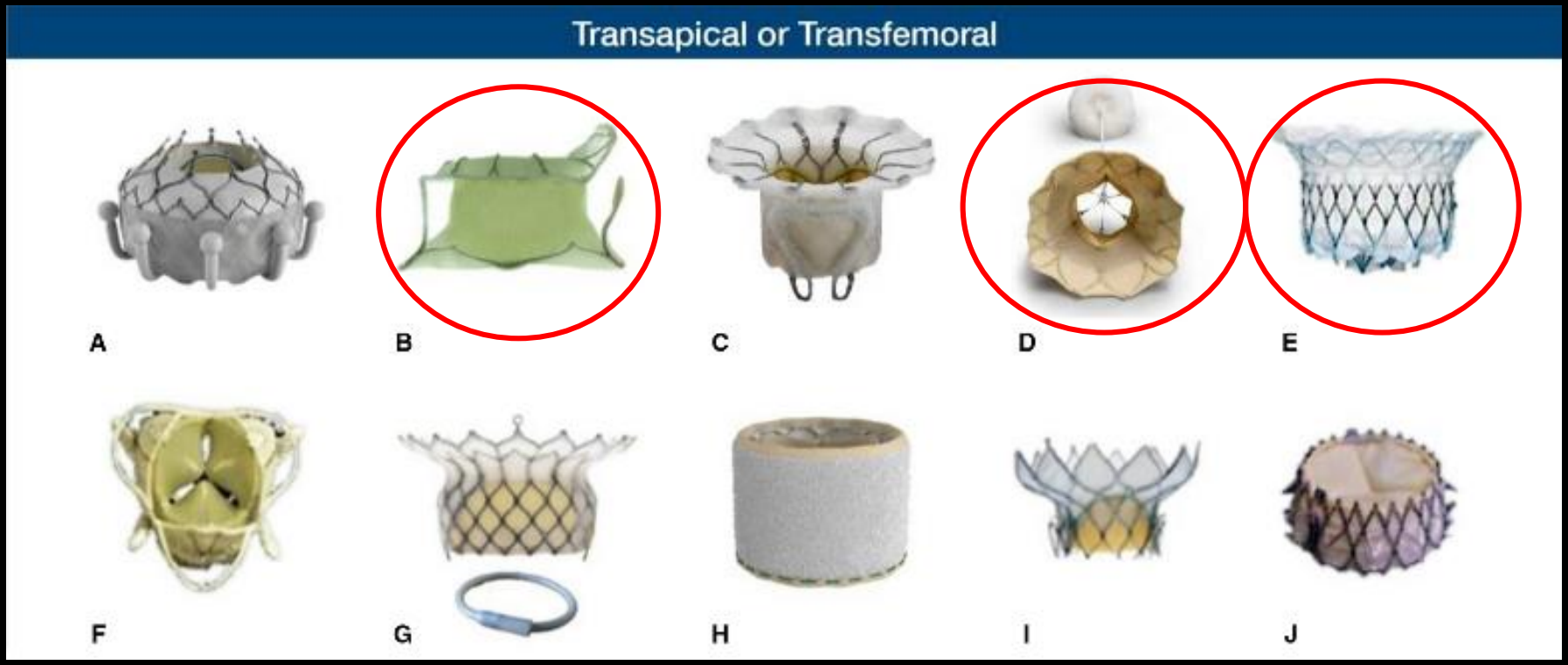
423 HFrEF pts on GDMT: “Moderate MR” stratified by EROA, RegVol, and RegFrac

3+ sMR COAPT Subgroup



Stone G. JACC: Heart Failure. Vol 7, No. 6, June 2019: 522-526.

TMVR- Still Evolving



B. Tiara (Neovasc Inc, Canada)- TIARA I and II Trials
D. Tendyne (Abbott Inc.)- SUMMIT Trial
E. Intrepid (Medtronic Inc.)- APOLLO Trial

B, D, and E all transapical

All others terminated, withdrawn, or still feasibility/early

Testa L. JAHA. Vol. 8, No. 22. DOI: (10.1161/JAHA.119.013352)

TMVR- Still Evolving

Device malfunction/migration

LVOT obstruction

Thrombosis

CVA

AKI/ARF

Access site/bleeding

Perivalvular regurgitation

Endocarditis

Mortality ≈ 25-30% at 1 year

del Val D. Early Experience with Transcatheter Mitral Valve Replacement: A Systematic Review. JAHA. Vol 8, No. 17. 23 August, 2019. https://doi.org/10.1161/JAHA.119.013332

Conclusions

Degenerative MR- primary valve disease

Functional MR- “secondary” (NICM, ICM, Afib, etc.)

Chronic MR is insidious

- structural Δ’s typically *precede* HF signs/symptoms

Medical Therapy- limited in pMR, GDMT in sMR

Early Surgical Intervention!

- severe MR +/- LVEF < 60% or LVSd > 4.0cm

High risk patients with DMR- MitraClip

COAPT Trial- FDA approved MitraClip (Medicare pending)

TMVR- Still evolving

Thank You

References

Nishimura RA, Otto CM, Bonow RO, Carabello BA, et al. 2014 AHA/ACC Guideline for the Management of Patients with Valvular Heart Disease, Journal of the American College of Cardiology (2014, doi; 10.1016/j.jacc.2014.02.536)

Francesca N. Delling, and Ramachandran S. Vasan. Circulation. 2014; 129: 2158-2170

Goel SS, Navkaranbir B, Aggarwal B, et al. Prevalence and Outcomes of Unoperated Patients With Severe Symptomatic Mitral Regurgitation and Heart Failure. JACC. 2014; 63 (2): 185-186.

Thavendiranathan P, Phelan D, Collier P, et al. Quantitative Assessment of Mitral Regurgitation. JACC Cardiovascular Imaging. 2012; 5 (11): 1161-1175.

Myerson SG, d'Arcy J, Christiansen JP, et al. Determination of Clinical Outcome in Mitral Regurgitation With Cardiovascular Magnetic Resonance Quantification. Circulation. 2016;133:2287-2296

Stone GW, Lindenfeld JA, Abraham WT, Kar S, et al. Transcatheter Mitral Valve Repair in Patients with Heart Failure. N Engl J Med. 2018; 379: 2307-18.

MitraClip®

Transcatheter Mitral Valve Repair

Procedure Animation

INDICATIONS:
Clip Delivery System: The MitraClip Clip Delivery System is indicated for the percutaneous reduction of significant symptomatic mitral regurgitation (MR ≥ 3+) due to primary abnormality of the mitral apparatus [degenerative MR] in patients who have been determined to be at prohibitive risk for mitral valve surgery by a heart team, which includes a cardiac surgeon experienced in mitral valve surgery and a cardiologist experienced in mitral valve disease, and in whom existing comorbidities would not preclude the expected benefit from reduction of the mitral regurgitation.

Steerable Guide Catheter: The Steerable Guide Catheter is used for introducing various cardiovascular catheters into the left side of the heart through the interatrial septum.