

Percutaneous Valve Treatment in 2023

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Pittsburgh, PA

Disclosures

- No disclosures

Outline

- Percutaneous Aortic Valve Treatment
 - TAVR – what's new?
- Percutaneous Mitral Valve Treatment
 - M-TEER
 - TMVR
- Percutaneous Tricuspid Valve Treatment
 - T-TEER
 - TTVR

The On-Going TAVR Story...

First in man TAVI performed by Dr. Alain Cribier

FDA expands indication for **intermediate-risk** patients

Lifetime Management

2002

2014

2016-2017

2019

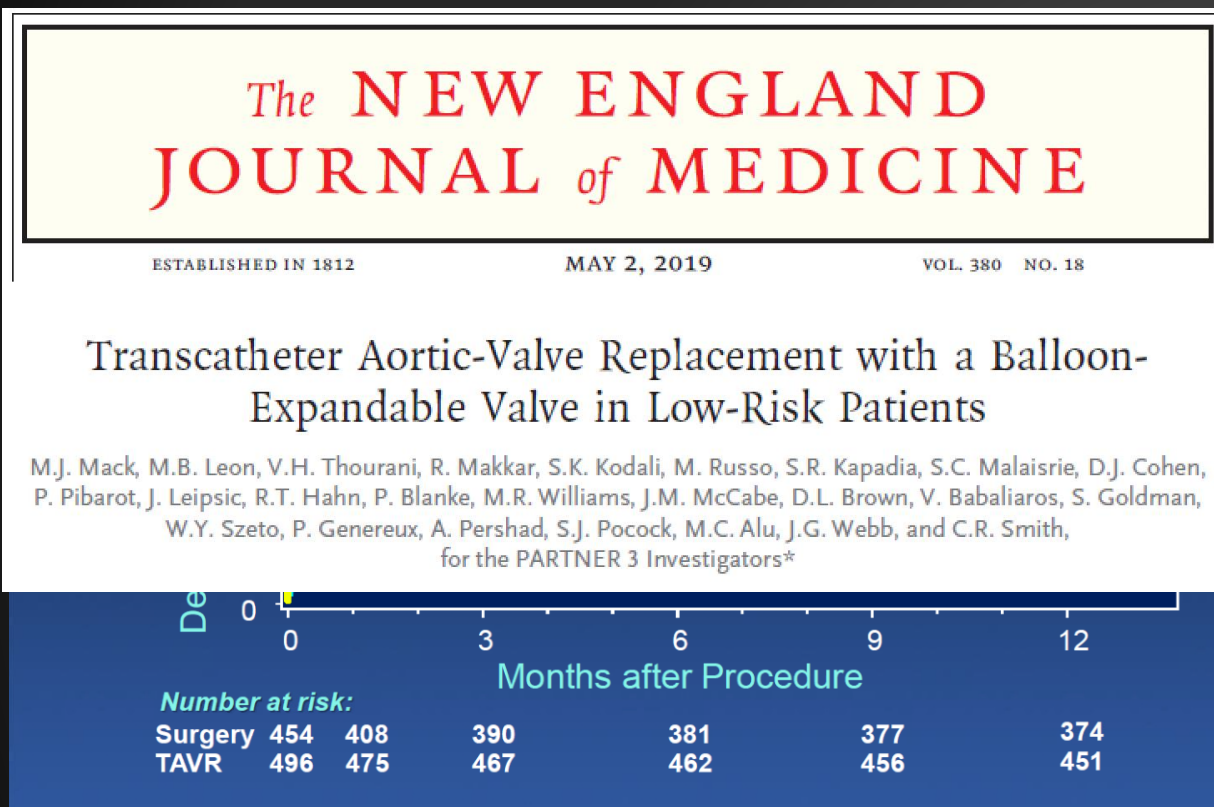
2023

FDA approves Sapien THV & CoreValve for **inoperable & high-risk** patients

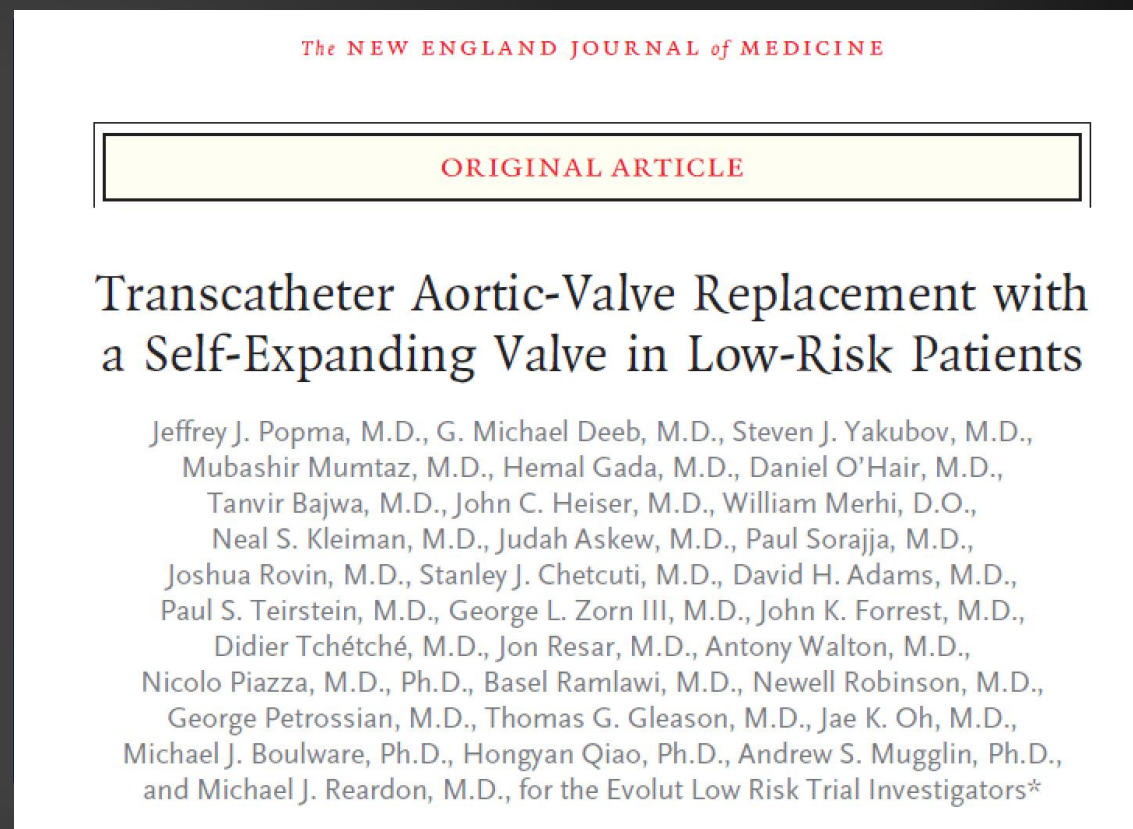
FDA expands indication for **low-risk** patients

Low Risk Trials: May 2019

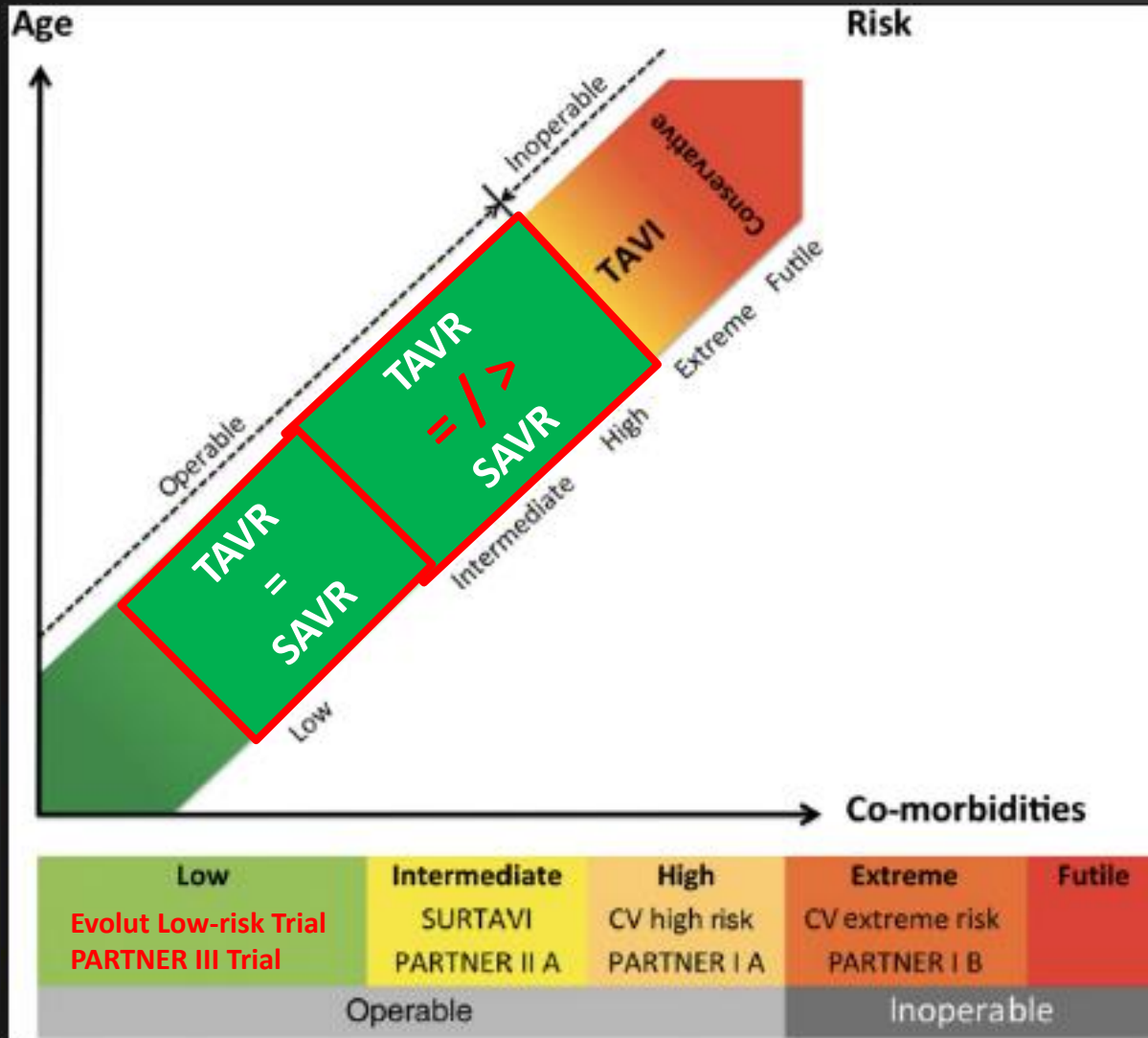
PARTNER 3 Trial:



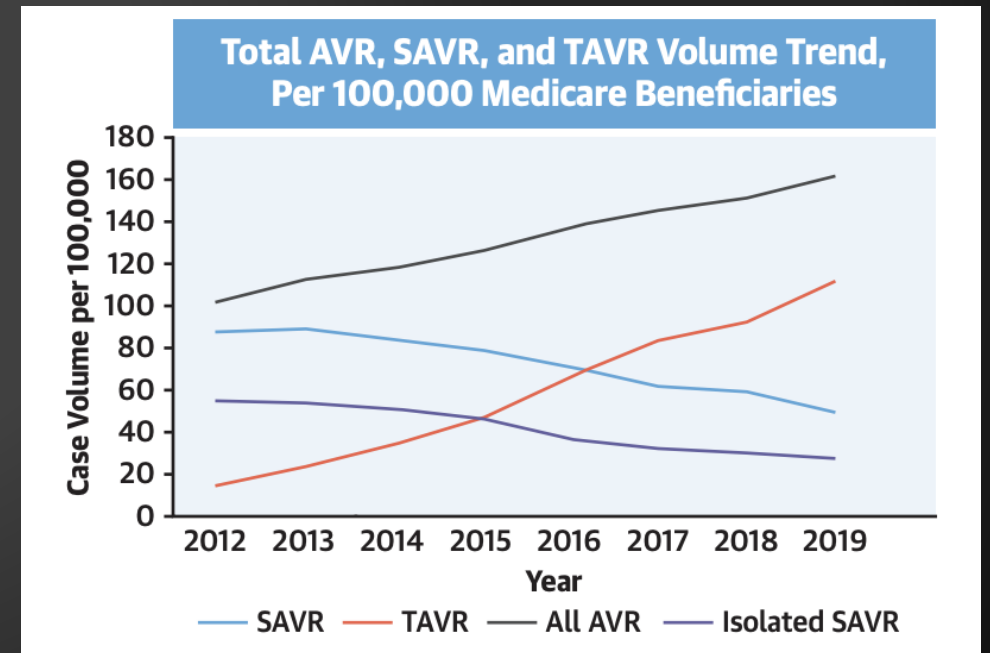
Evolut Low Risk Trial:



TAVR in Low-risk patients

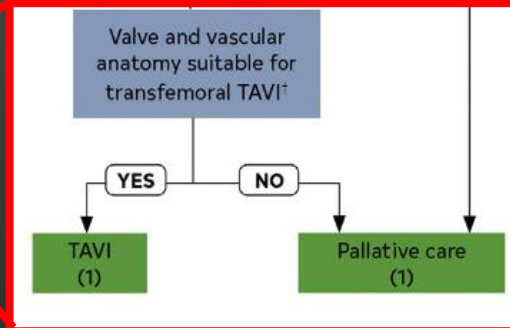
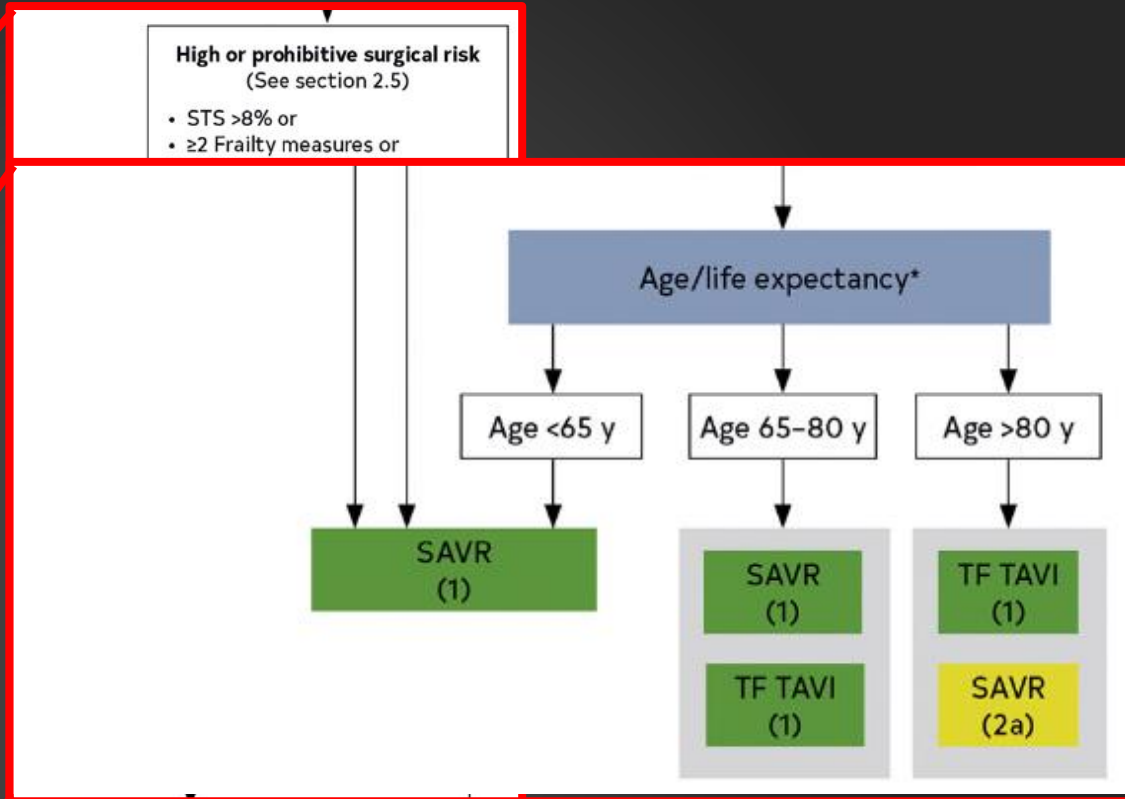
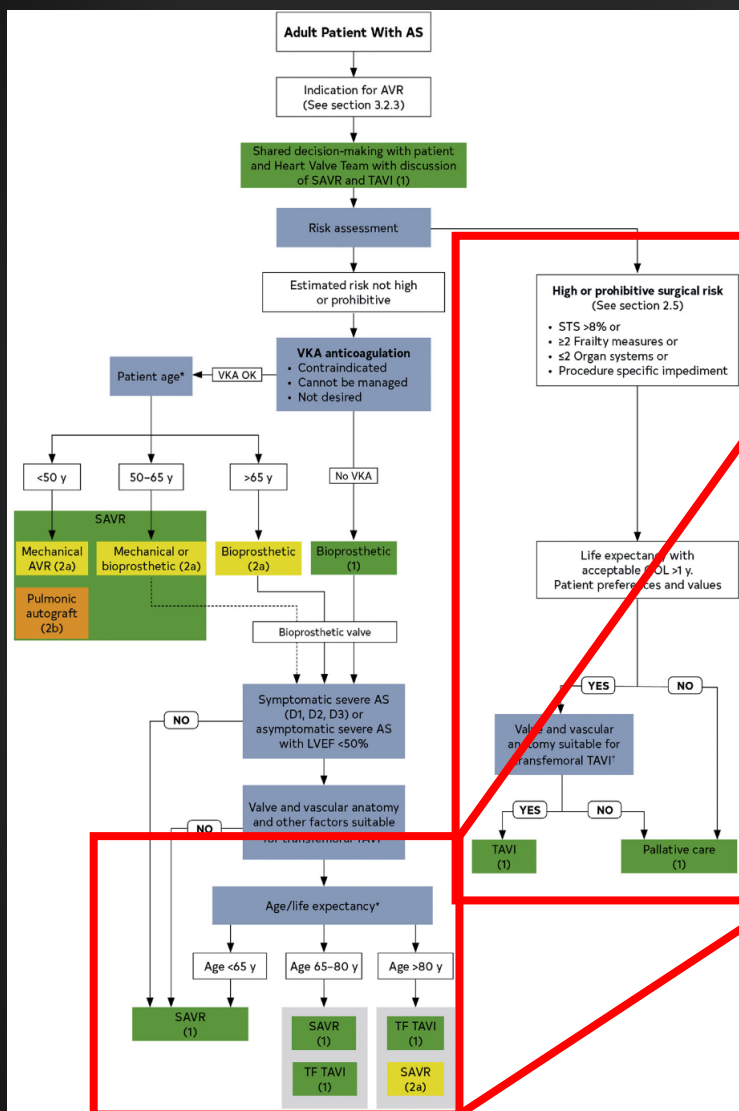


- STS (Society of Thoracic Surgeons) calculator from national database to generate risk of mortality
 - Low Risk - <3%
 - Intermediate Risk – 3-8%
 - High risk - >8%



Mori, et al. JACC 2021;78:2161–2172

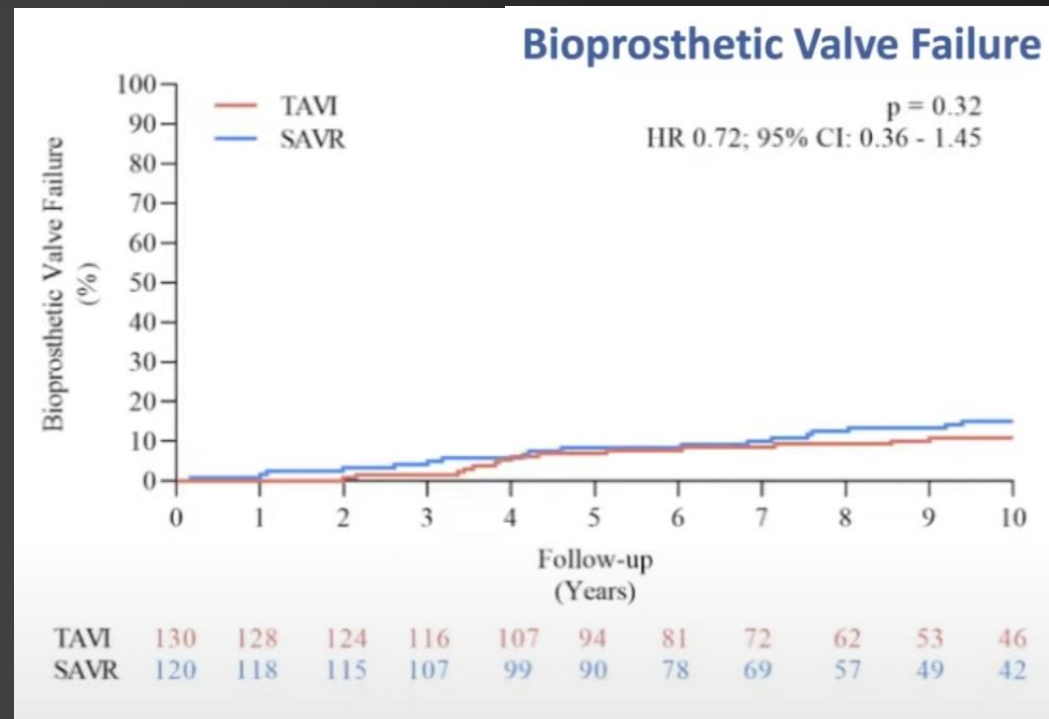
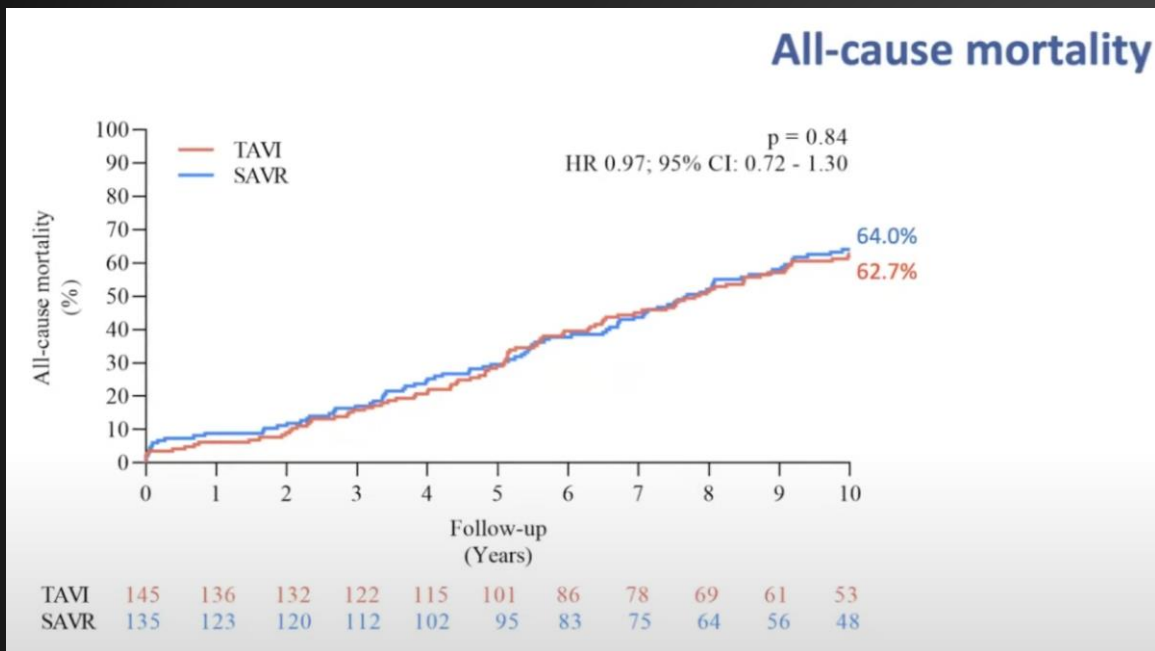
2020 ACC/AHA Valvular Guidelines



How durable are TAVR valves?

- Current generation valves have gone through structural iterations every couple of years, thus long-term data on the exact valve we are implanting now are lacking.
- Early TAVR was done in extreme or high-risk patients, many of whom have died from a noncardiac cause

NOTION 10-year RCT - CoreValve

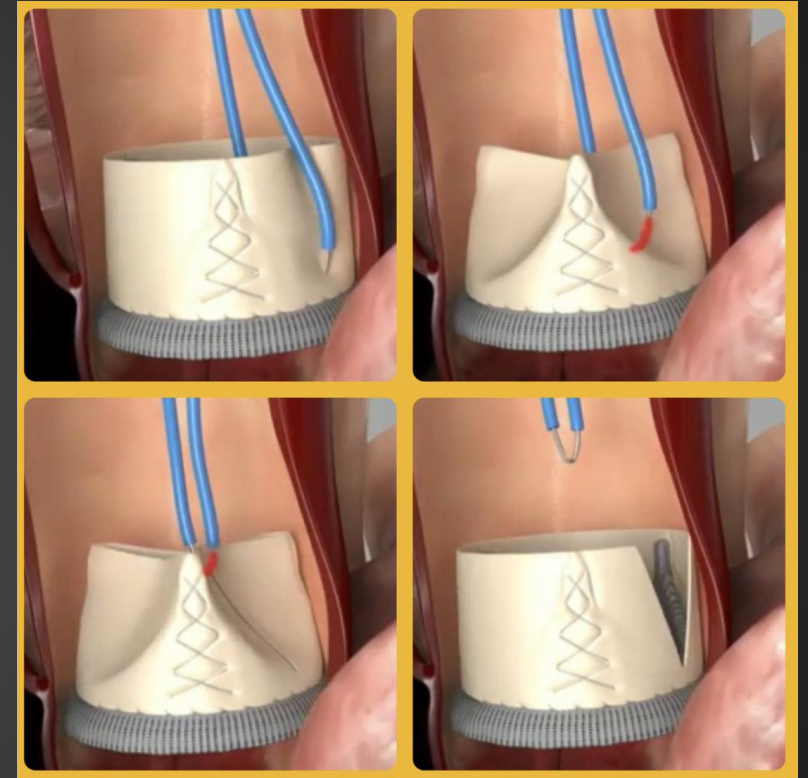


Lifetime Management

- Discussion more akin to palliation rather than definitive correction in younger patients
 - 70-year-old, still working, TAVR now, SAVR later?
 - 70-year-old, large annulus, TAVR now, TAV in TAV later?
 - 70-year-old, tissue SAVR now, TAV in SAV later?
- If you're going to need an open surgery, would you rather do it at age 70, or age 80?
- Etiology of Severe AS in 70 yo? More Bicuspid AoV...

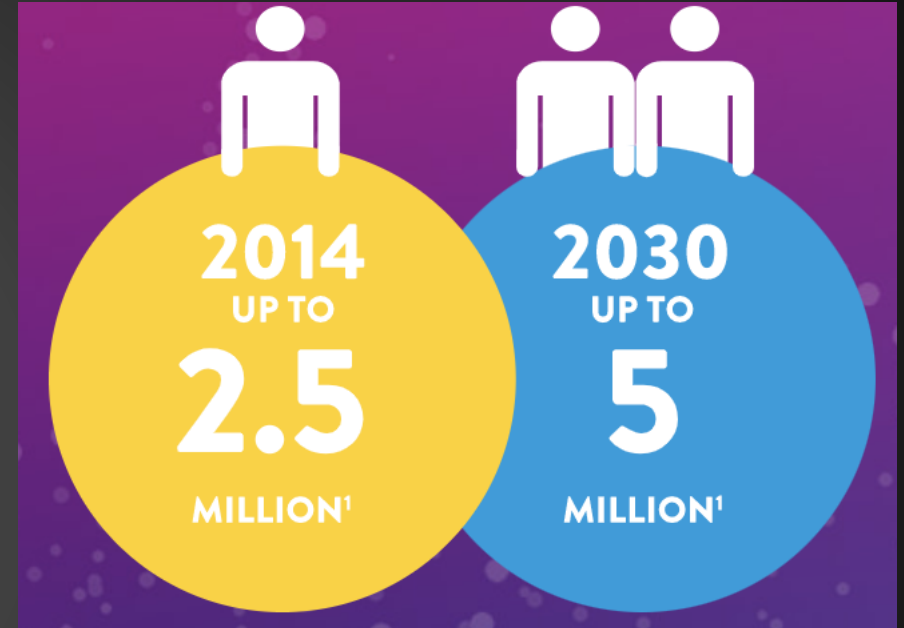
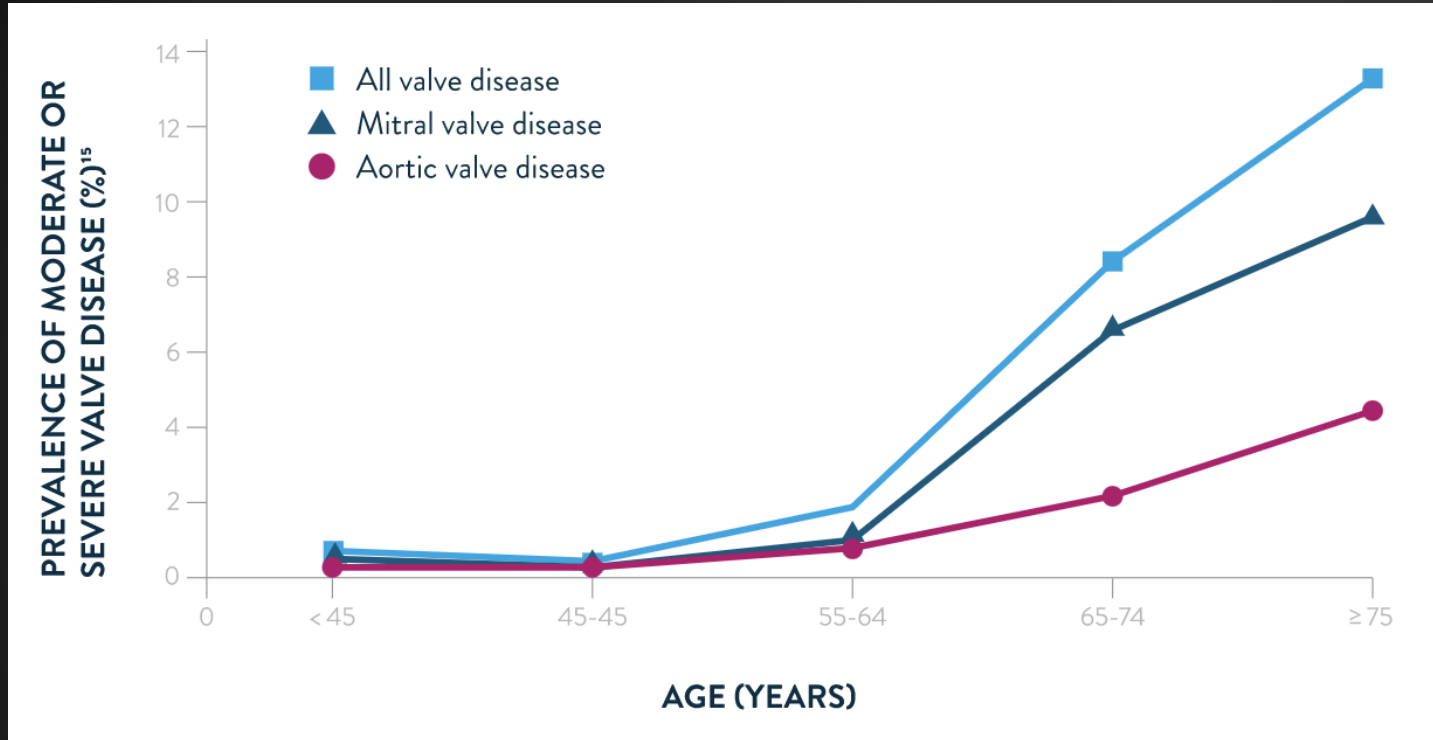
Lifetime Management

- Comprehensive Heart Team Discussion / Shared Decision-making Model
 - Caveats:
 - Small annulus
 - Bicuspid AoV
 - Severe AR
 - Valve-in-Valve issues (i.e. coronary obstruction, AC, size, etc...)
 - Mortality/Morbidity of TAVR explant



DAIC 8/27/2019:
<https://www.dicardiology.com/article/basilica-procedure-prevents-coronary-obstruction-tavr>

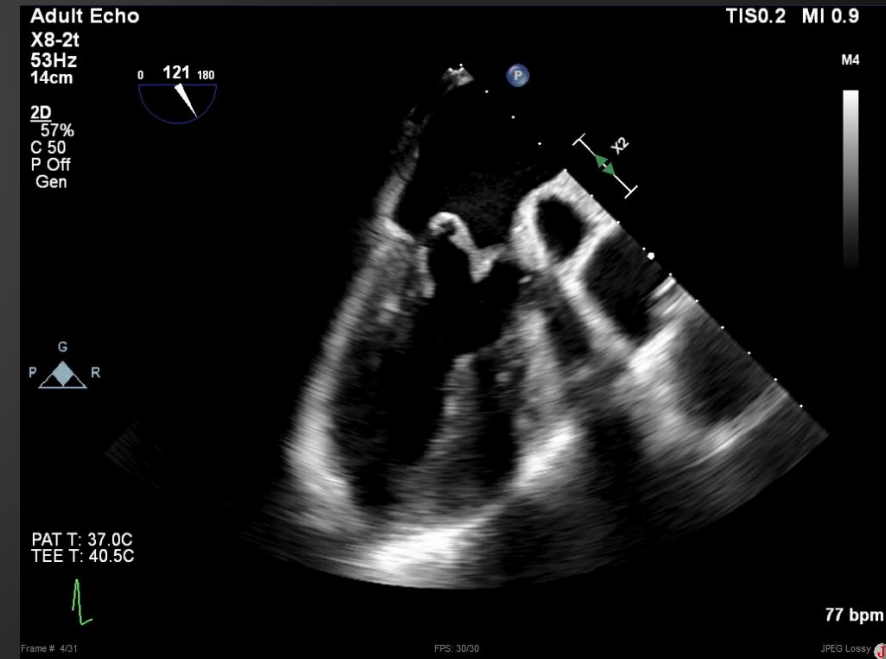
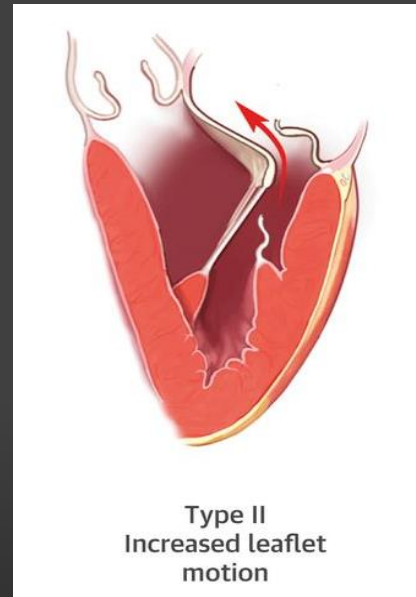
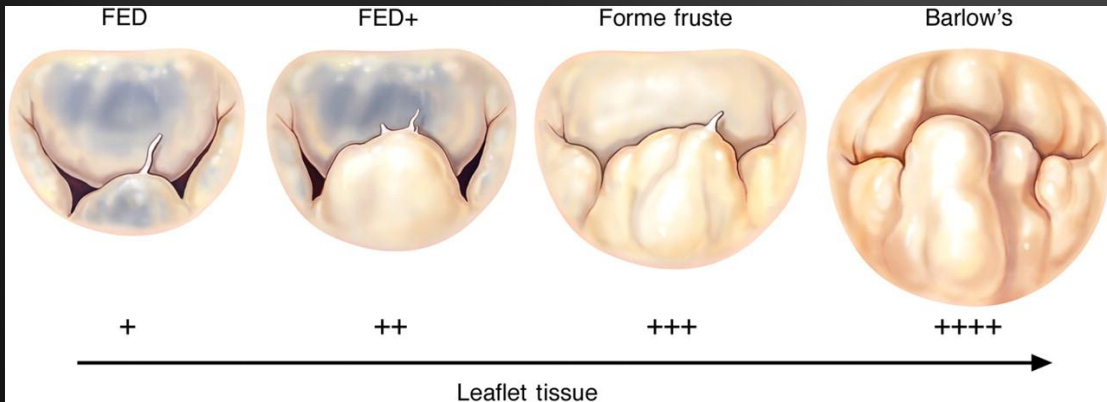
Mitral Valve Disease



Two Types of Mitral Regurgitation

- **Primary (Degenerative) MR**

- Involves the leaflets, chordae and papillary muscles
- *Most common cause: MVP (Fibroelastic Dz and Barlow's)*
- Flail leaflet secondary to chordal rupture or pap muscle rupture
- *Treatment: Surgical Repair*



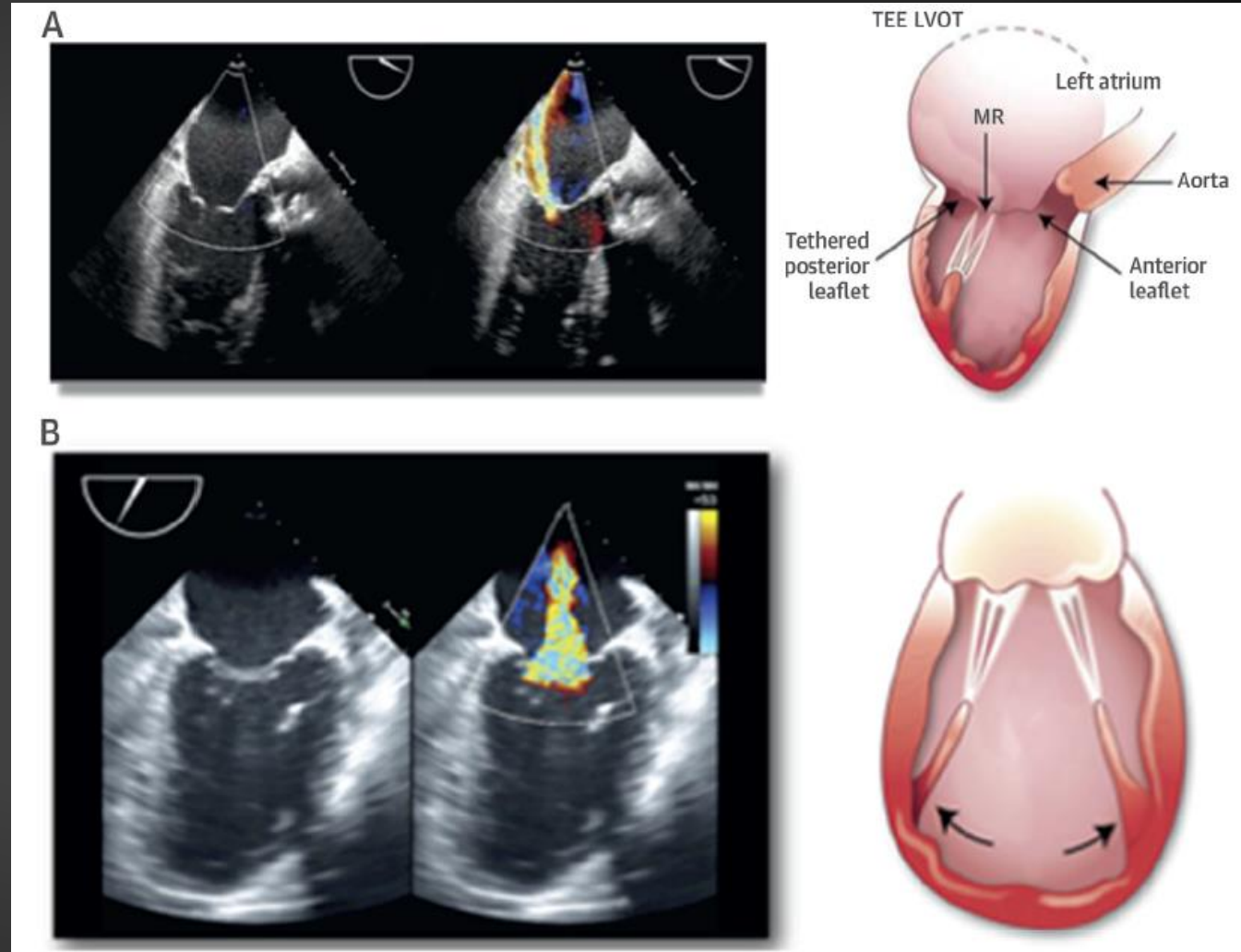
Two Types of MR

- **Secondary (Functional) MR**

- It's the ventricle → Ischemic or Nonischemic CMP
 - Tethering of the leaflets
 - Decreased closing forces

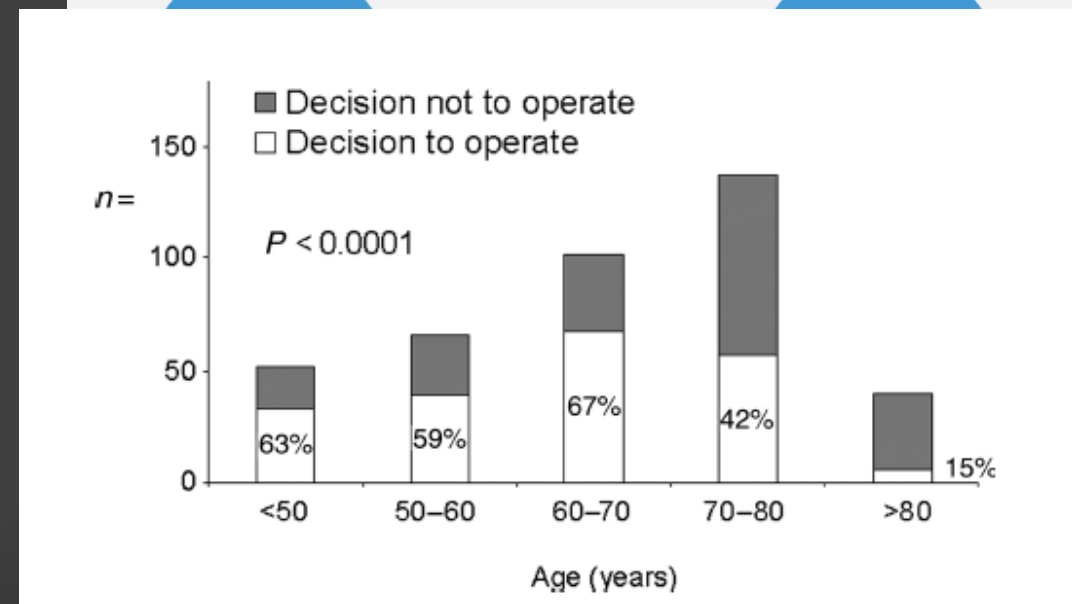
- "Atrial Functional" → Afib with LAE (dilated annulus)

- *Treatment:* Revasc, GDMT / CRT



Mitral Valve Disease

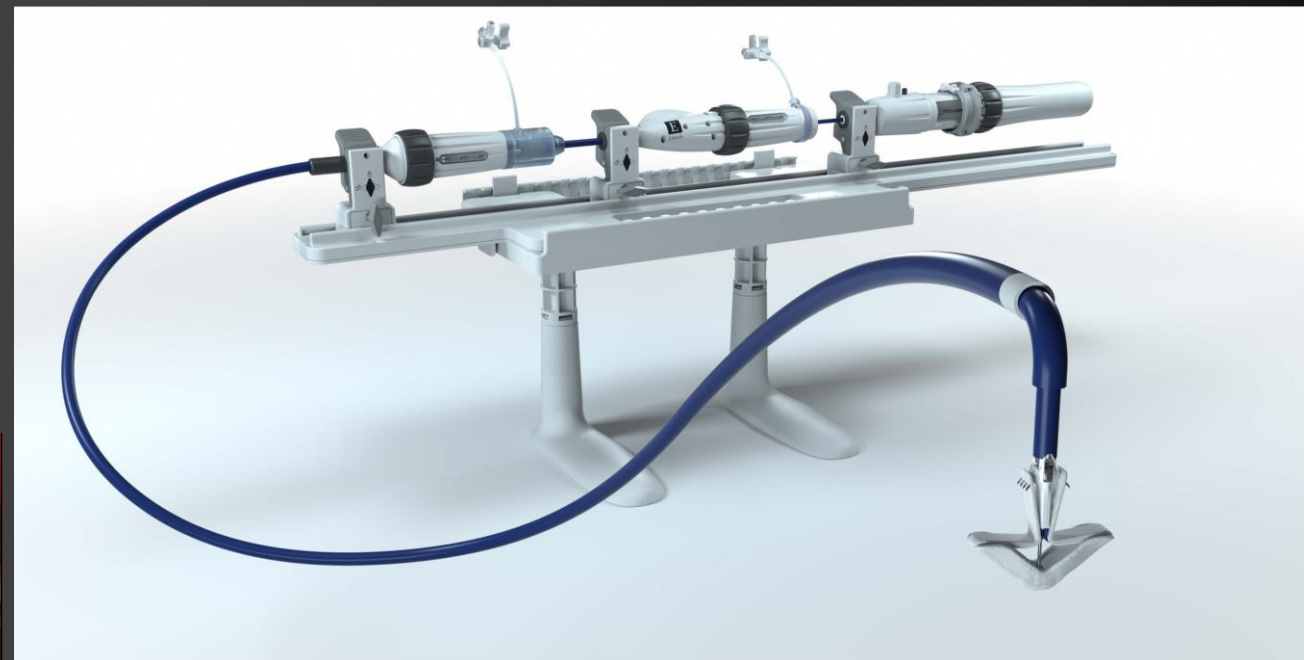
- If left untreated, MR can initiate a cascade of events leading to heart failure and death, with a 1-year mortality up to 57%
- 74% of eligible patients with primary MR were not referred for surgery for valve replacement.
 - Nearly 50% of all MR patients will be denied valve replacement surgery due to risks.



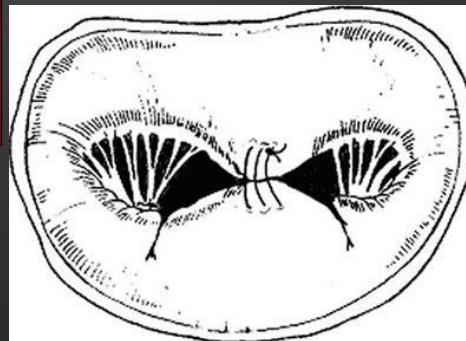
- Cioffi G, Tarantini L, De Feo S, et al. Functional mitral regurgitation predicts 1-year mortality in elderly patients with systolic chronic heart failure. *Eur J Heart Fail.* 2005;7(7):1112-1117.
- Bach DS, Awais M, Gurm HS, Kohnstamm S. Failure of guideline adherence for intervention in patients with severe mitral regurgitation. *J Am Coll Cardiol.* 2009;54(9):860-865.
- Mirabel M, Iung B, Baron G, et al. What are the characteristics of patients with severe, symptomatic, mitral regurgitation who are denied surgery? *Eur Heart J.* 2007;28(11):1358-1365.

Transcatheter Edge-to-Edge Repair (TEER)

- 2 FDA approved devices: Abbott **MitraClip**® & Edwards **Pascal**®



Mimics surgical Alfieri stitch



TEER – for Primary MR (EVEREST II TRIAL)

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812

APRIL 14, 2011

VOL. 364 NO. 15

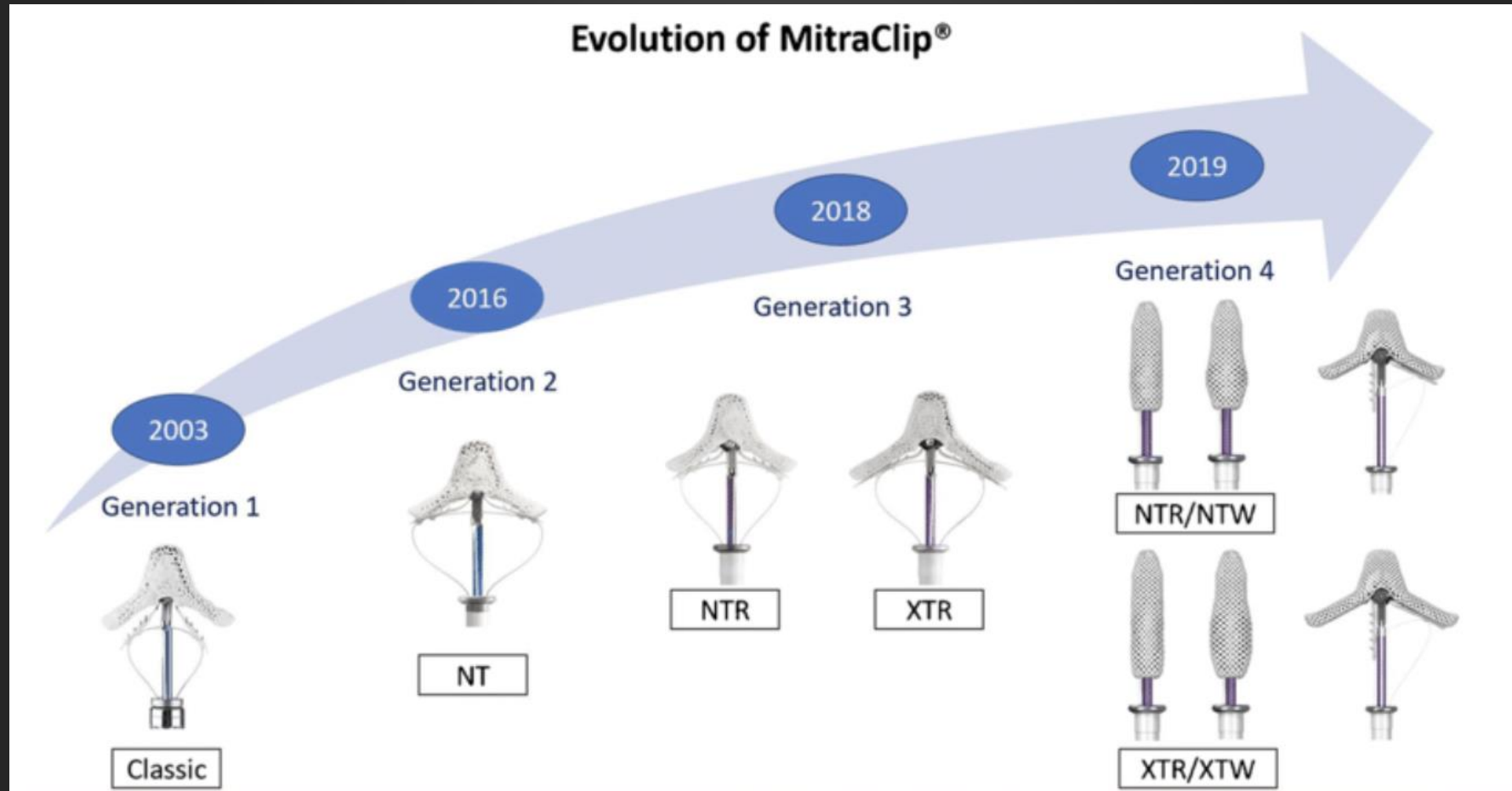
Percutaneous Repair or Surgery for Mitral Regurgitation

Ted Feldman, M.D., Elyse Foster, M.D., Donald D. Glower, M.D., Saibal Kar, M.D., Michael J. Rinaldi, M.D., Peter S. Fail, M.D., Richard W. Smalling, M.D., Ph.D., Robert Siegel, M.D., Geoffrey A. Rose, M.D., Eric Engeron, M.D., Catalin Loghin, M.D., Alfredo Trento, M.D., Eric R. Skipper, M.D., Tommy Fudge, M.D., George V. Letsou, M.D., Joseph M. Massaro, Ph.D., and Laura Mauri, M.D., for the EVEREST II Investigators*

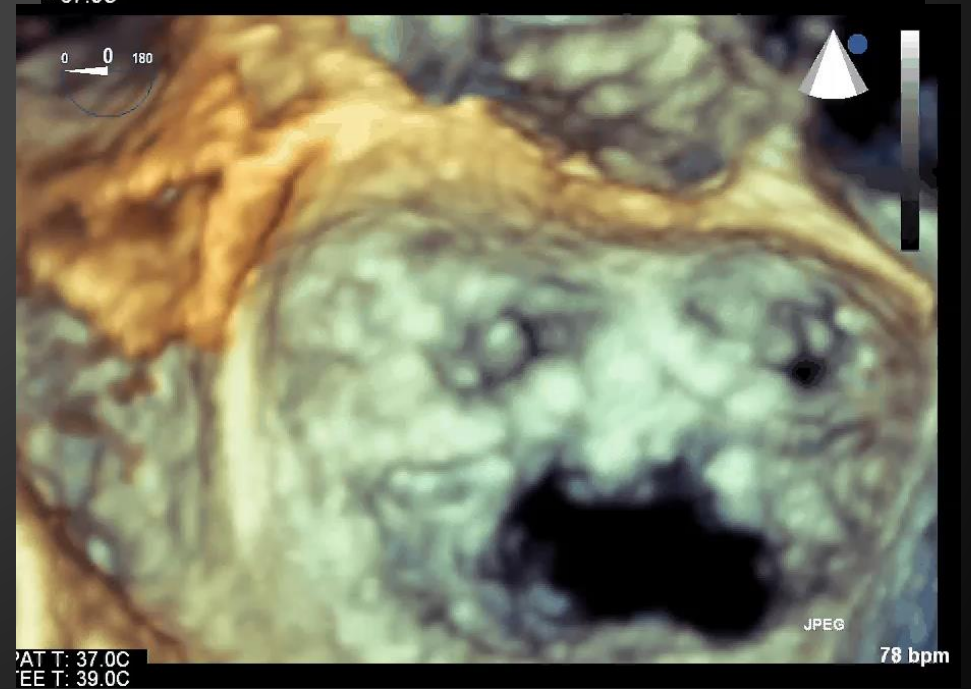
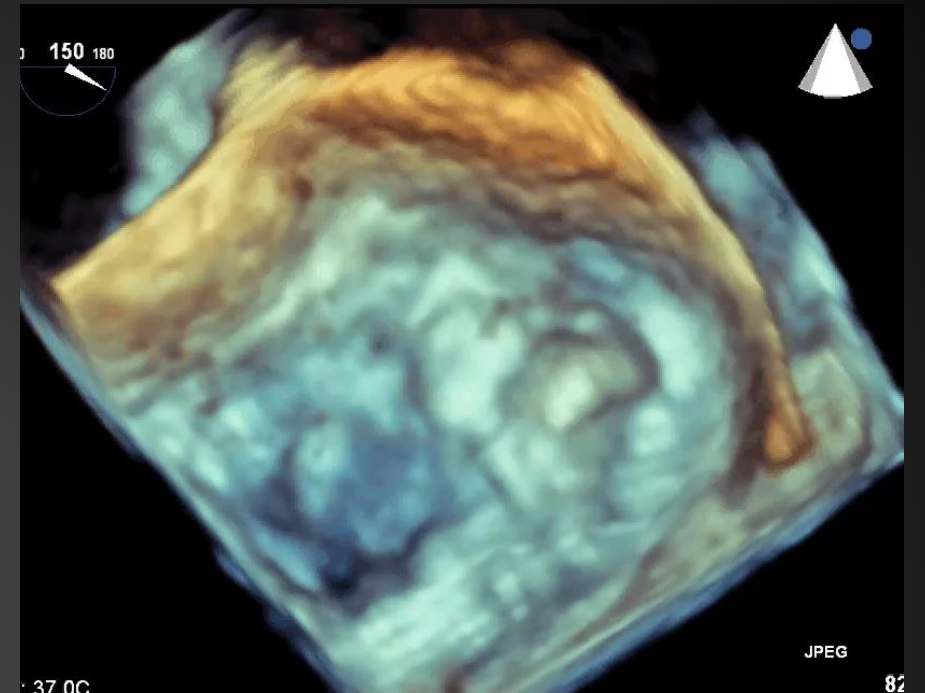
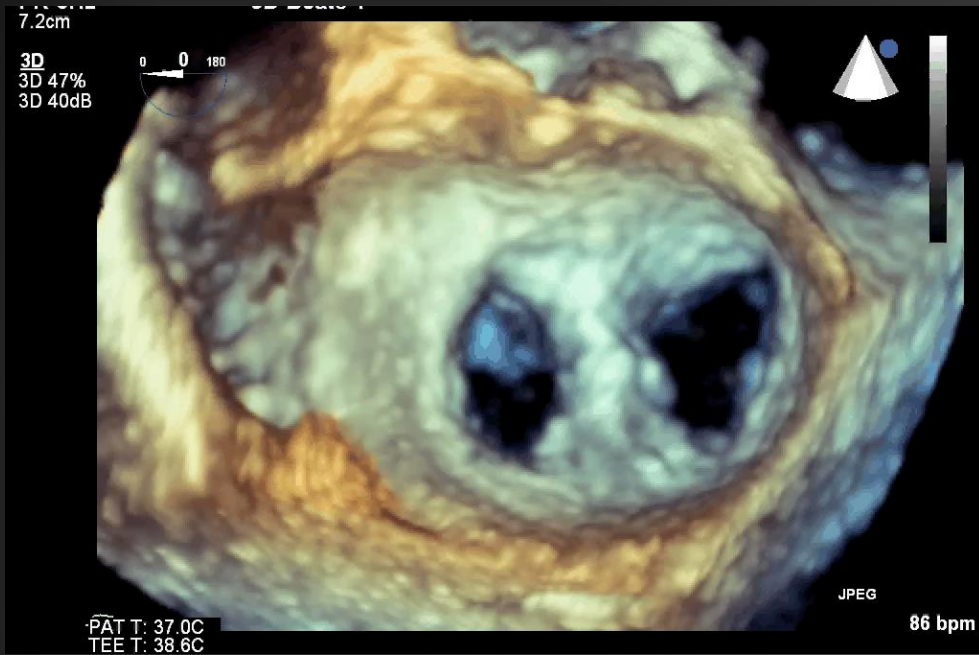
- 279 pts randomized
- 1^o Outcome: Freedom from death, redo MR surgery and Grade 3-4+ MR
 - 23% of MC arm had 3-4+ MR (10 pts had No Clips placed)
- Surgery clearly more durable with less MR
- MitraClip better safety than surgery
 - Similar clinical outcomes with good TEER results

TEER – For Primary MR

- Approved by FDA in 2013 for HIGH-risk surgical patients

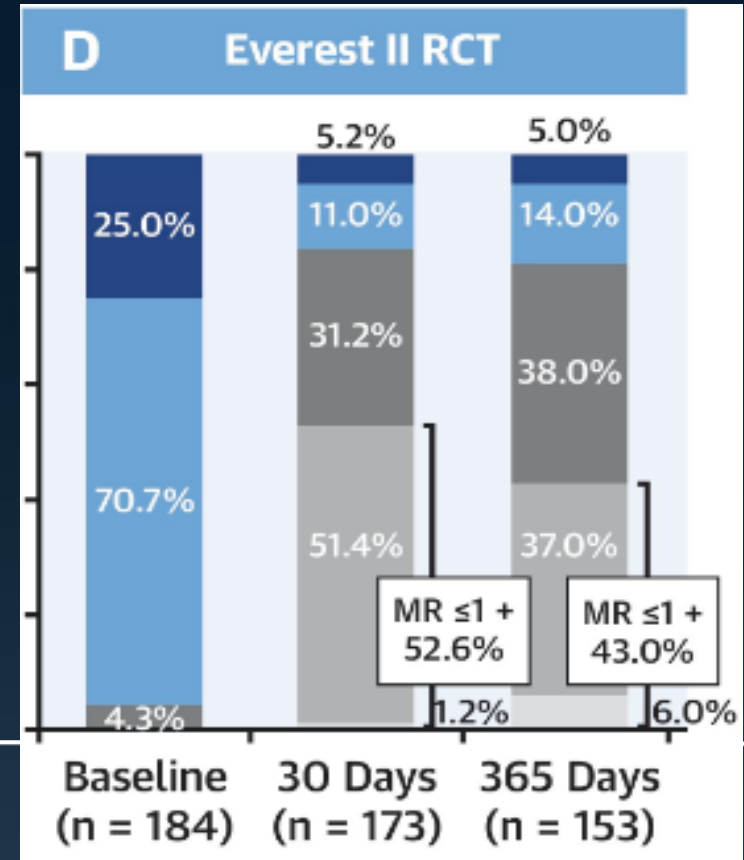
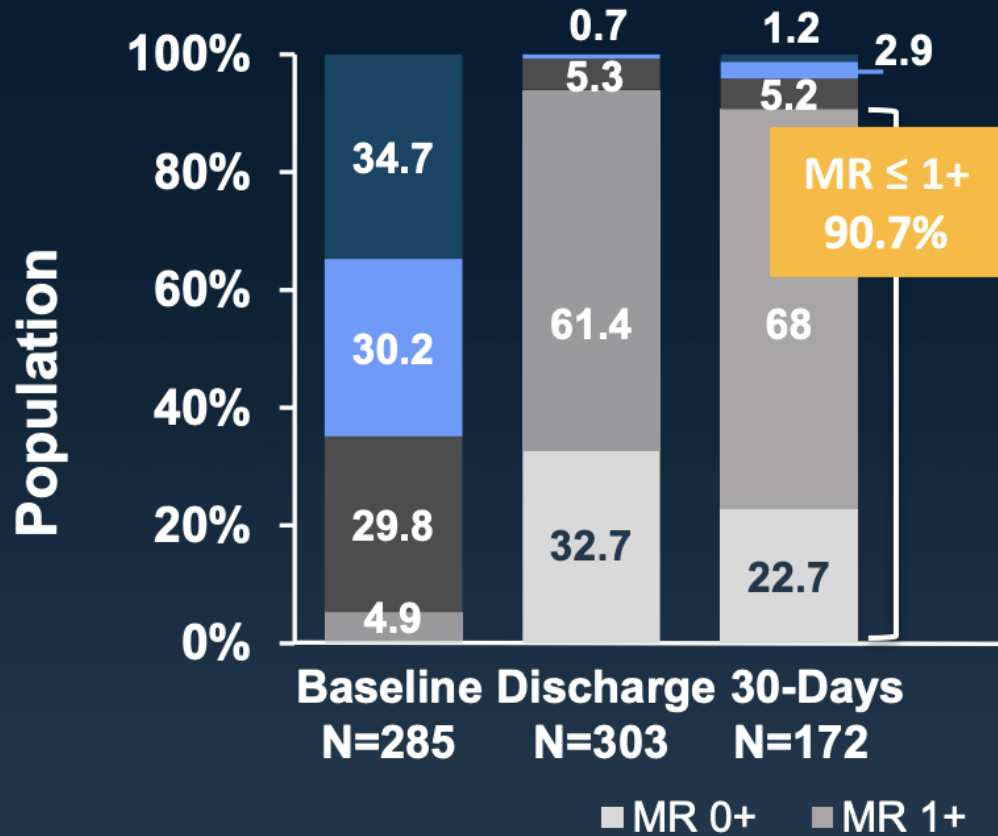


TEER – Beyond EVEREST II



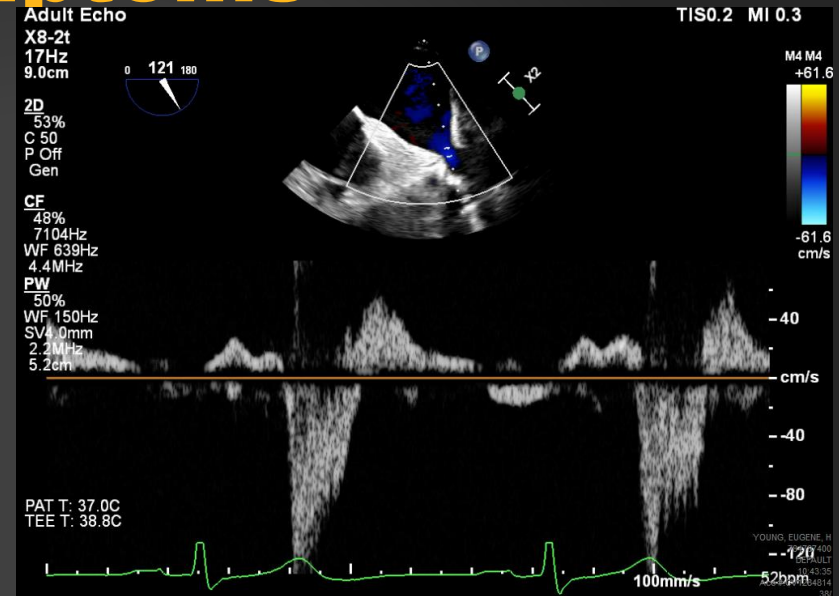
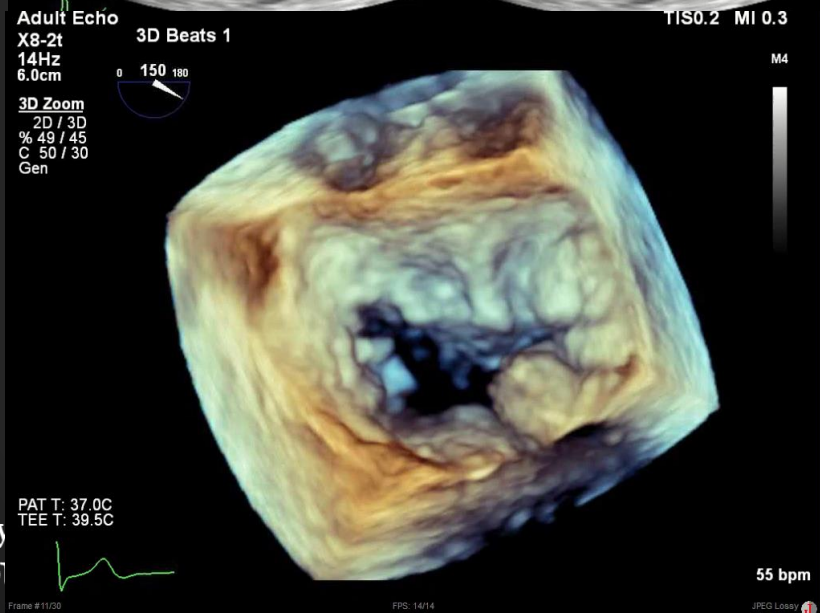
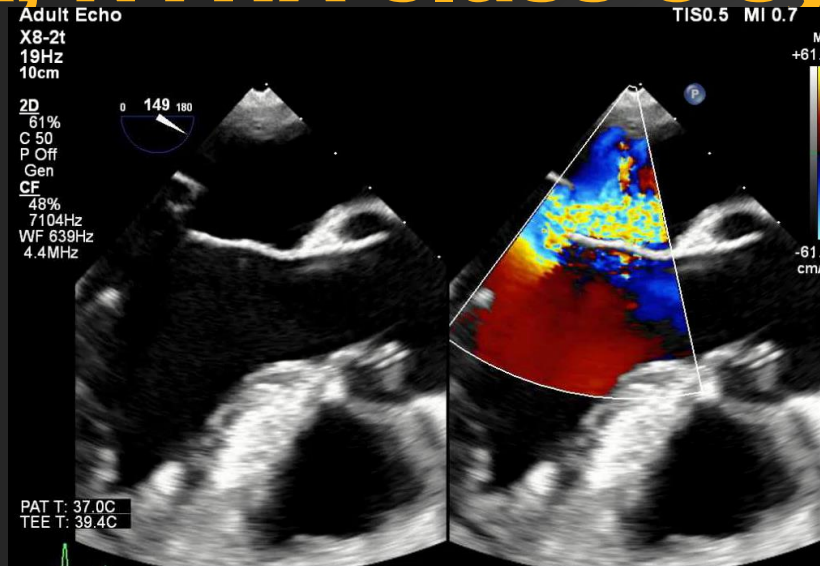
TEER – EXPAND G4 Registry

EXPAND G4

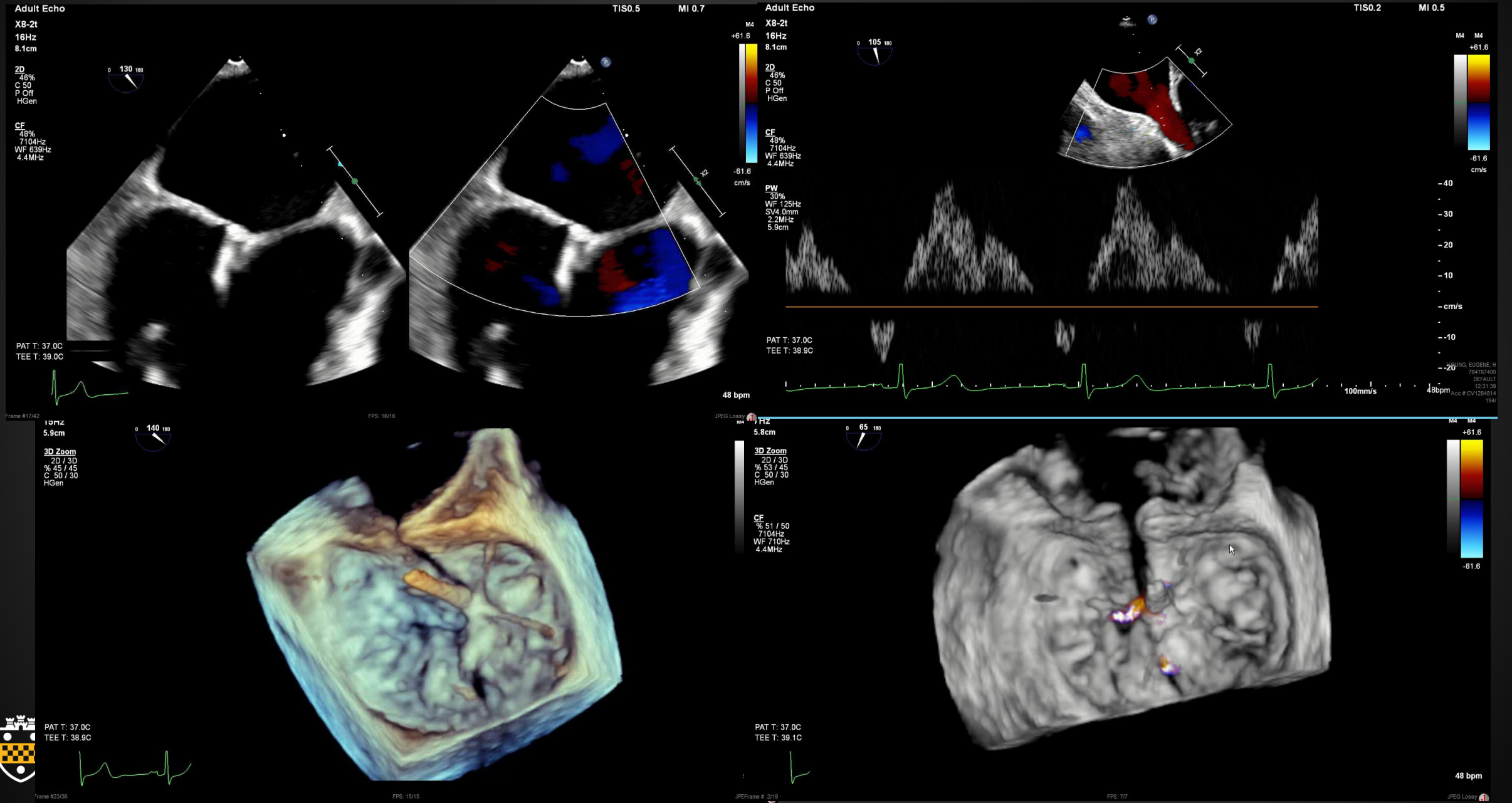


MR Reduction to ≤ Mild at 30 days achieved in 90.7% of subjects; 95.9% had MR reduction to ≤ Moderate.

86 y/o male w/CABG, dementia, MVP w/severe MR, NYHA class 3 symptoms

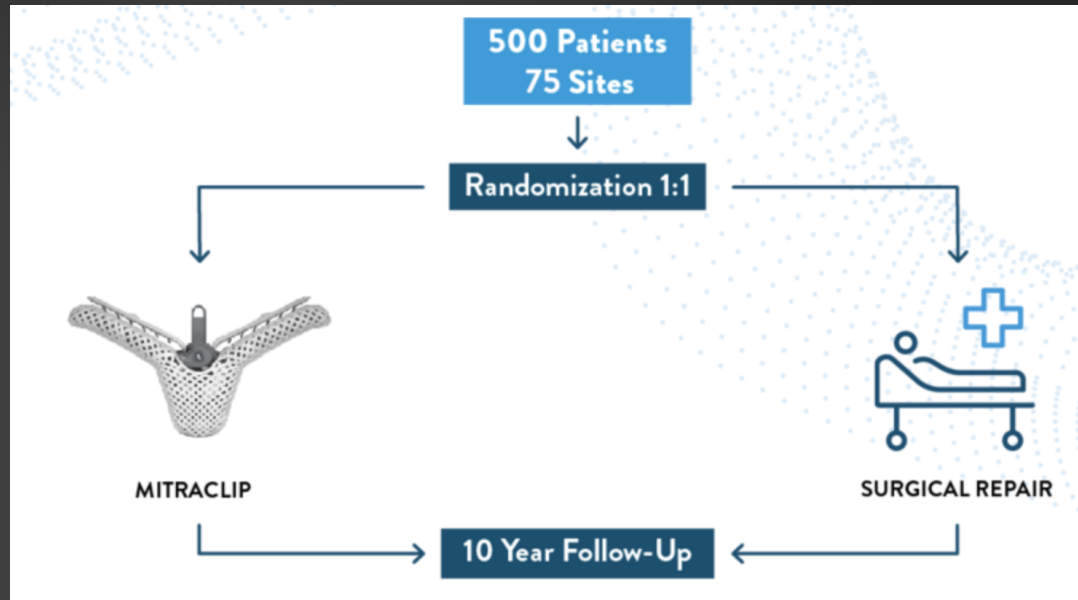


2 NTW Clips – 1+ MR, mean grad 2mmHg



TEER – for Primary MR

Ready for lower surgical risk patients??



MitraClip™ vs. surgical repair in patients with severe primary MR who are at **intermediate** surgical risk

- **Primary outcome:** All-cause mortality, stroke, cardiac hospitalization, or acute kidney injury requiring renal replacement therapy at 2 years
- **Secondary outcome:** Proportion $\leq 2+$ MR, without need for surgery/reintervention at 2 years

TEER – For Functional MR

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*

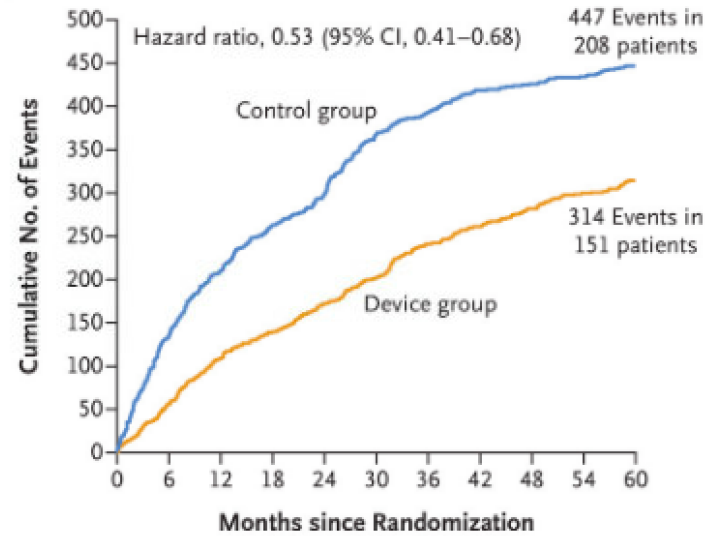
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FDA APPROVAL 2019: Mod-Sev or Severe FUNCTIONAL MR after optimal medical/device therapy

COAPT 5 YR Data

March 5, 2023

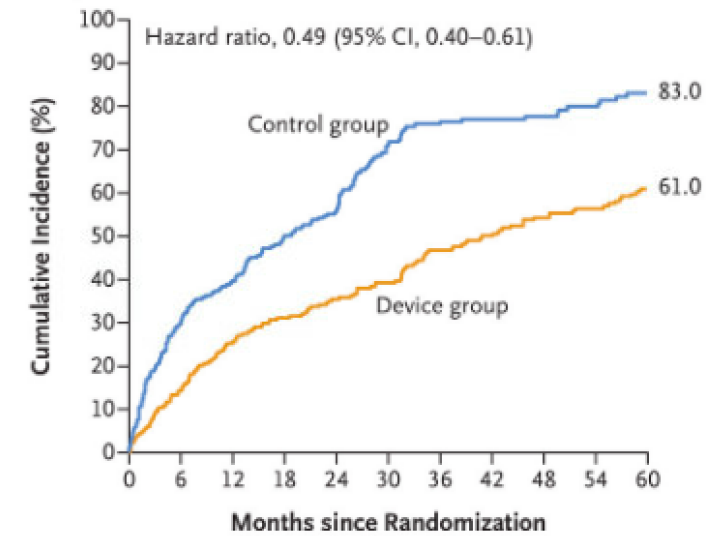
A Hospitalizations for Heart Failure



No. at Risk

Control group	312	272	224	188	156	133	120	106	94	84	59
Device group	302	269	238	219	205	186	167	151	138	124	79

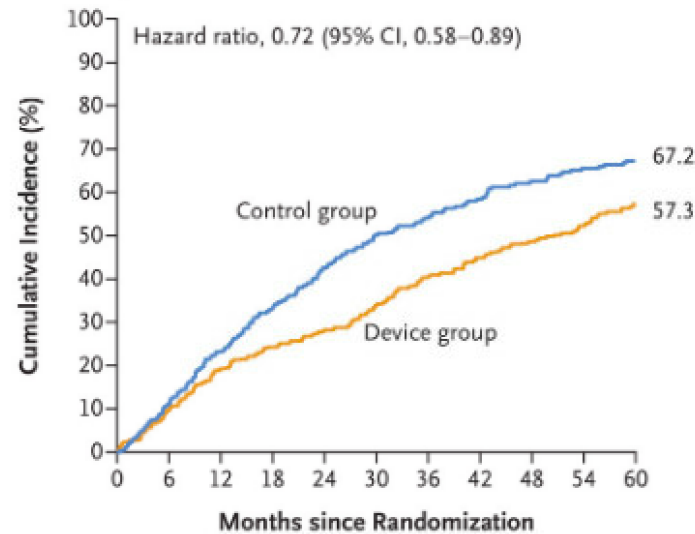
B First Hospitalization for Heart Failure



No. at Risk

Control group	312	206	157	122	95	58	43	37	33	26	17
Device group	302	236	194	174	158	141	118	105	93	81	52

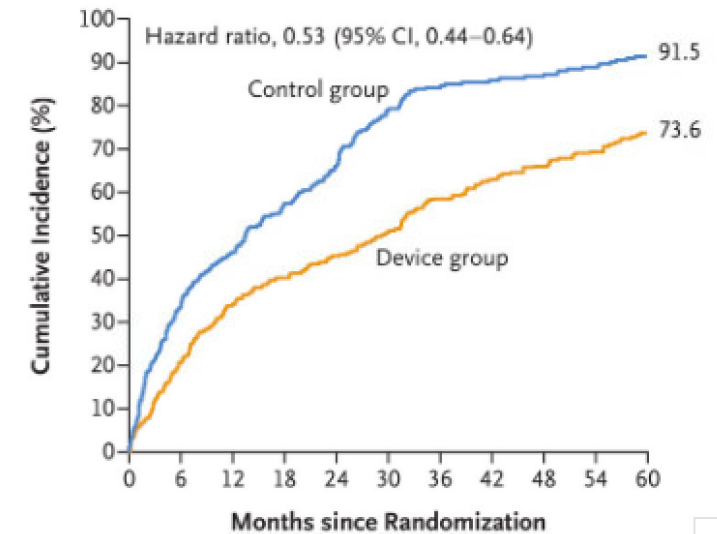
C Death from Any Cause



No. at Risk

Control group	312	272	224	189	157	135	122	107	94	84	59
Device group	302	269	238	219	205	186	167	151	138	124	79

D Death from Any Cause or First Hospitalization for Heart Failure

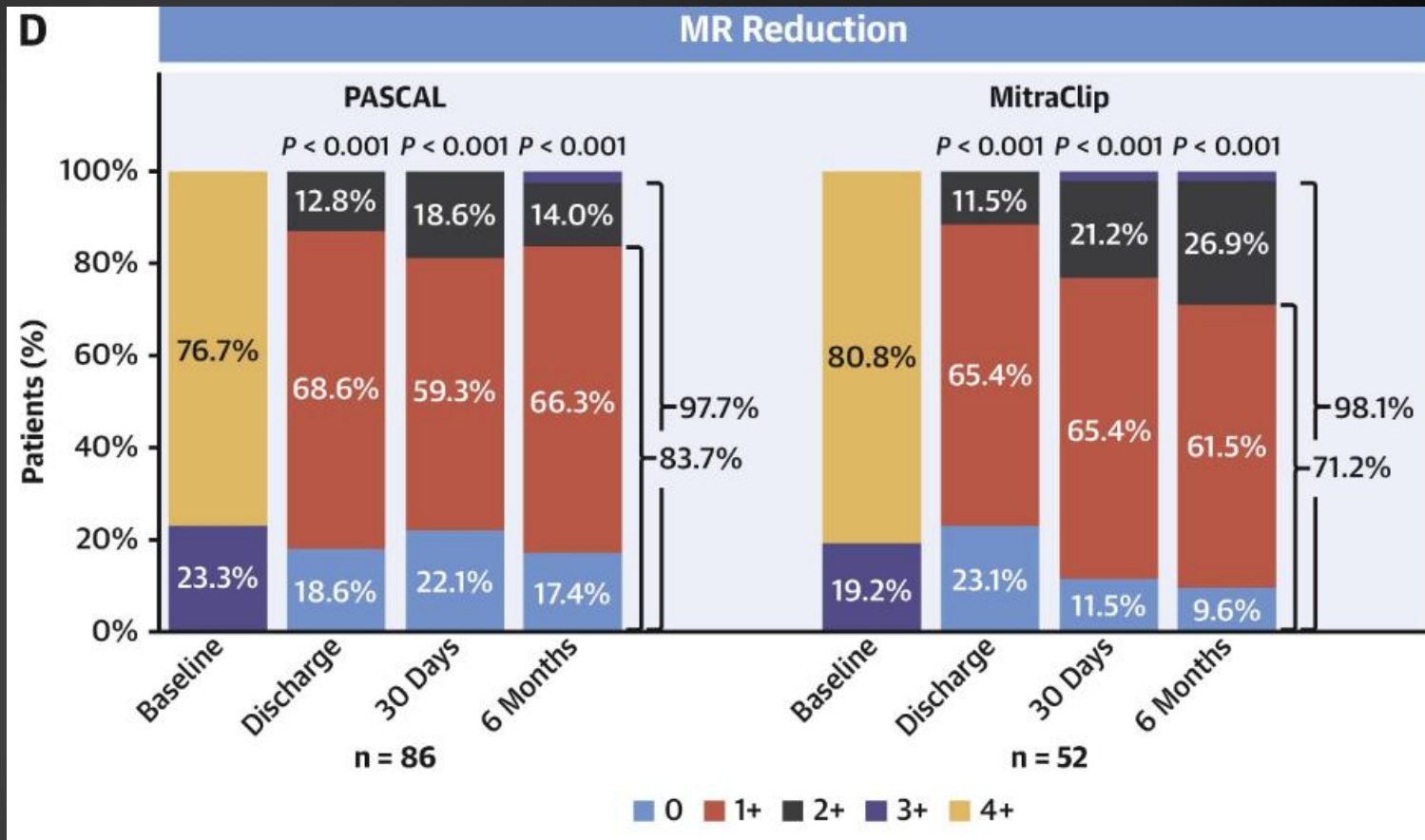
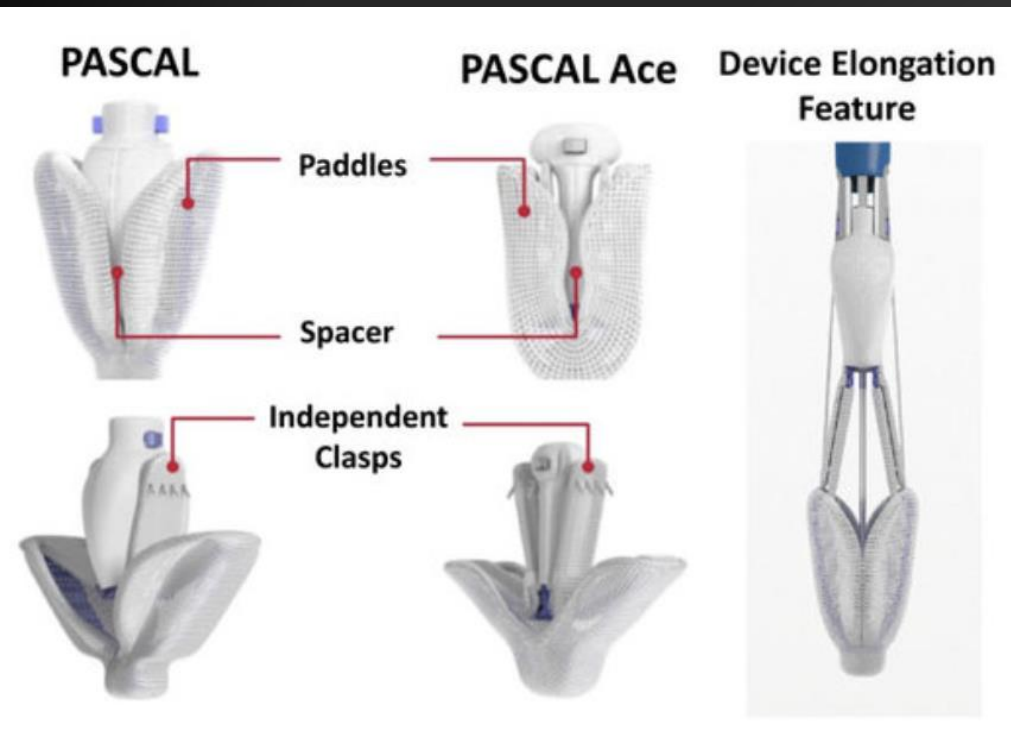


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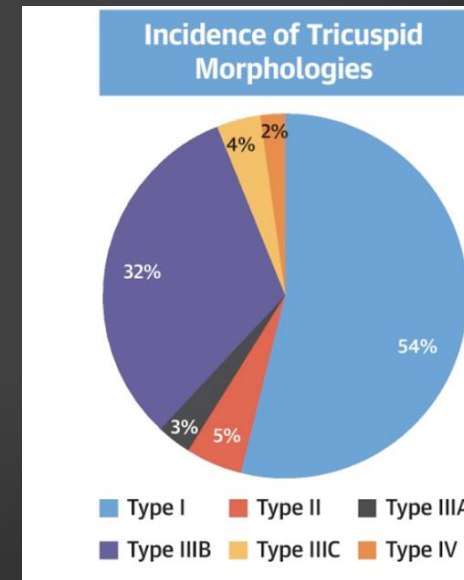
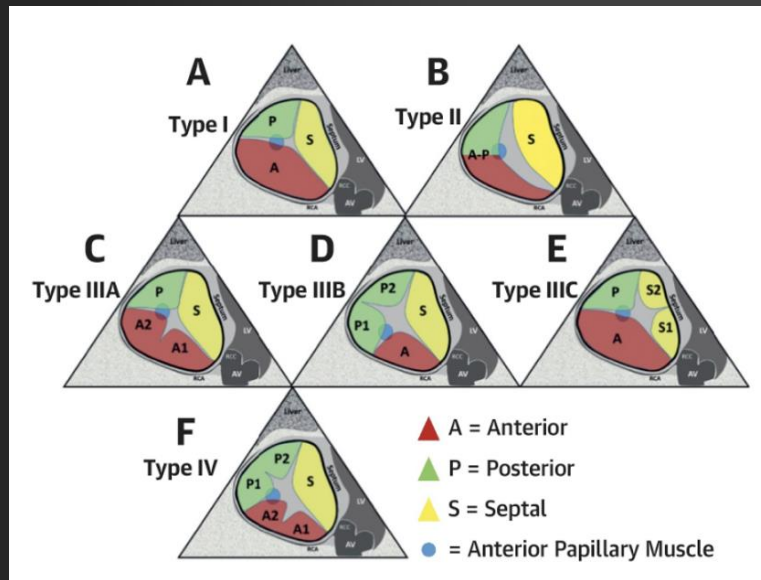
TEER with PASCAL® - CLASP 2D RCT



FDA APPROVAL Jan 2023: Mod-Sev or Severe DEGENERATIVE MR at high-risk for surgery

Tricuspid TEER??.....YES!

- High morbidity and mortality
- High surgical risk
- Medical Rx: SGLT2i and diuretics
- Tricuspid anatomy complex

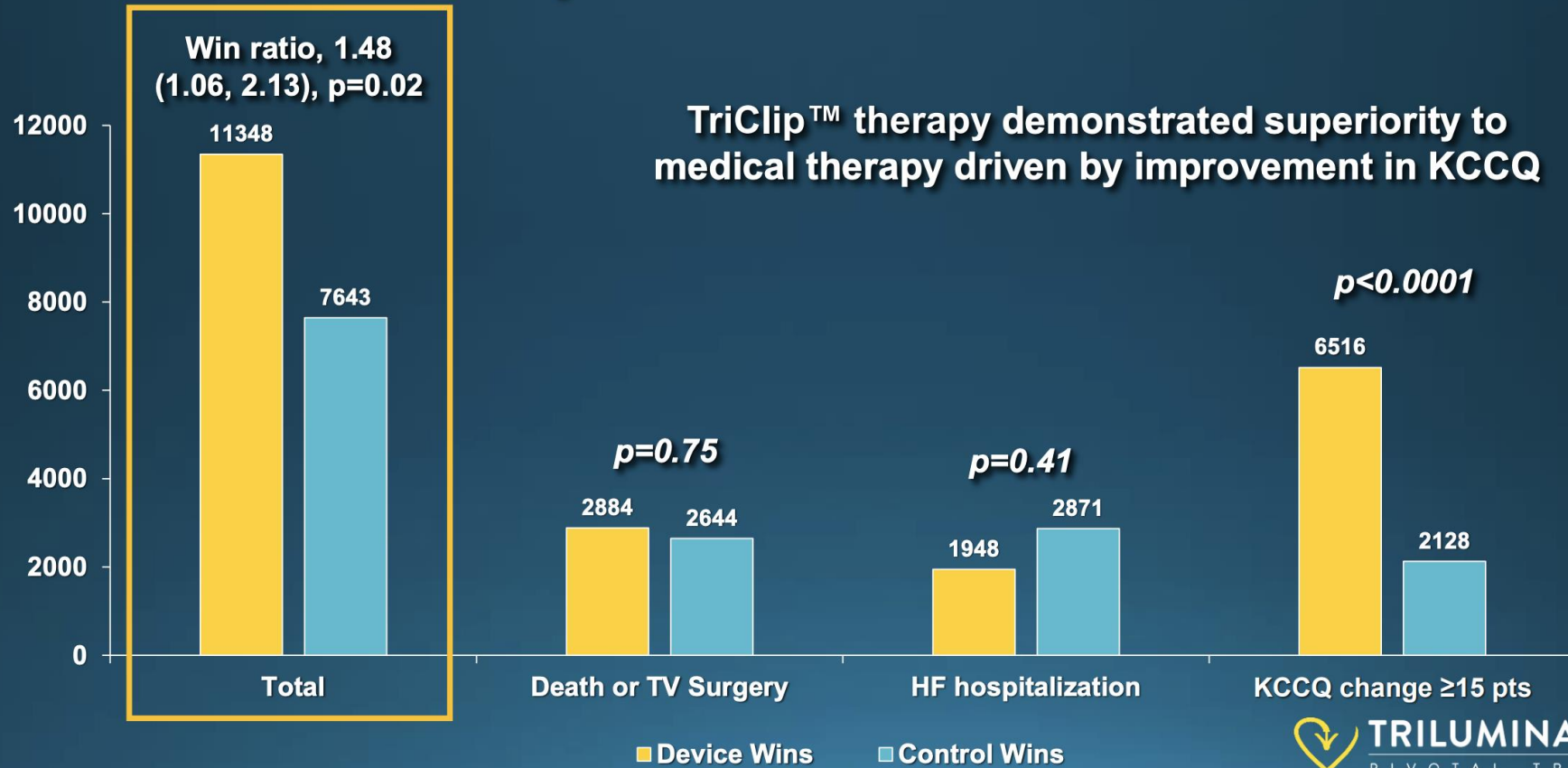


TRILUMINATE Study

- Pr at VS
- Pr ac

Primary Endpoint

Finkelstein-Schoenfeld Analysis



SO....TEER for all??.... *Not so fast*

- There are still challenges with TEER

- Complex mitral anatomy
 - Small annulus/high resting gradients
 - Mixed MS/MR
 - Thickened leaflets/chordae
 - Calcified leaflets/MAC
 - Multiple jets/clefts
 - Large gaps
- TEE Visualization



Proper Patient Selection

The Hope of Transcatheter Mitral Valve Replacement (TMVR)

- Device agnostic to MR etiology
- Perform in real-world anatomy (especially where TEER struggles)
 - MAC, small annuli, thickened leaflets, mixed disease MR/MS
- Trans-septal delivery system
 - Large enough valve sizes in reasonable delivery catheter

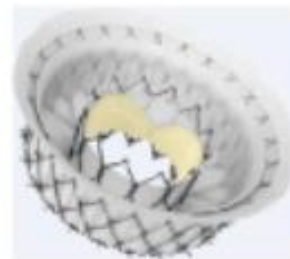
TMVR – No single platform likely adequate



EVOQUE
Edwards



Sapien M3
Edwards



Intrepid
Medtronic



CardioValve
Venus Medtech



Tendyne
Abbott



CEPHEA
Abbott



AltaValve
4C Medical



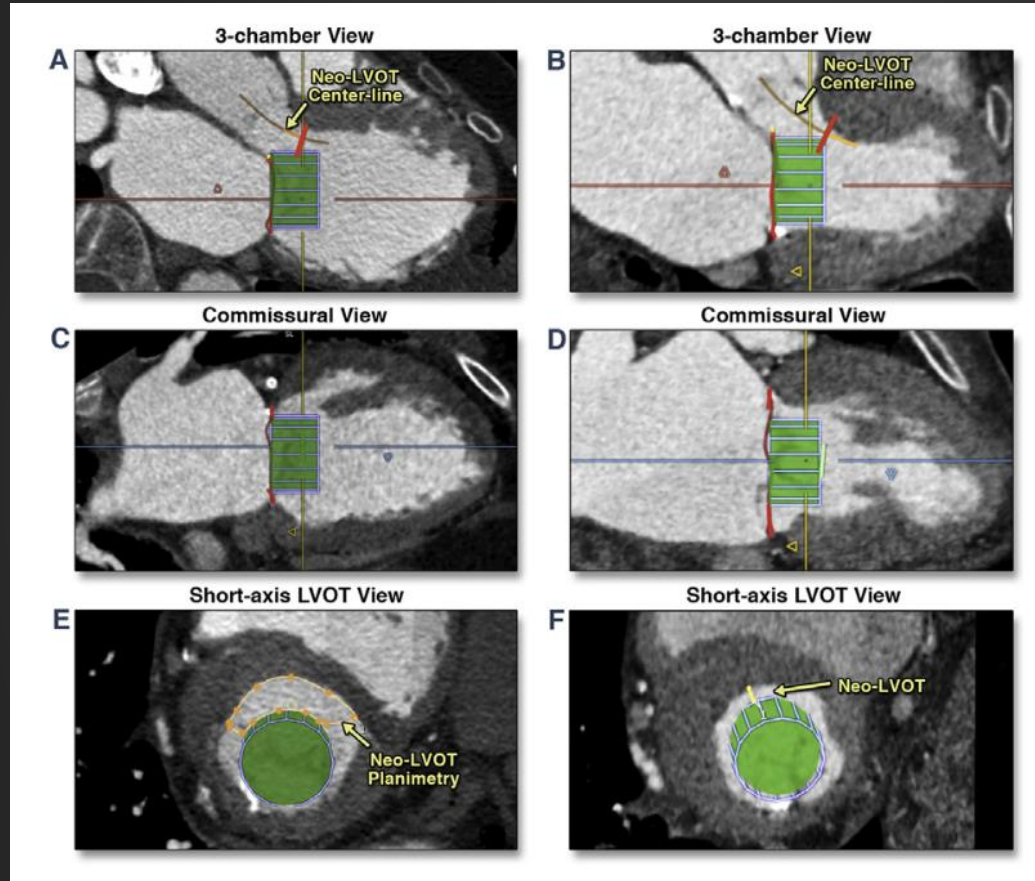
HighLife
HighLife Medical



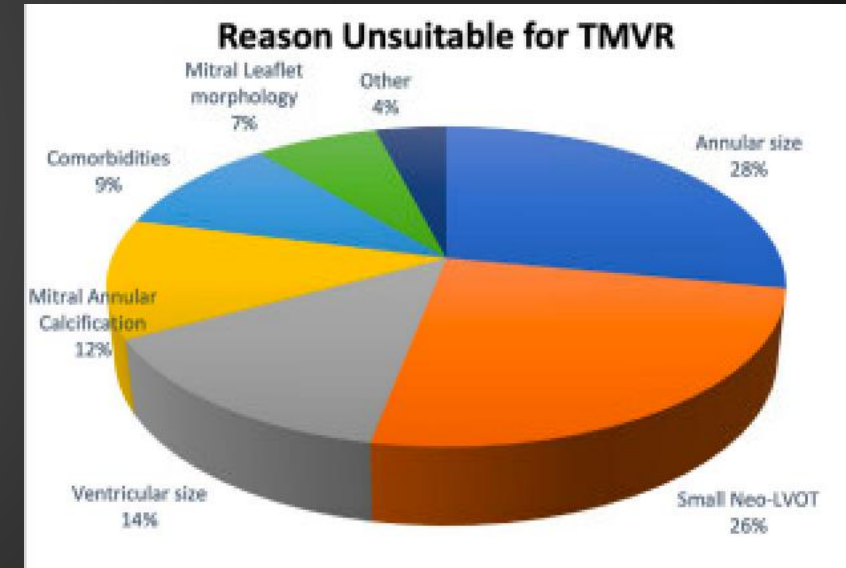
Tiara
Neovasc

Challenges of TMVR – *Performing in Real-world Anatomy*

- Anchoring / Sealing
- LVOT Obstruction
- Evolution of CT planning/guidance



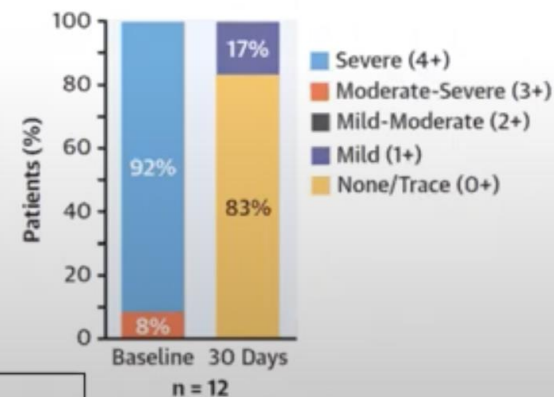
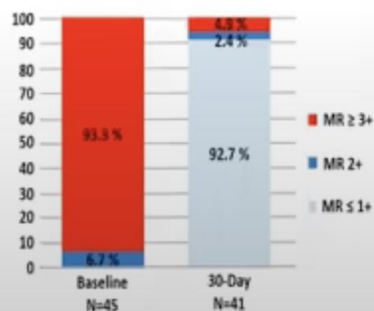
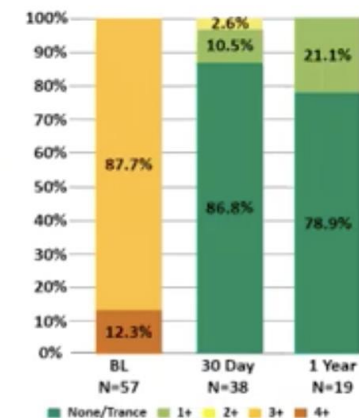
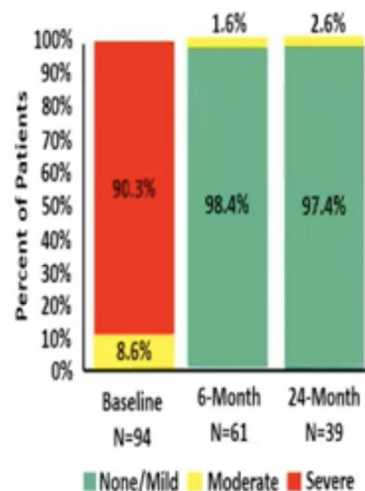
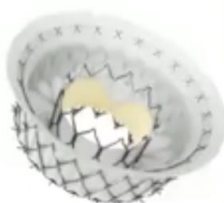
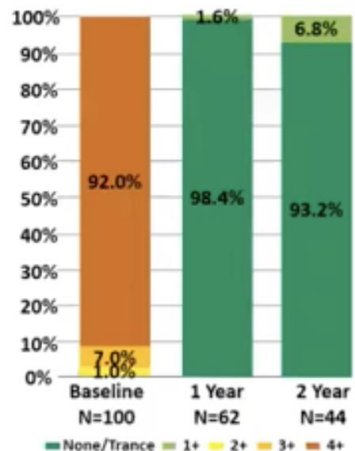
- Screen-failure rates for RCTs between 66%-78% reported



Hope of TMVR

- Despite the challenges in design, engineering, deliverability, wide-scale applicability...
- A lot of patients stand to benefit
- Current generation devices and iterations continue to provide high-quality solutions

Hope of TMVR



NO patients had **MR ≥ 1+** @ 1 year with current transapical TMVR Technologies

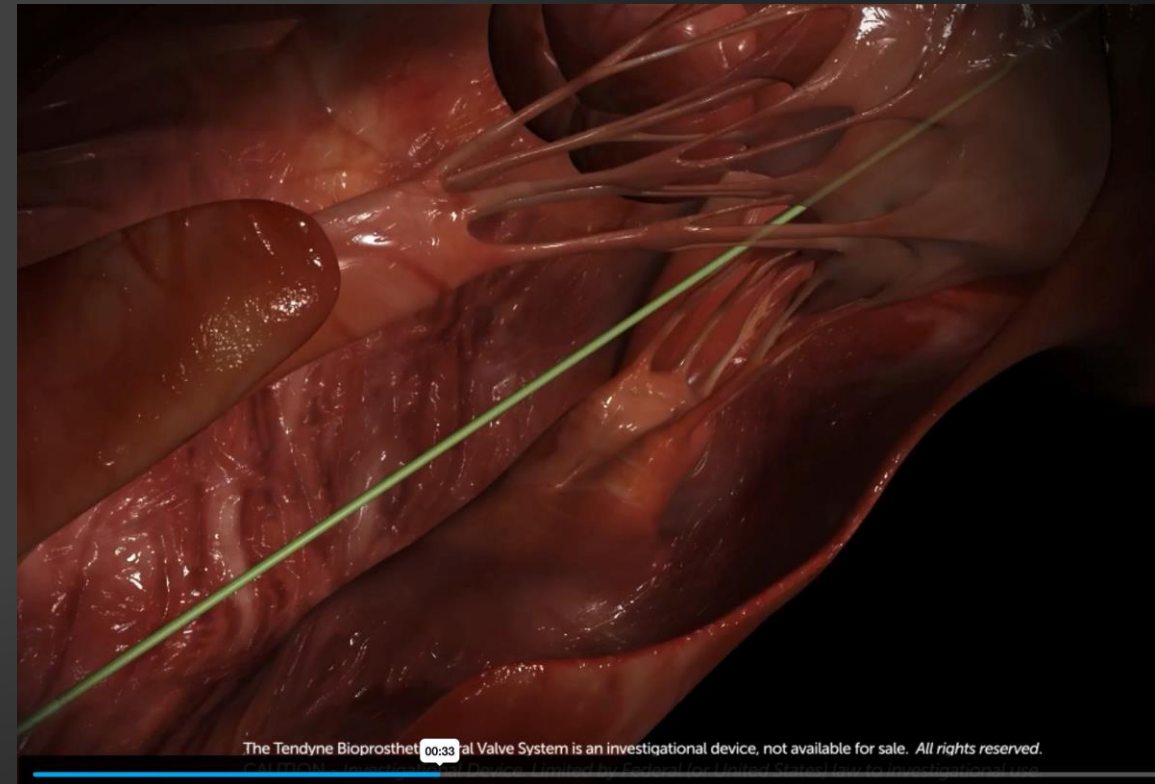
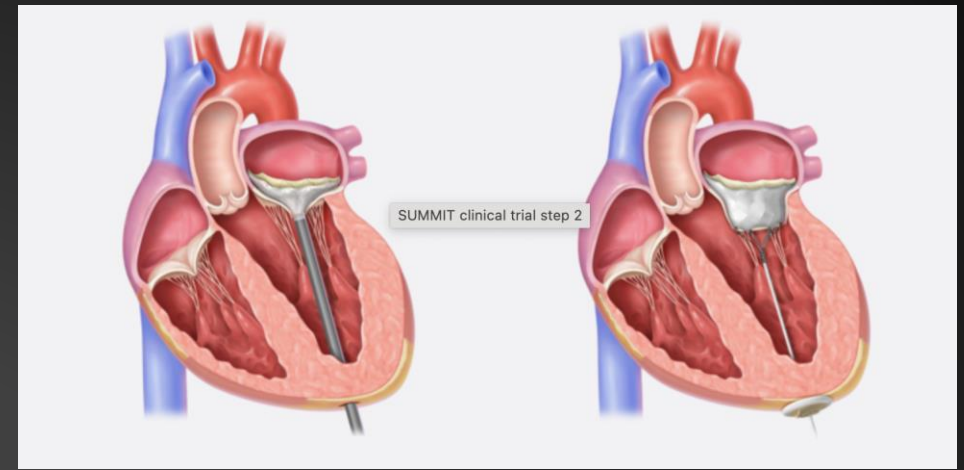
76 y.o. male with ischemic cardiomyopathy, EF 30% and severe, functional MR

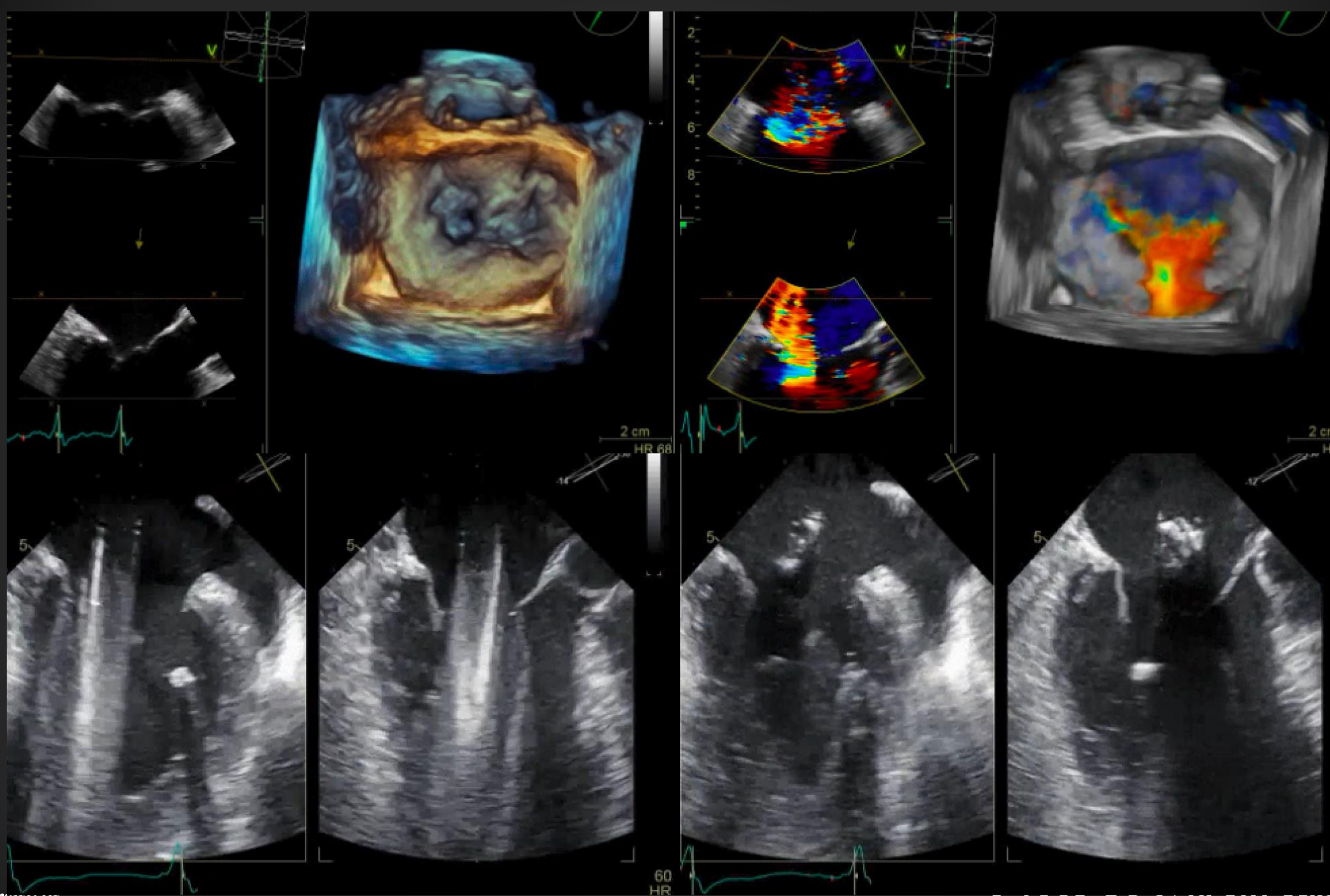
- Fully revascularized
- On max tolerated GDMT
- AV node ablation with CRT-D placed for difficult to control Afib
- Persistent NYHA functional class 2-3 symptoms

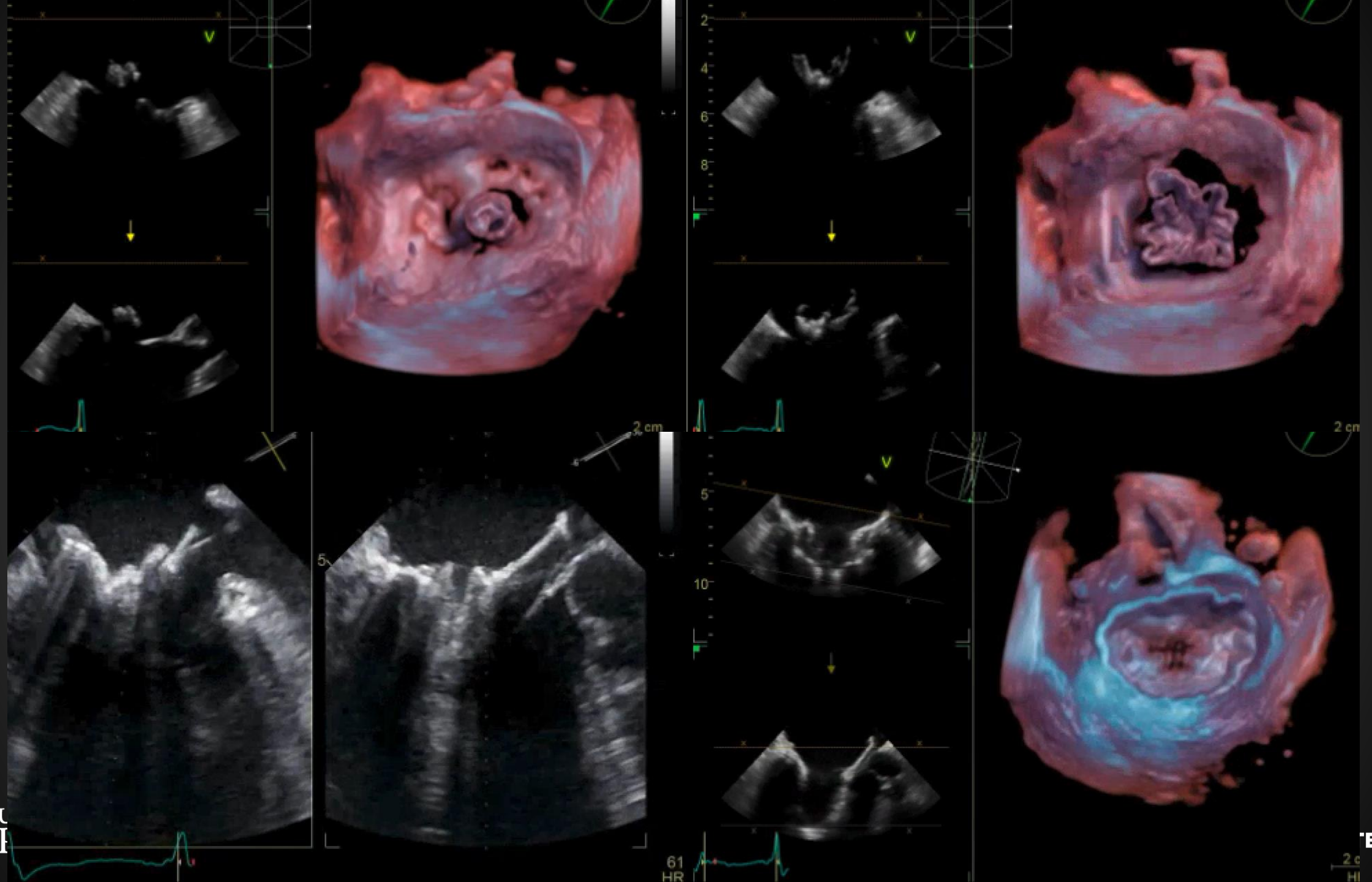
- High risk for surgical valve, anatomy amenable for TMVR
- Enrolled in the SUMMIT Randomized Clinical Trial
 - Abbott Tendyne ® TMVR via trans-apical approach

Abbott Tendyne® TMVR

- RCT for patients with symptomatic, moderately severe or severe MR, randomized in 1:1 fashion Tendyne® TMVR vs TEER with MitraClip®.
- Primary outcome for the randomized cohort is survival free of heart failure hospitalization at 12 months.
- Repositionable and retrievable valve composed of 2 self-expanding nitinol frames and a porcine pericardial valve delivered from transapical approach



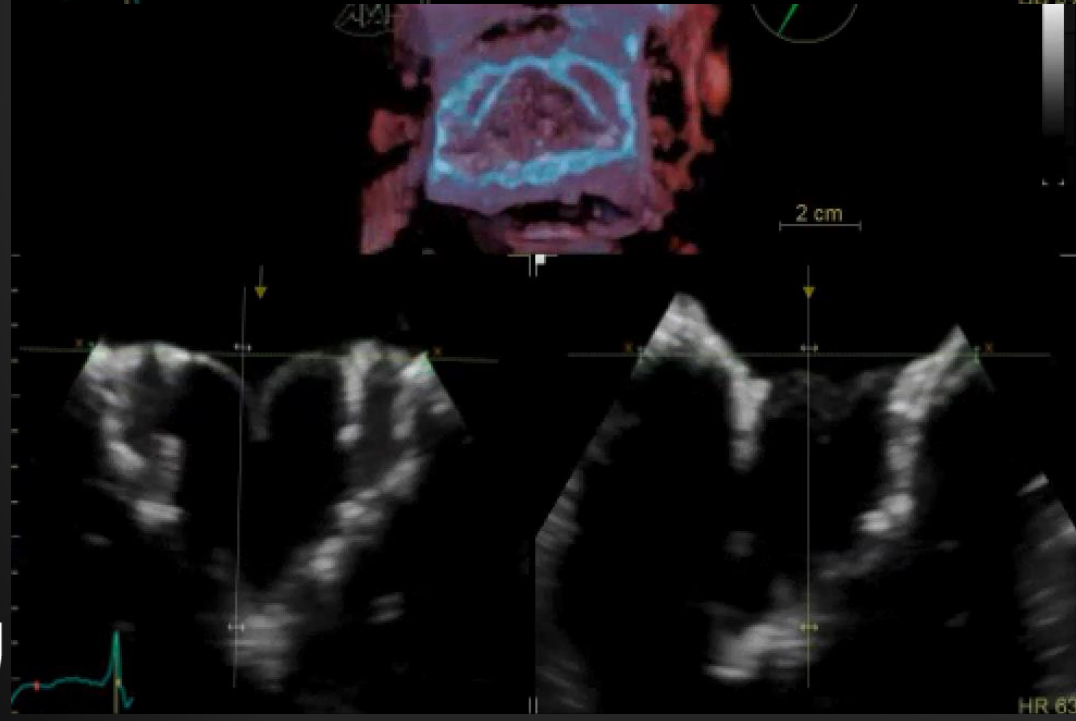
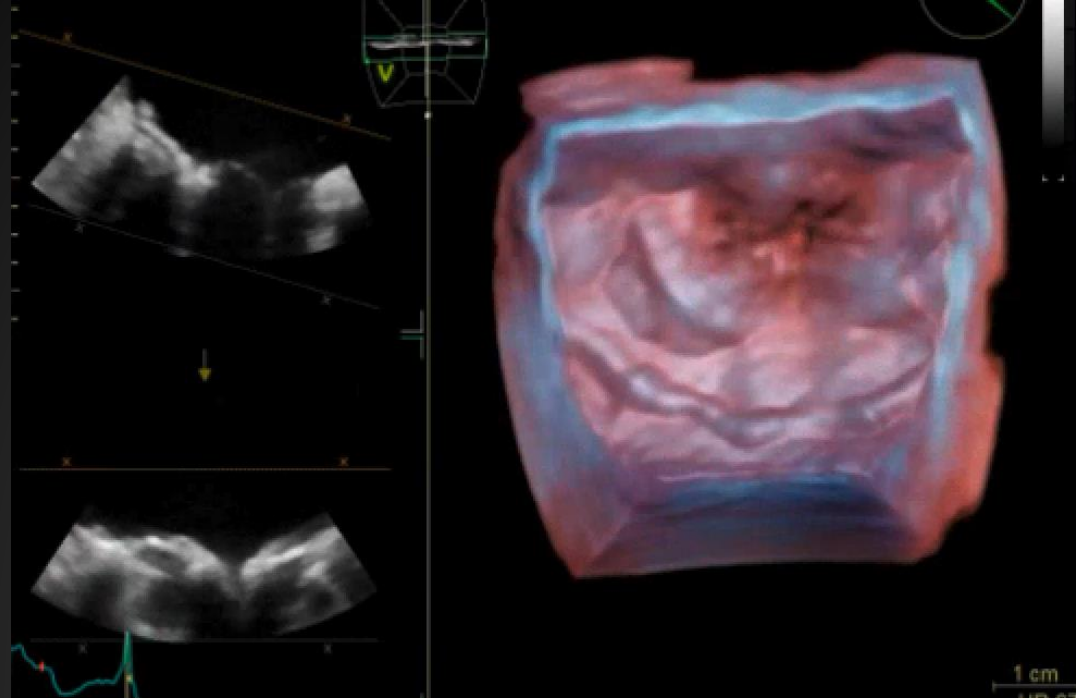




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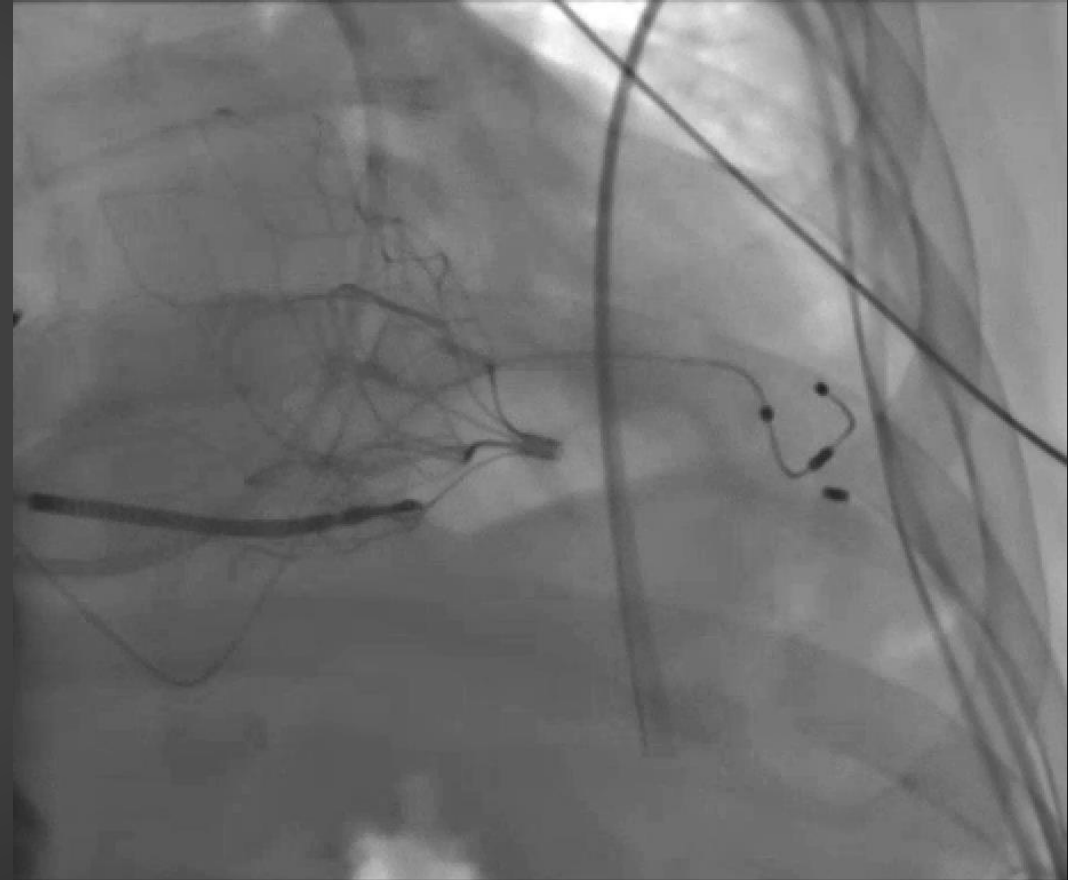


HR 63

STITUTE

1 year Follow-up

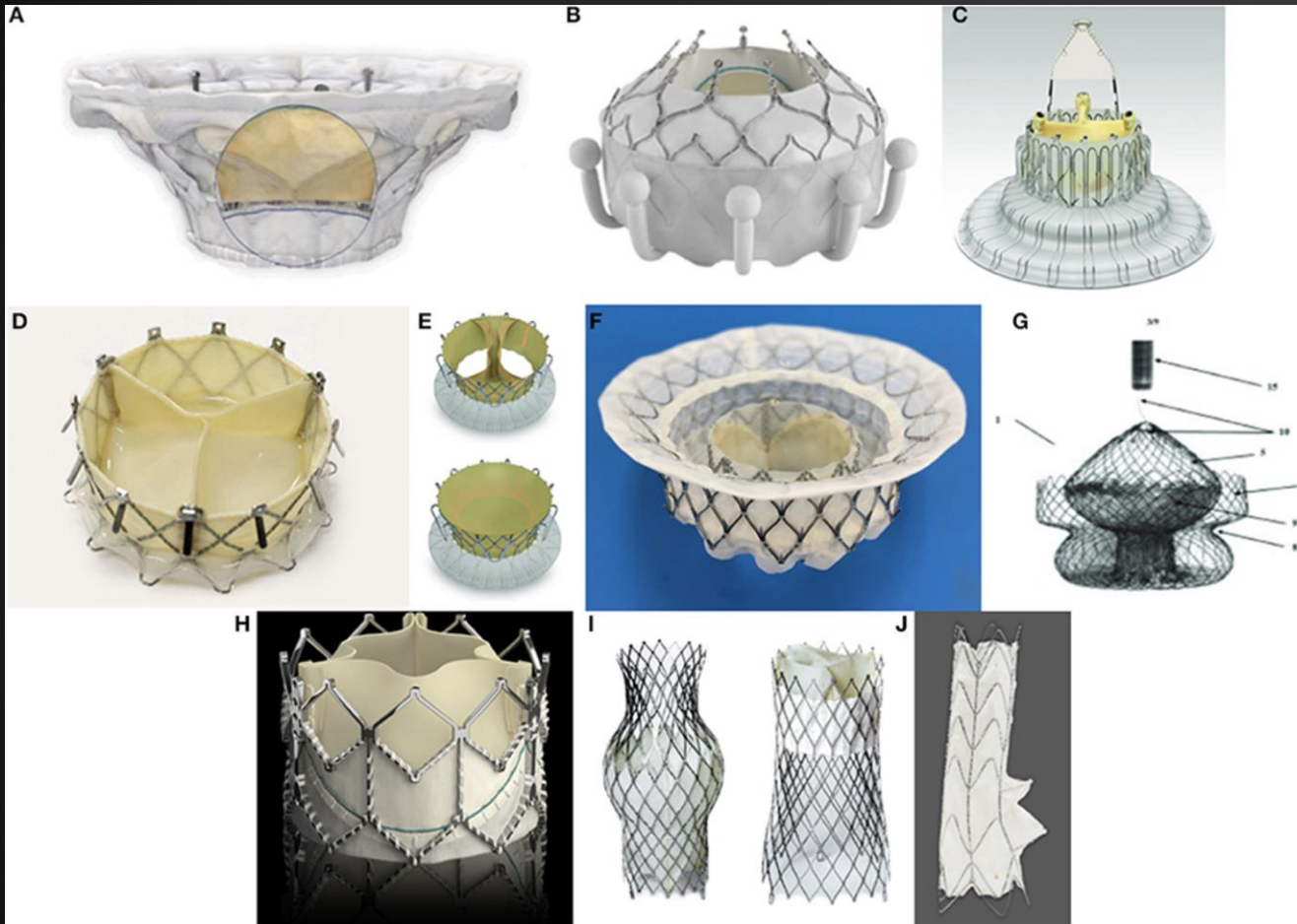
- 33mm Tendyne® Valve placed successfully
- No paravalvular leak, No MR, mean gradient 2mmHg
- DC home on Warfarin a couple of days later
- One year follow-up: No HF admissions, NYHA functional class 1-2 symptoms. Continues with no MR, no PVL, mean gradient 2-3mmHg



Tricuspid TTVR

- Even more anatomic challenges....
 - TV leaflets thinner/more fragile
 - High chordal density and RV trabeculations challenge navigation
 - RV dimensions can be small, limiting space to maneuver
 - Lack of calcium presents sealing problems
 - Dynamic annulus overtime (saddle-shaped→planar/circular)
 - TEE imaging difficult given anterior orientation of TV

TTVR Valves undergoing investigation

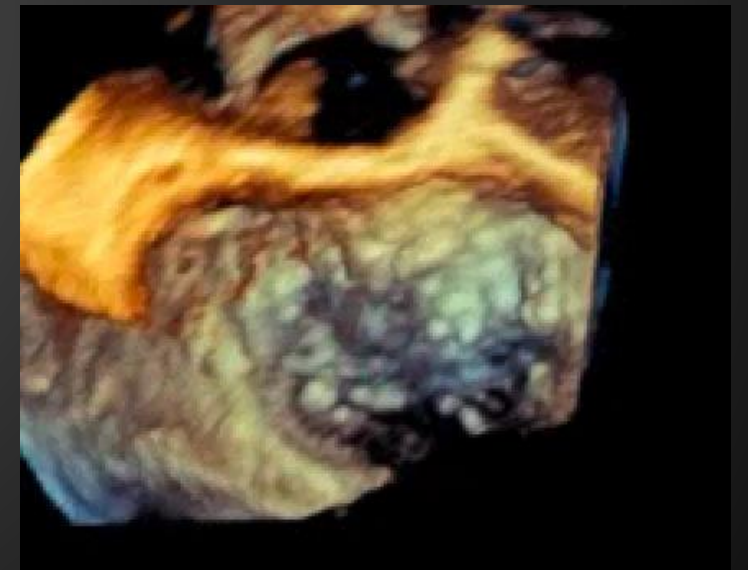
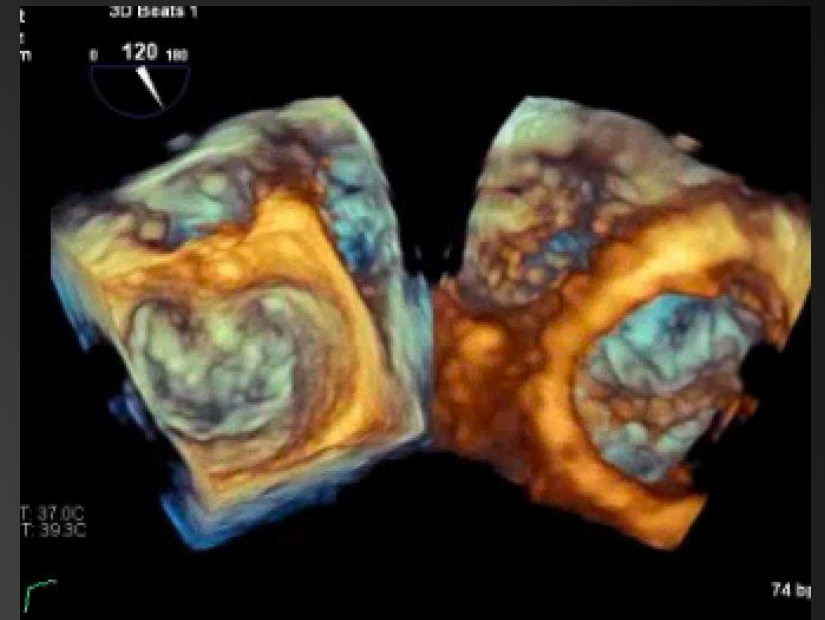


- (A) Cardiovalve (Boston Medical, Shrewsbury, MA, USA).
- (B) Evoque (Edwards Lifescience, Irvine, CA, USA)
- (C) LUX-Valve (Jenscare Biotechnology, Ningbo, China).
- (D) NaviGate (NaviGate Cardiac Structures Inc., Lake Forest, CA, USA)
- (E) Trisol (Trisol Medical, Yokneam, Israel)
- (F) Intrepid (Medtronic Plc, Minneapolis, MN, USA)
- (G) Tricare (TRiCares SAS, Paris, France).
- (H) Sapien XT (Edwards Lifescience, Irvine, CA, USA)
- (I) TricValve (P+F Products + Features, Vienna, Austria)
- (J) Tricento (New Valve Technology, Hechingen, Germany).

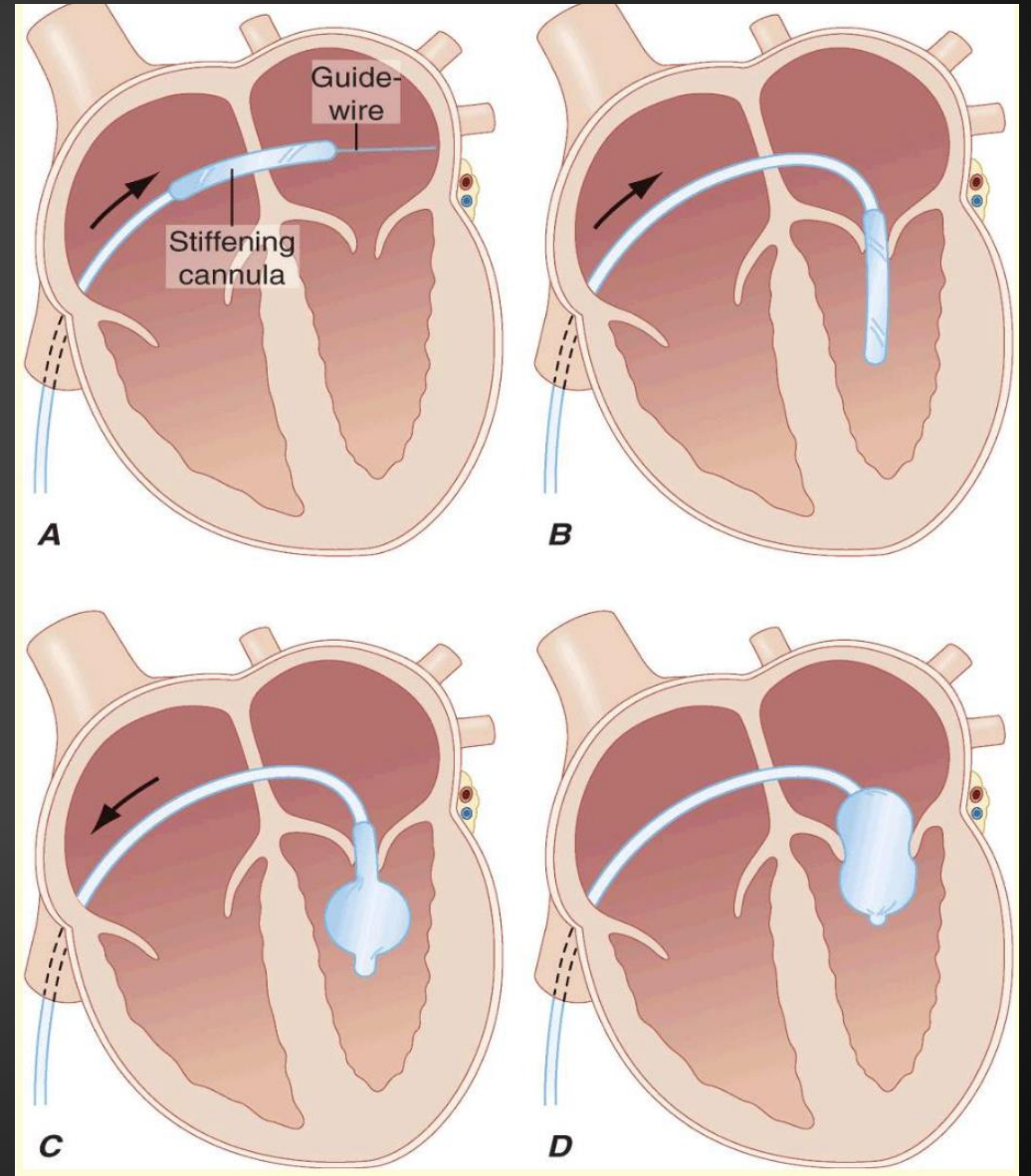
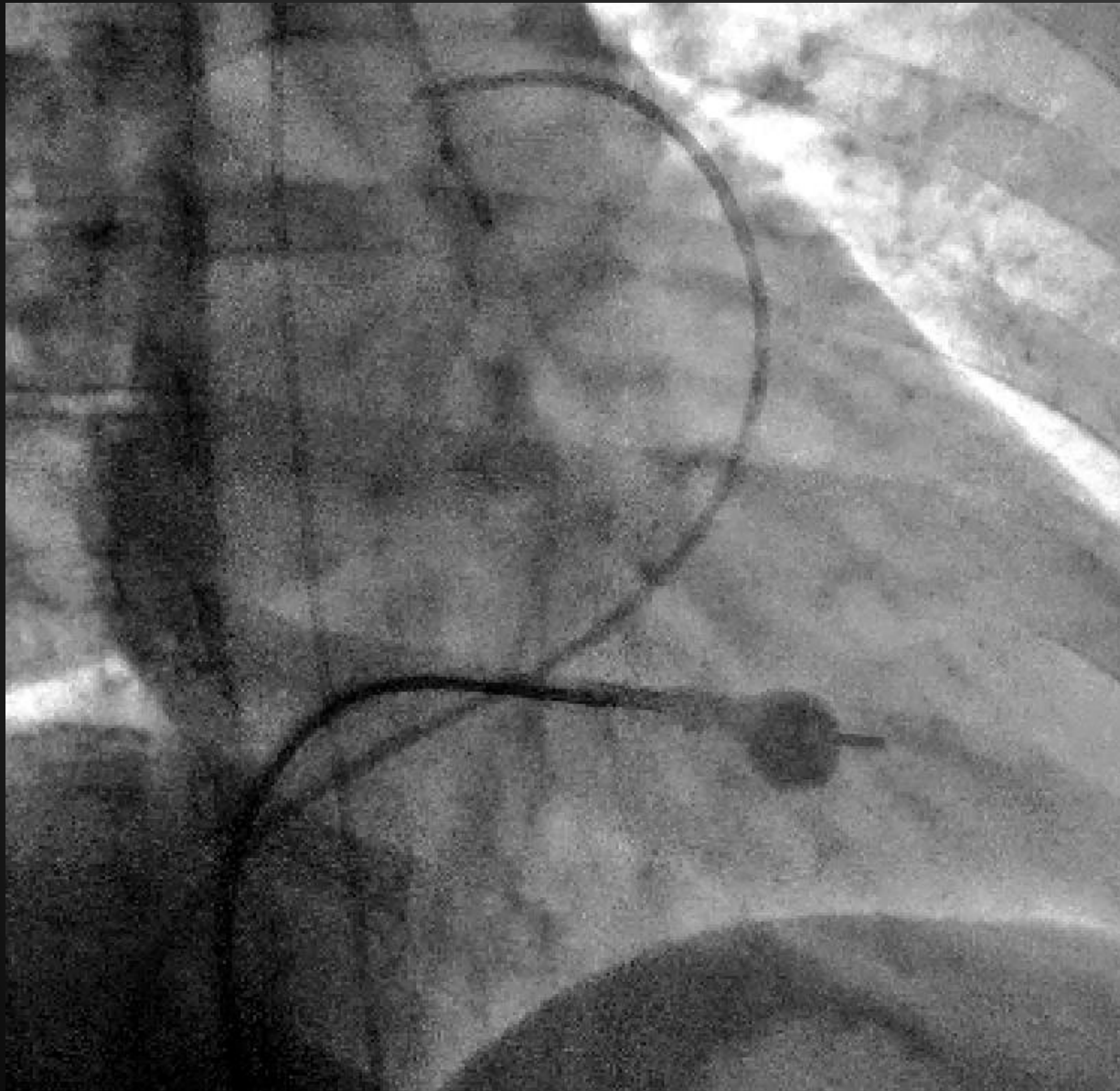
Stay Tuned....

Mitral Stenosis

- Rheumatic disease – commissural fusion
- Degenerative, calcific MS



Percutaneous Mitral Balloon Valvotomy

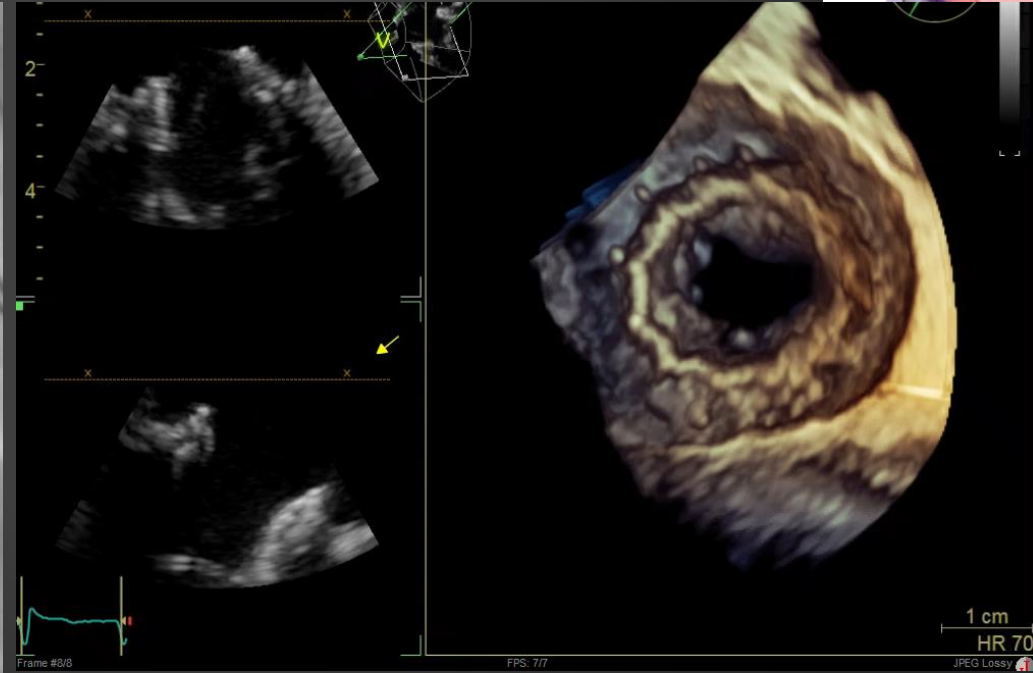
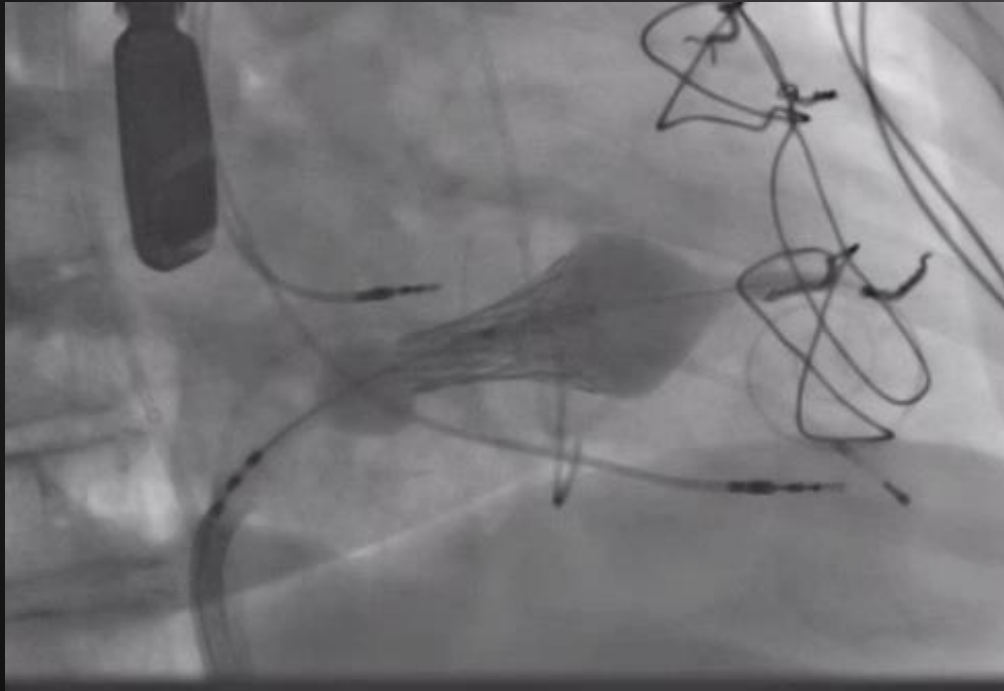
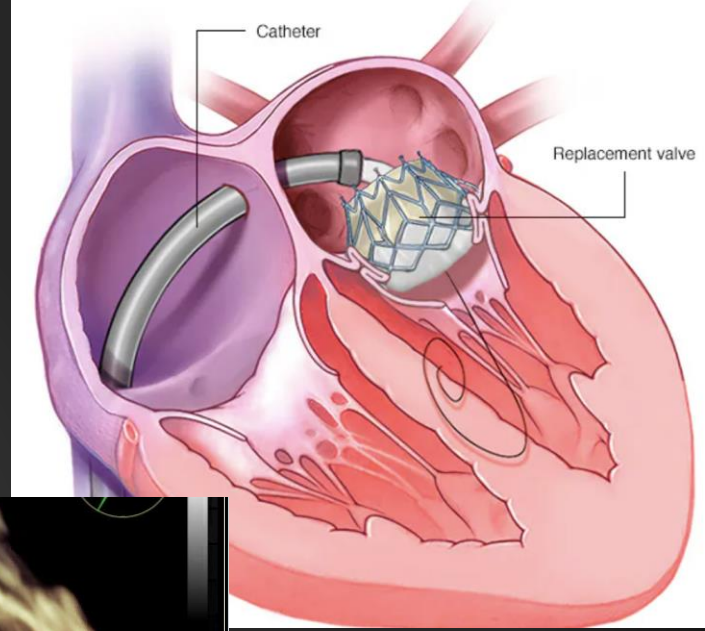


Calcific MS – our Achilles heel?

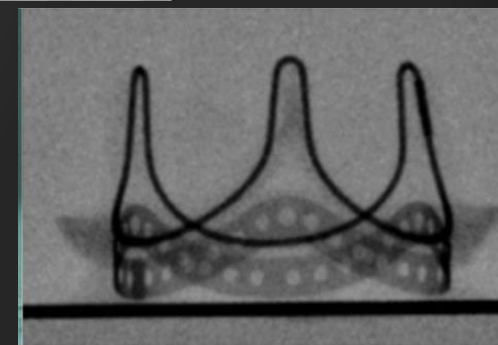
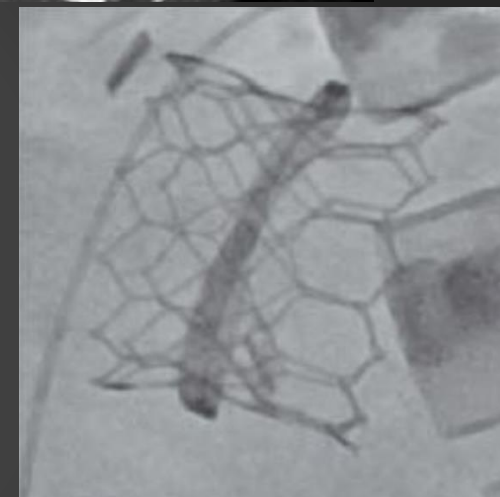
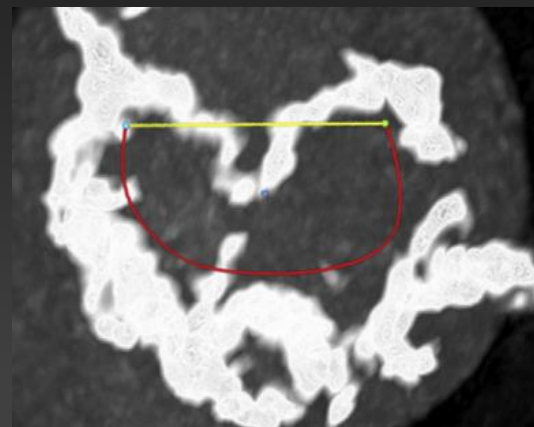
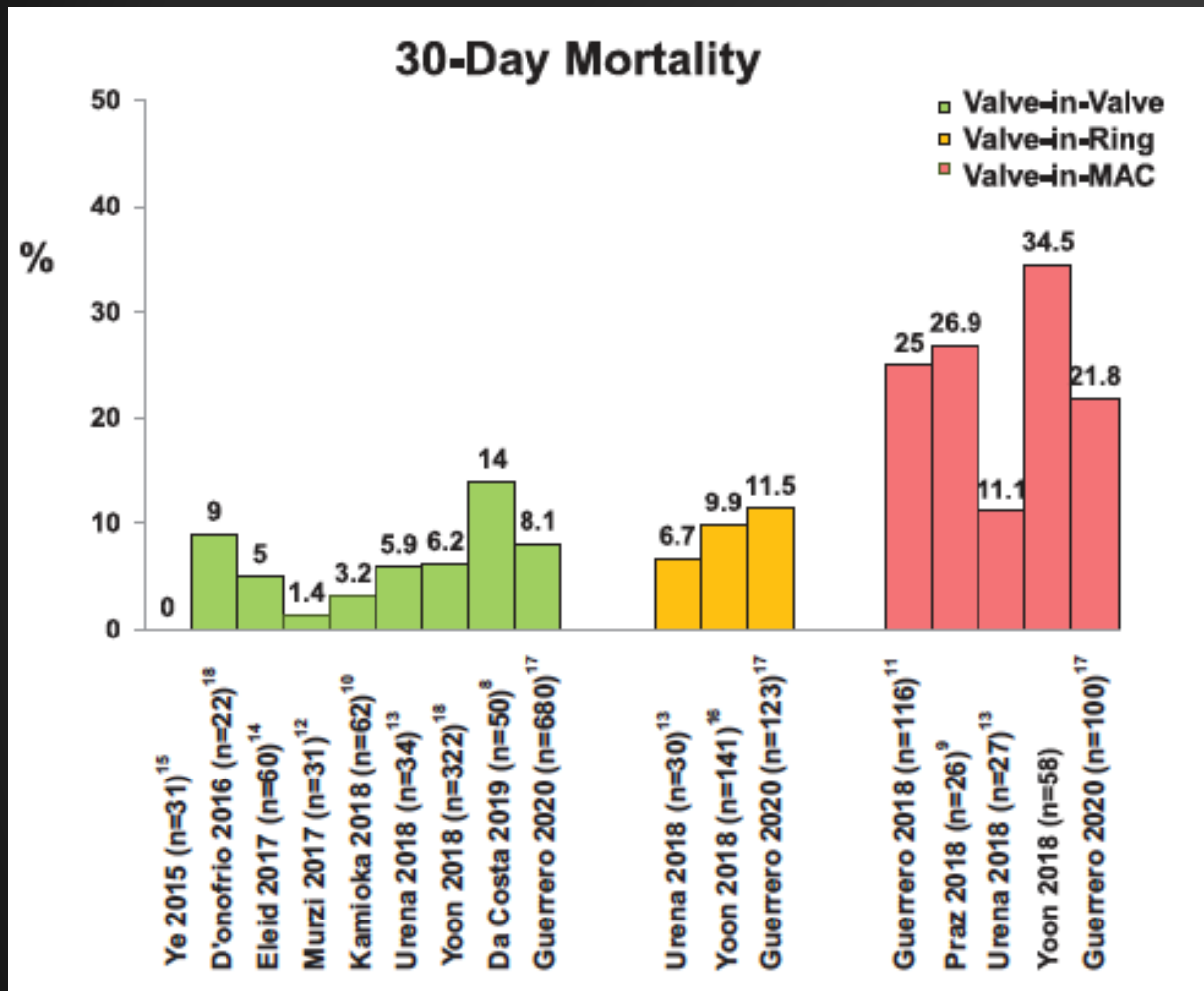
- TMVR may play a big role, although few studying MAC and severe MS in current RCTs
- What about degenerative MVRs or Mitral rings with MS?
- ***Off label Valve-in-MAC, Valve-in-Ring or Valve-in-Valve with Sapien TAVR valve*



#29 Sapien Valve-in-Valve via trans-septal approach



High risk procedures: *ViMAC* > *ViR* > *ViV*



Conclusions

- A lot of innovation in Percutaneous Valve therapies
 - New devices/technology / constant iteration
- Pipeline is promising...
 - TMVR, T-TEER, TTVR devices
 - Need to enroll in RCTs
- Many challenges still exist and high-risk patient population
 - Evaluation at Comprehensive Valve Centers

Thank you!

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