1

Structural Options for the "No-Option" patient

Konstantinos V. Voudris MD, PhD
Abbott Northwestern – Minneapolis Heart Institute

Minneapolis Heart Institute | Allina Health | Minneapolis Heart Institute Foundation

2

Disclosure

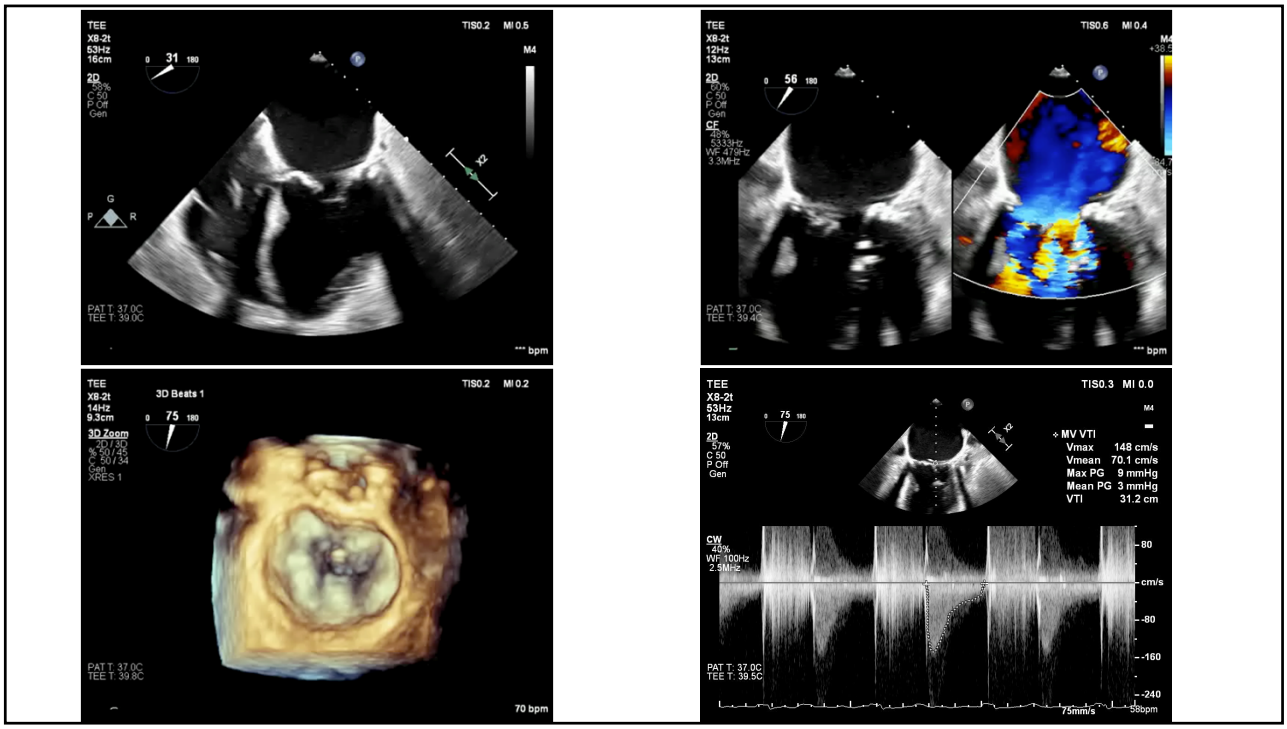
- No disclosure

3

Case 1

- 81-yo male with shortness of breath and dyspnea on exertion
  - Prior TF-TAVR with 26mm S3 (6 years ago) – well functioning valve
  - Persistent AF s/p AVN ablation and SC-PPM placement
  - Mild non-obstructive coronary artery disease
  - Hypertension
  - Diabetes
- NYHA III
- GDMT – Metoprolol, Lisinopril and Empagliflozin

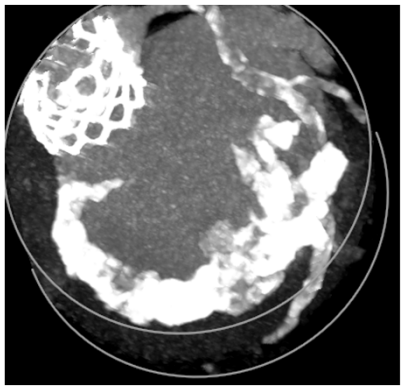
4

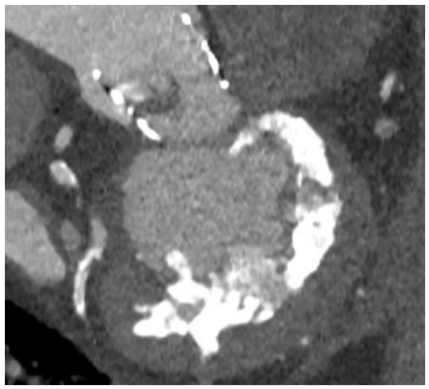


5

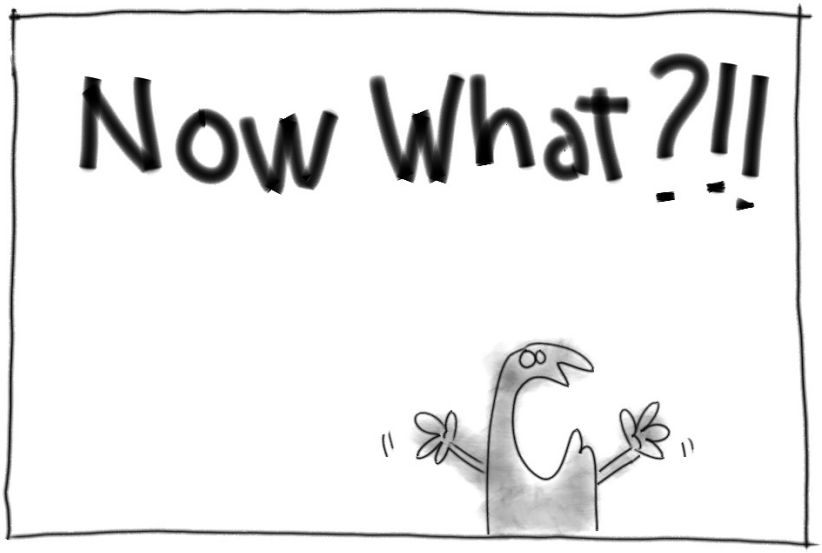
Cardiac CTA

Severe Mitral Annular Calcification
MAC Score 7





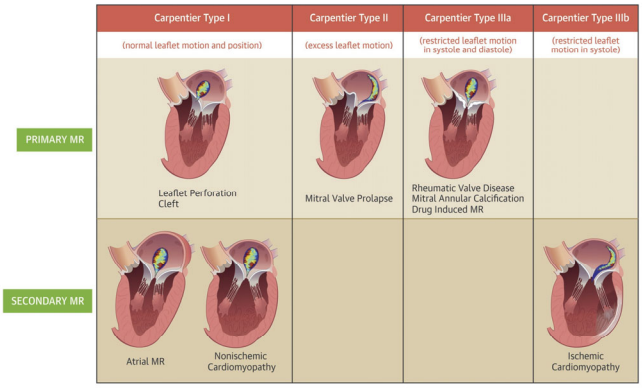
6



7

Mitral regurgitation - Epidemiology

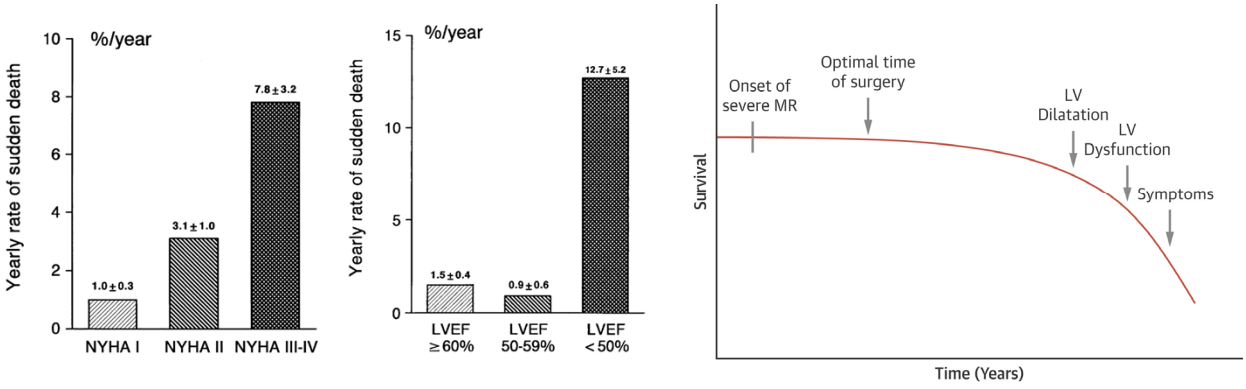
- Mitral regurgitation is the second most common heart valve disease in Europe and US
- Its prevalence increases with age, with a prevalence rate of up to 9% in individuals >75 years old
- Surgery has been shown to improve survival in patients with symptomatic primary mitral regurgitation



El Sabbagh, A. et al. J Am Coll Cardiol Img. 2018;11(4):628

8

Mitral regurgitation - Outcomes

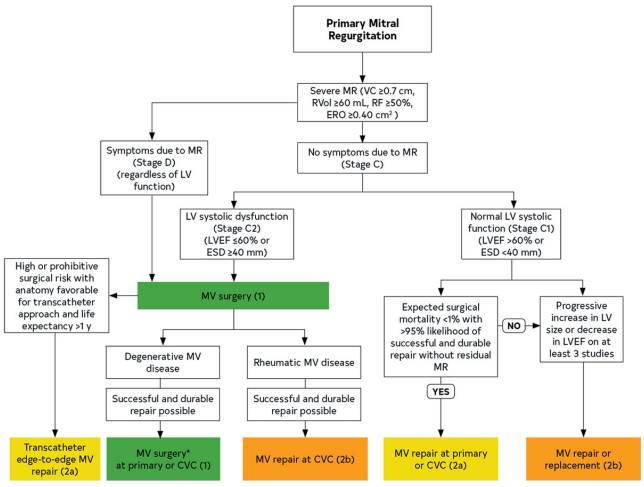


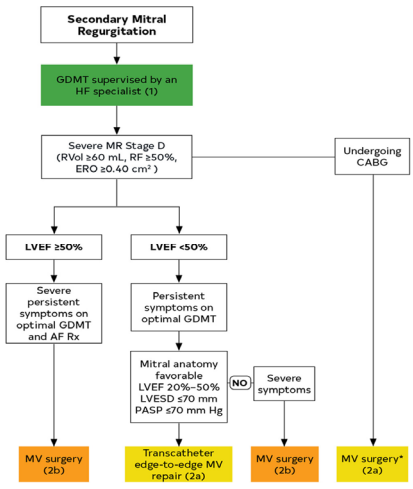
Grigioni F. et al. J Am Coll Cardiol, 34 (1999), pp. 2078-2085
El Sabbagh A. et al. J Am Coll Cardiol Img. 2018;11(4):628

9

Recommendations for intervention

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

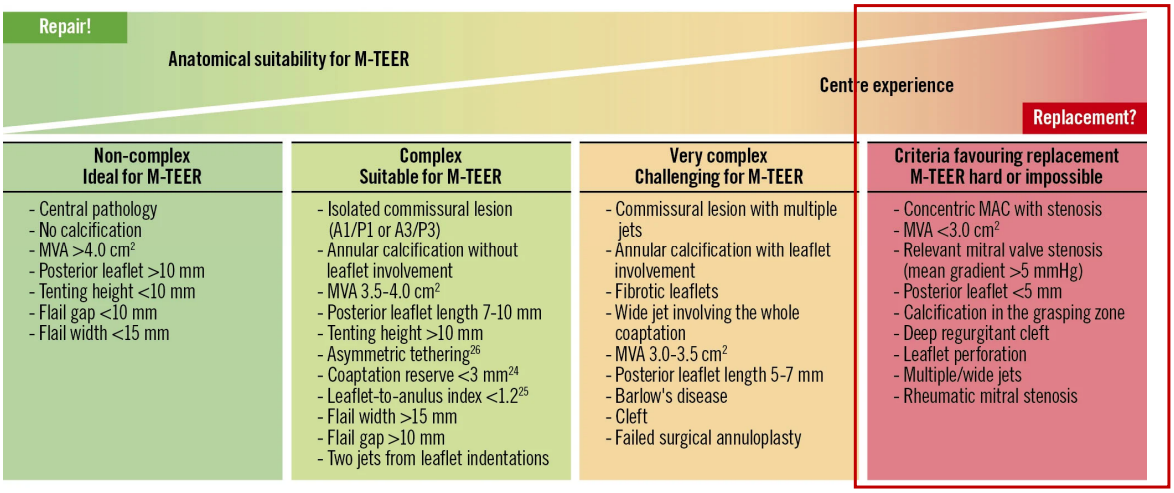




Catherine M. Otto Circulation. Volume: 143, Issue: 5, Pages: e72-e227

10

Mitral TEER – Anatomical Complexity



Non-complex Ideal for M-TEER	Complex Suitable for M-TEER	Very complex Challenging for M-TEER	Criteria favouring replacement M-TEER hard or impossible
- Central pathology - No calcification - MVA >4.0 cm^2 - Posterior leaflet >10 mm - Tenting height <10 mm - Flail gap <10 mm - Flail width <15 mm	- Isolated commissural lesion (A1/P1 or A3/P3) - Annular calcification without leaflet involvement - MVA 3.5-4.0 cm^2 - Posterior leaflet length 7-10 mm - Tenting height >10 mm - Asymmetric tethering[26] - Coaptation reserve <3 mm[24] - Leaflet-to-anulus index <1.2[25] - Flail width >15 mm - Flail gap >10 mm - Two jets from leaflet indentations	- Commissural lesion with multiple jets - Annular calcification with leaflet involvement - Fibrotic leaflets - Wide jet involving the whole coaptation - MVA 3.0-3.5 cm^2 - Posterior leaflet length 5-7 mm - Barlow's disease - Cleft - Failed surgical annuloplasty	- Concentric MAC with stenosis - MVA <3.0 cm^2 - Relevant mitral valve stenosis (mean gradient >5 mmHg) - Posterior leaflet <5 mm - Calcification in the grasping zone - Deep regurgitant cleft - Leaflet perforation - Multiple/wide jets - Rheumatic mitral stenosis

Hausleiter J et al. EuroIntervention. 2023;18(12):957-76.

11

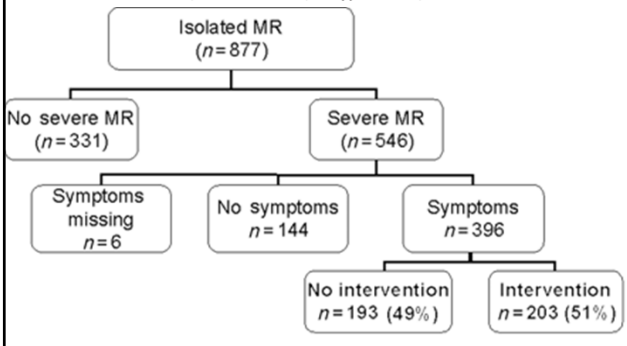
Up to 50% of patients with MR and an indication for intervention may not receive treatment

European Heart Journal (2007) 28, 1358–1365
doi:10.1093/eurheartj/ehm001

Clinical research
Valvular heart disease

What are the characteristics of patients with severe, symptomatic, mitral regurgitation who are denied surgery?

Mariana Mirabel[1], Bernard Iung[1]*, Gabriel Baron[2], David Messika-Zeitoun[1], Delphine Détaint[1], Jean-Louis Vanoverschelde[3], Eric G. Butchart[4], Philippe Ravaud[2], and Alec Vahanian[1]

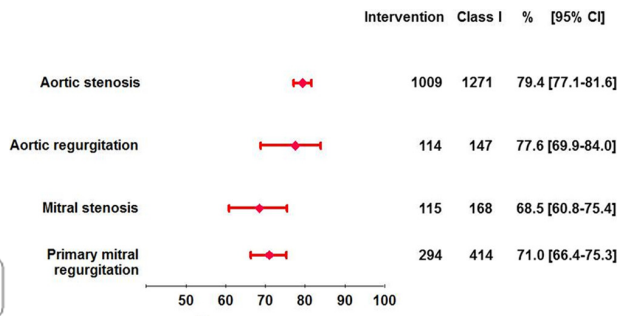


Circulation
Volume 140, Issue 14, 1 October 2019; Pages 1156-1169
https://doi.org/10.1161/CIRCULATIONAHA.119.041080

ORIGINAL RESEARCH ARTICLE

Contemporary Presentation and Management of Valvular Heart Disease

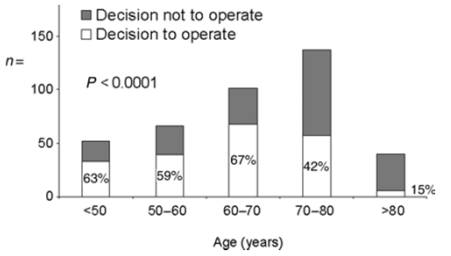
The EUROObservational Research Programme Valvular Heart Disease II Survey

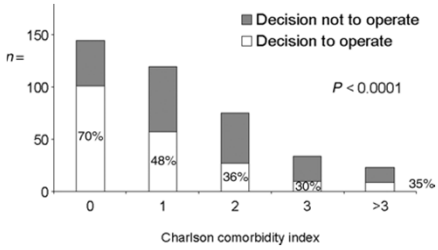


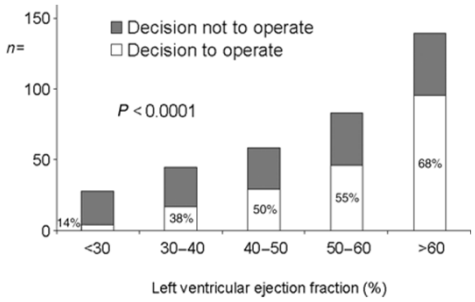
Mirabel M et al. Eur Heart J, Volume 28, Issue 11, June 2007, Pages 1358–1365
Lung B. Circulation, Volume: 140, Issue: 14, October 2019 Pages: 1156-1169

12

Characteristics of patients denied surgery







Mirabel M et al. Eur Heart J, Volume 28, Issue 11, June 2007, Pages 1358–1365

13

Mitral Annular Calcification (MAC)

- Prevalence varies between 5 - 42%
- Most commonly occurs in the posterior aspect of the annulus
- Only 1% of patients with MAC exhibit circumferential calcification of the annulus
- Severe MAC can lead to mitral stenosis and/or regurgitation
- Technical difficulties for surgery:
  - Decalcification (Resect)
  - Intra-atrial device position
  - Extracardiac valved conduit

(Respect)

Higher risk of complications

14

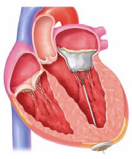
Respect vs Resect

	Working around the calcified annulus (respect)	Decalcification and annular reconstruction (resect)
Advantages	• Simpler and shorter surgeries • Lower risk of AV groove disruption • TMVR: possible percutaneous approach, promising	• Allow for natural prosthesis size and position • More likely to allow valve repair vs replacement (except for the Cleveland Clinic technique) • Less risk of PVLs and higher likelihood of healing mild PVLs
Disadvantages	• Replacement as opposed to repair (except for untraditional and supersized annuloplasty, on the basis of configuration of calcium) • Higher PVLs that are less likely to heal • Suture around calcium: risk of injury to circumflex artery, and less commonly conduction system or coronary sinus • Intra-annular: smaller sized valve and high PVLs • Supra-annular: PVLs with atrial rupture due to subjection to ventricular pressures • Combined intra and supra-annular (with or without collar): significant valve downsizing • Extra-anatomic bypass: only with stenosis, unphysiologic, last resort • TMVR: experimental, requires dense near-circumferential MAC, unknown long-term durability	• Technically challenging • Longer CPB and clamp times • Low but real risk of AV groove disruption

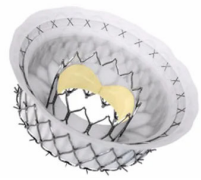
15

Dedicated Transcatheter Mitral Valve Devices

Tendyne



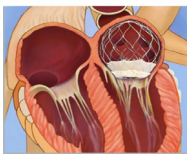
Intrepid



Cephea

Evoque

AltaValve



Sapien M3

HighLife

Cardiovalve

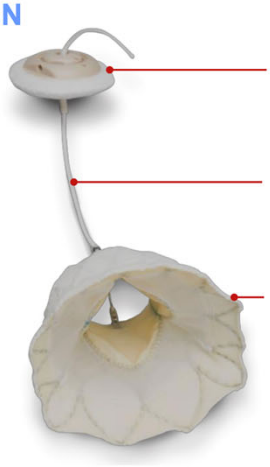
Saturn

16

Tendyne TMVR System Overview

UNIQUE VALVE-TETHER-PAD DESIGN

- Repositionable
- Fully retrievable
- No need for CPB or rapid ventricular pacing



APICAL PAD

- Placed over ventricular access site

TETHER DESIGN

- Enables full retrievability

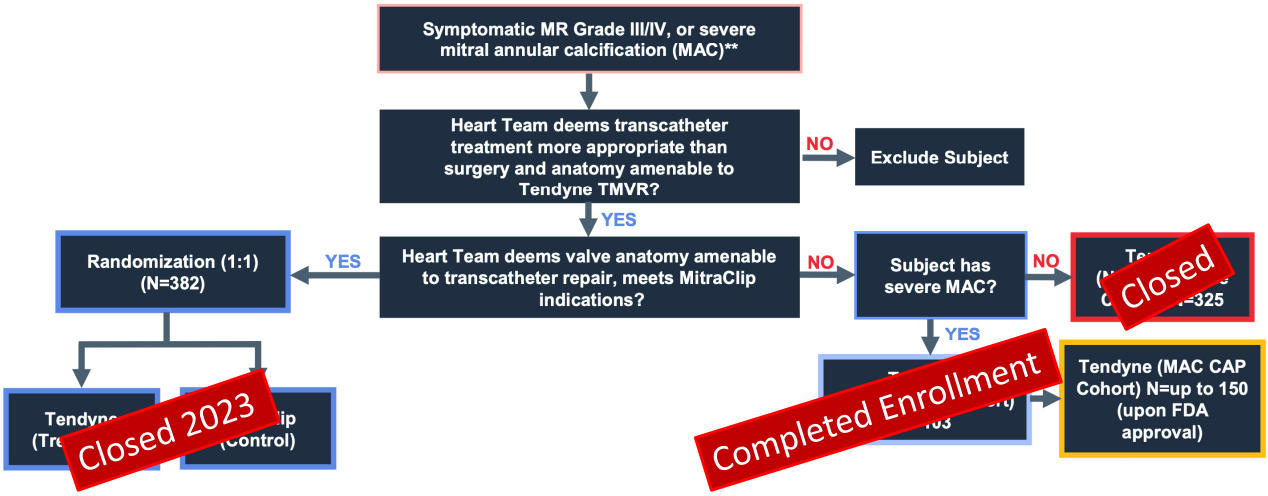
VALVE DESIGN

- Tri-leaflet, bioprosthetic valve
- Outer frame contoured to mitral annulus
- Variety of valve sizes and profiles to accommodate broad range of patient anatomies
- Standard and Low-profile frames options

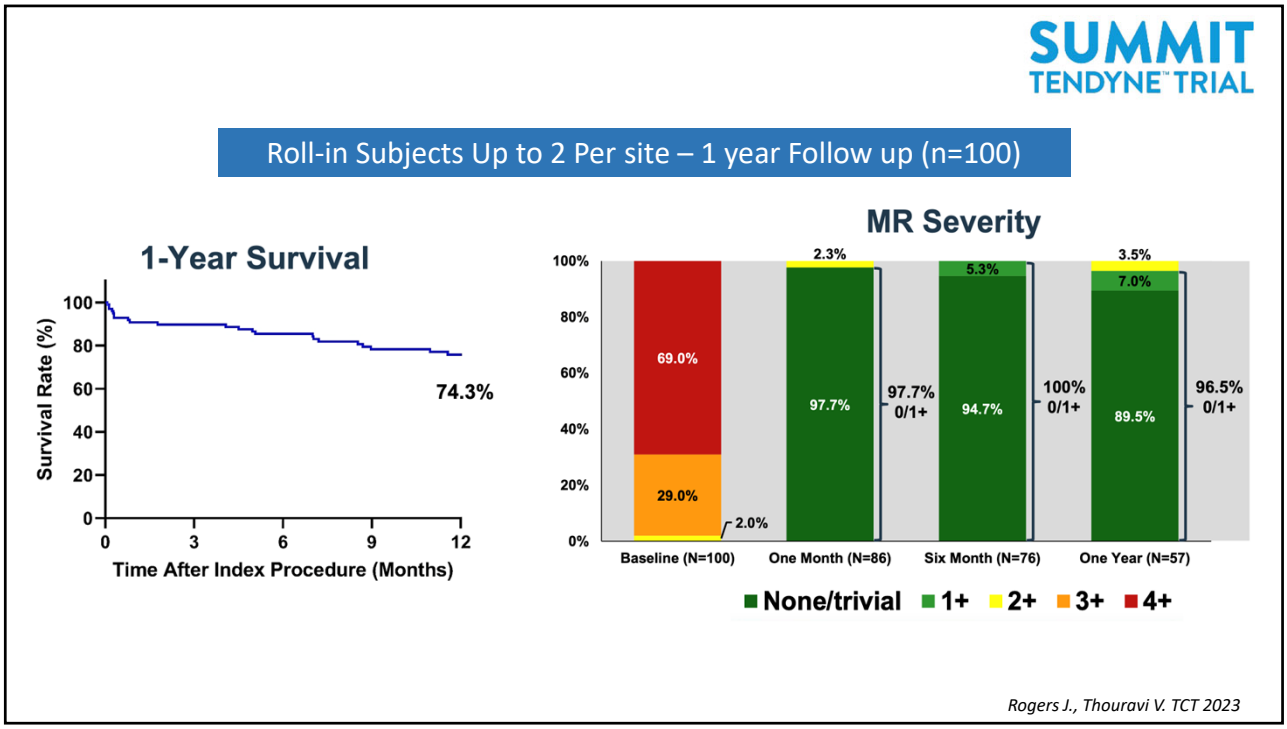
17

SUMMIT TENDYNE™ TRIAL

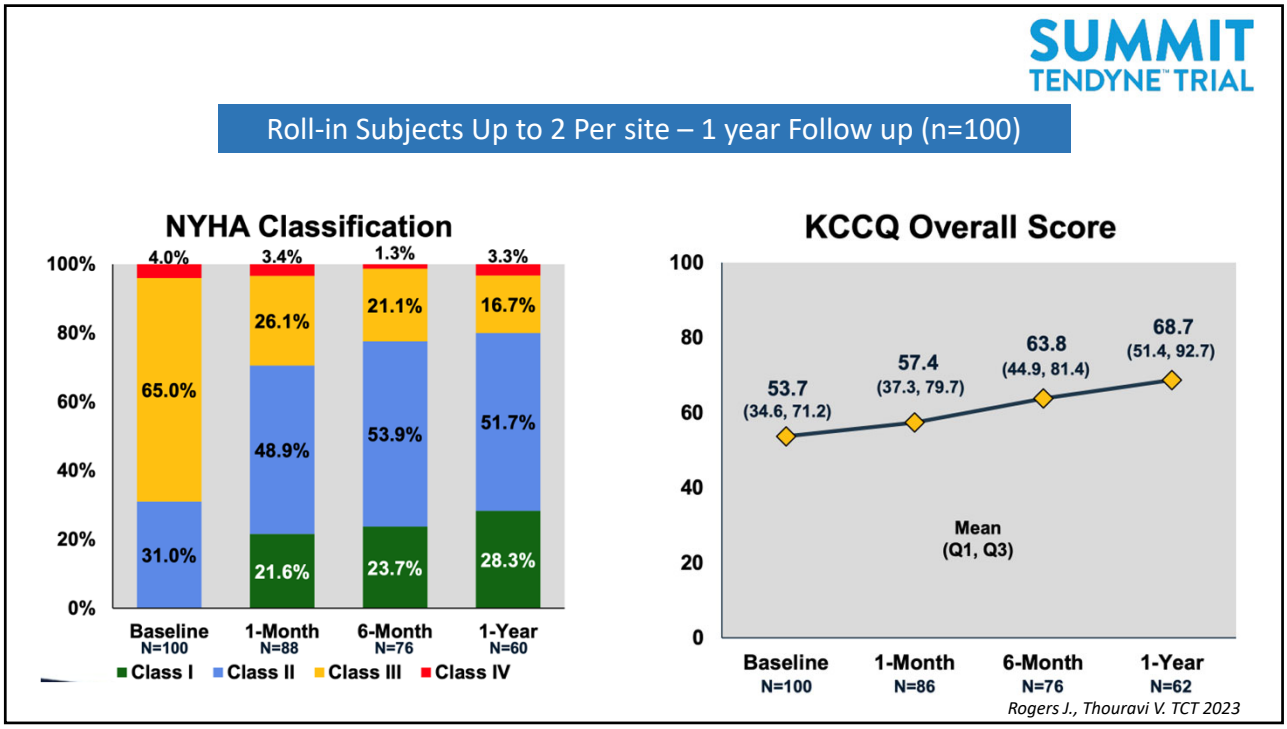
Study Design



18


SUMMIT
TENDYNE™ TRIAL
Roll-in Subjects Up to 2 Per site – 1 year Follow up (n=100)
1-Year Survival
Survival Rate (%)
100
80
60
40
20
0
0
3
6
9
12
Time After Index Procedure (Months)
74.3%
MR Severity
100%
80%
60%
40%
20%
0%
69.0%
29.0%
2.0%
2.3%
97.7%
97.7%
0/1+
5.3%
94.7%
100%
0/1+
3.5%
7.0%
89.5%
96.5%
0/1+
Baseline (N=100)
One Month (N=86)
Six Month (N=76)
One Year (N=57)
None/trivial
1+
2+
3+
4+
Rogers J., Thouravi V. TCT 2023

19


SUMMIT
TENDYNE™ TRIAL
Roll-in Subjects Up to 2 Per site – 1 year Follow up (n=100)
NYHA Classification
100%
80%
60%
40%
20%
0%
4.0%
65.0%
31.0%
3.4%
26.1%
48.9%
21.6%
1.3%
21.1%
53.9%
23.7%
3.3%
16.7%
51.7%
28.3%
Baseline
N=100
1-Month
N=88
6-Month
N=76
1-Year
N=60
Class I
Class II
Class III
Class IV
KCCQ Overall Score
100
80
60
40
20
0
53.7
(34.6, 71.2)
57.4
(37.3, 79.7)
63.8
(44.9, 81.4)
68.7
(51.4, 92.7)
Mean
(Q1, Q3)
Baseline
N=100
1-Month
N=86
6-Month
N=76
1-Year
N=62
Rogers J., Thouravi V. TCT 2023

20

SUMMIT TENDYNE™ TRIAL

Severe MAC Cohort 30-Day (n=103)

Procedural Events	n (%)
Procedural survival	101 (98.1)
Technical success*	97 (94.2)
Valve implanted†	103 (100)
Emergency surgery/intervention	6 (5.8)
CPB	3 (2.9)
Procedural stroke	0 (0)

*MVARC definition
†One valve retrieved with secondary valve implanted

30-Day Events*	n (%)
All-cause mortality	7 (6.8)
Cardiovascular mortality	7 (6.8)
Disabling stroke	1 (1.0)
Myocardial infarction	1 (1.0)
Post-op mitral reintervention	2 (2.0)
Device thrombosis	0 (0)
Major bleeding	22 (21.4)

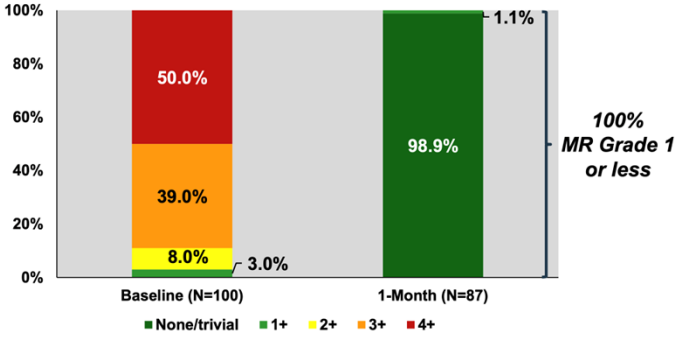
*All events adjudicated by independent CEC per MVARC definitions

Rogers J., Thouravi V. TCT 2023

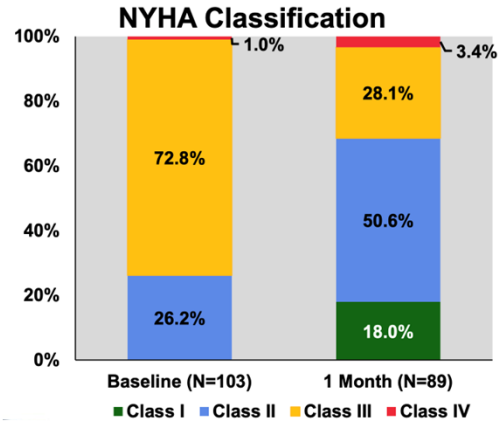
21

SUMMIT TENDYNE™ TRIAL

Severe MAC Cohort 30-Day (n=103)



100% MR Grade 1 or less



Rogers J., Thouravi V. TCT 2023

22

Intrepid – Mitral Valve

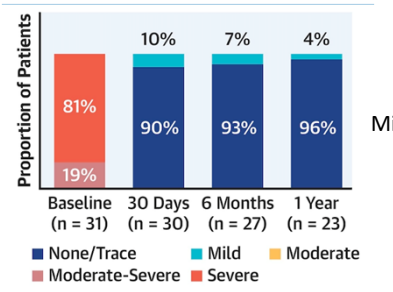
- Prosthesis anchors with multiple small cleats and a cork-like effect
- Symmetrical design eliminates need for rotational alignment
- Circular inner stent houses a 27 mm tri-leaflet bovine pericardial valve
- 42 & 48 mm valves in clinical evaluation; 54 mm valve in development
- ~35 Fr delivery system; 29 Fr coming

23

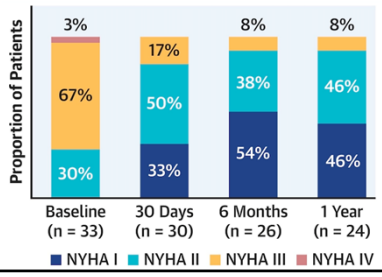
Transfemoral Transeptal INTREPID TMVR EFS 1-year (N=33)

Early and Late Clinical Outcomes

	30 Days	1 Year
All-cause mortality	0.0%	6.7%
Stroke	0.0%	0.0%
CV hospitalization	6.1%	22.3%
Re-operation (or re-intervention)	3.0%	3.0%
Clinically significant valve thrombosis	0.0%	3.4%
MV endocarditis (definite)	0.0%	3.4%
MVARC major vascular complications	24.2%	24.2%
ASD closure performed	75.0%	–



Mitral Regurgitation

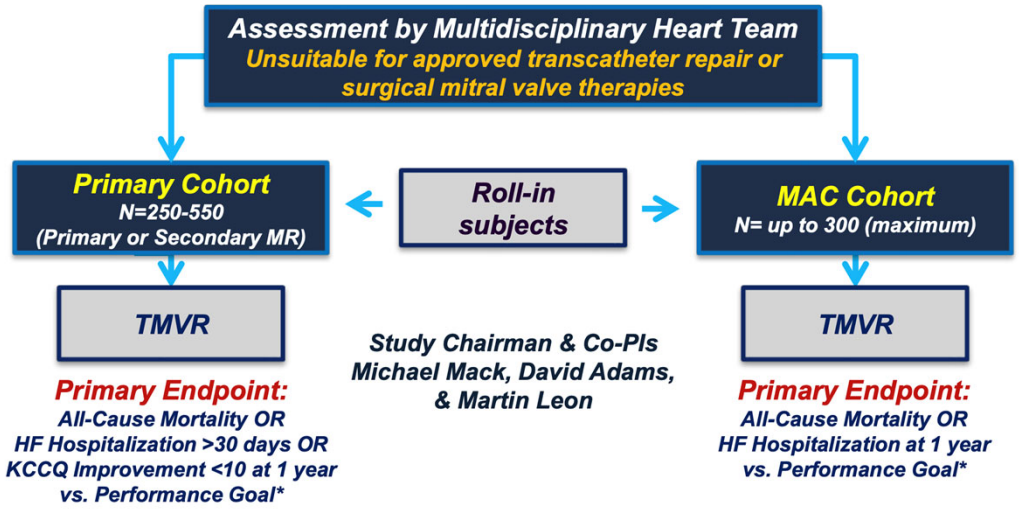


NYHA Functional Class

Firas Zahr et al. J Am Coll Cardiol Intv 2023; 16:2868-2879.

24

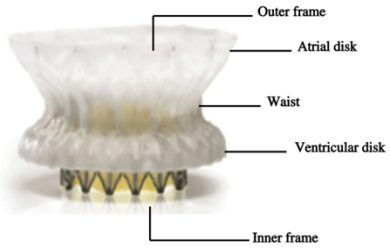
Apollo Pivotal Trial

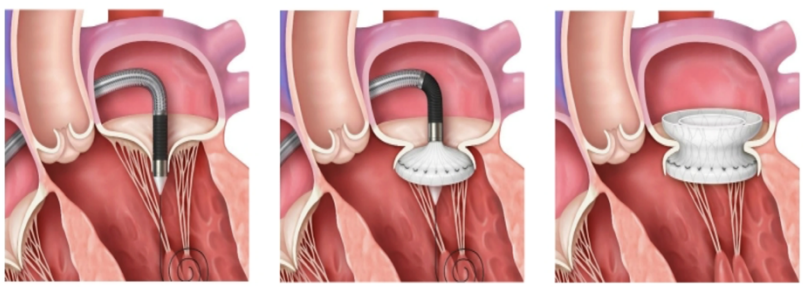


25

Cephea

- Dual disk circular design
- Anchoring via compression and radial forces
- Low-profile delivery system (Trans-septal 36-38 Fr)
- Fully repositionable and recapturable





26

Cephea™ EFS Phase 1 Experience

Outcomes: Intra-procedural and 30-Day (n=10)

Procedural Events	
Outcome	N=10
Valve implanted	10 (100.0%)
Technical success (MVARC)	10 (100.0%)
Implant retrieved/abandoned	0 (0.0 %)
Procedural stroke	0 (0.0 %)
Emergency surgery	0 (0.0 %)
ECMO required	0 (0.0 %)
Procedural mortality	0 (0.0 %)
iASD Closures	0 (0.0 %)

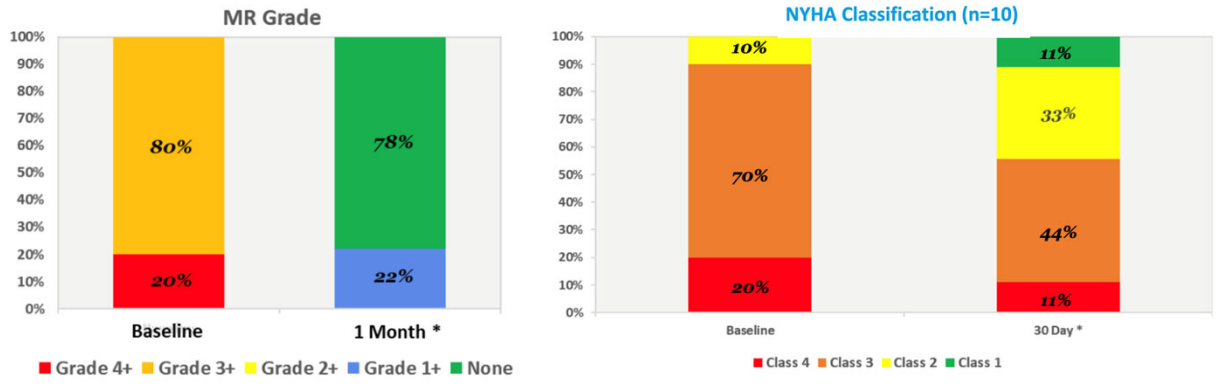
30-Day Adverse Events	
Any mortality – no. (%)	0 (0.0)
Cardiovascular mortality – no. (%)	0 (0.0)
Disabling stroke – no. (%)	0 (0.0)
Myocardial infarction – no. (%)	0 (0.0)
Severe Access Site Hematoma – no. (%)	1 (10.0)
New Onset Atrial Fibrillation – no. (%)	2 (20.0)
Cardiac Injury – no. (%) *(Chordal Rupture)*	1 (10.0)
Reintervention for MV – no. (%)	0 (0.0)
Structural valve dysfunction – no. (%)	0 (0.0)
MV HALT w/o PVD* *(Coumadin Non-Compliance)*	2 (20.0)
Major Bleeding (G.I. Bleed) – no. (%)	1 (10.0)
Endocarditis – no. (%)	0 (0.0)

Yadav P. TVT 2023

27

Cephea™ EFS Phase 1 Experience

Core Lab Echo Evaluation (n=10)



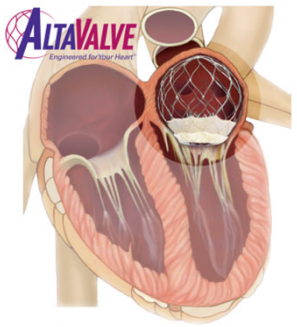
* *n=9 (1 missed 1 Month visit)*

Yadav P. TVT 2023

28

AltaValve

- Supra-annular with minimally protrusion (<15 mm) into the left ventricle
- Anchoring is achieved by a nitinol frame that is oversized relative to the left atrium
- Orientation parallel to the outflow tract
- Transapical or transseptal approaches
- No interaction with the native mitral valve or apparatus

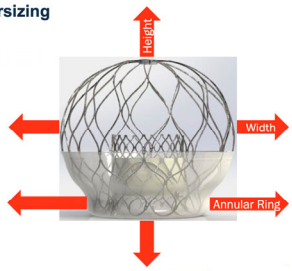


AltaValve sizing is based off an oversizing strategy to the size of the LA:

1. **Height: 10-30%**
2. **Width: 10-30%**

Implant anchoring

3. **Annular Ring: 5-20%** - Implant sealing



29

AltaValve

First Percutaneous AltaValve
May 2023

30

MITRAL Trial

Mitral **I**mplantation of **TRA**nscatheter va**L**ves

91 patients extremely high surgical risk (STS PROM >15% or M&M >50%)

SAPIEN XT

SAPIEN 3

Inclusion Criteria

NYHA II or greater

Valve-in-Valve n=30	Valve-in-Ring n=30	Native MV (MAC) n=31*
Severe MS (MVA ≤1.5 cm2)	Severe MS (MVA ≤1.5 cm2)	Severe MS (MVA ≤1.5 cm2)
At least Moderate-Severe MR	At least Moderate-Severe MR	Severe MR + Moderate MS

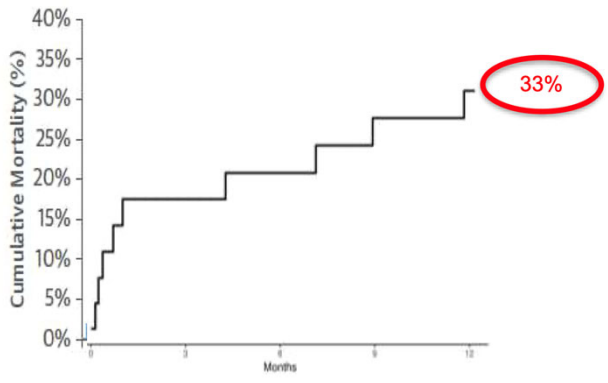
First 2 patients in MAC arm were treated with SAPIEN XT, all subsequent patients were treated with SAPIEN 3 valves

Guerrero M. TVT 2019

31

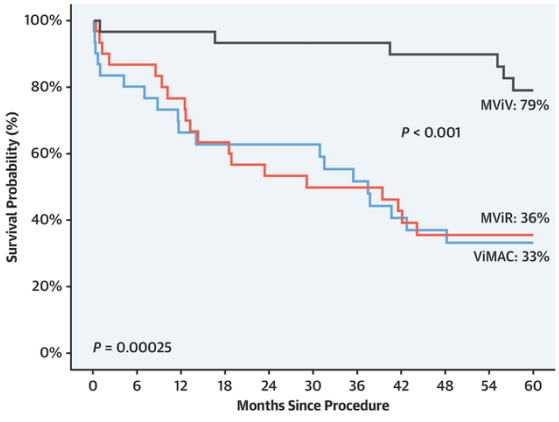
MITRAL Trial

1-year



MAC arm

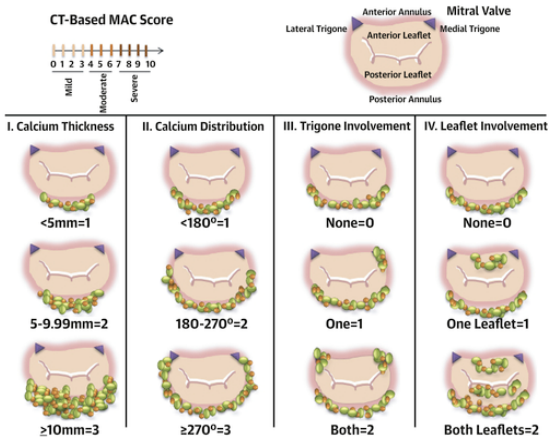
5-year

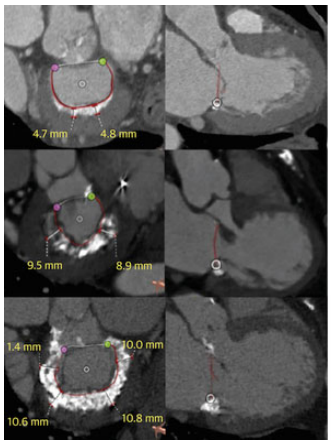


Guerrero M. et al. J Am Coll Cardiol Intv 2021; 14:830-845.
Guerrero M. et al. J Am Coll Cardiol Intv 2023; 16:2211-2227.

32

Mitral Annular Calcification Score





Calcium thickness: < 5 mm=1
Calcium distribution: <180°=1
Trigone involvement : No=0
Leaflet Involvement: No=0

Total score: 2 = **Mild MAC**

Calcium thickness: 5-9.99 mm=2
Calcium distribution: 180°-270°=2
Trigone involvement : medial=1
Leaflet Involvement: No=0

Total score: 5 = **Moderate MAC**

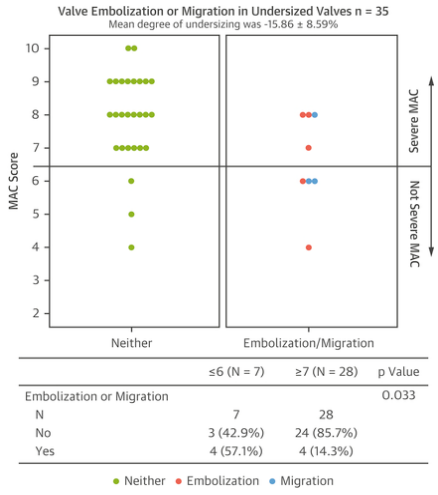
Calcium thickness: ≥10 mm=3
Calcium distribution : ≥270°=3
Trigone involvement: Both=2
Leaflet Involvement: No=0

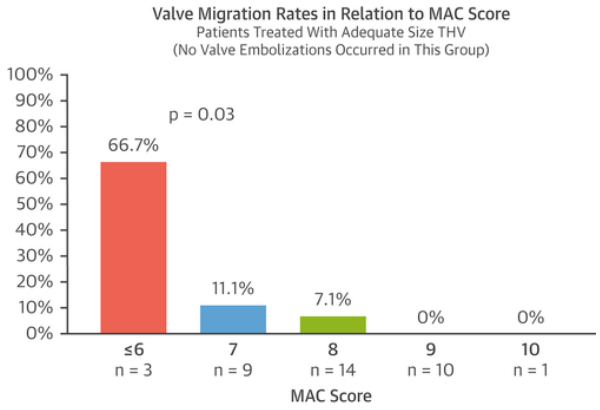
Total score: 8 = **Severe MAC**

Guerrero M et al. J Am Coll Cardiol Img 2020; 13:1945-1957.

33

Mitral Annular Calcification Score





Guerrero M et al. J Am Coll Cardiol Img 2020; 13:1945-1957.

34

MITRAL II Pivotal Trial

Mitral Implantation of TRAnscatheter vaLves

Severe MAC with Severe mitral stenosis or 3+mitral regurgitation or mixed ≥ moderated stenosis and ≥ moderate regurgitation.

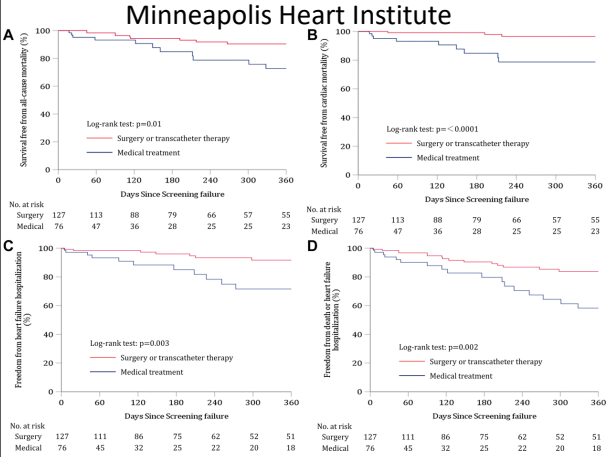
- **Valve-in-MAC N=110**
  - Transeptal MAC score ≥ 7
- **Natural History N=100**

Primary End Point
All Cause Morality and Hospitalization for Heart Failure

35

Screen Failure

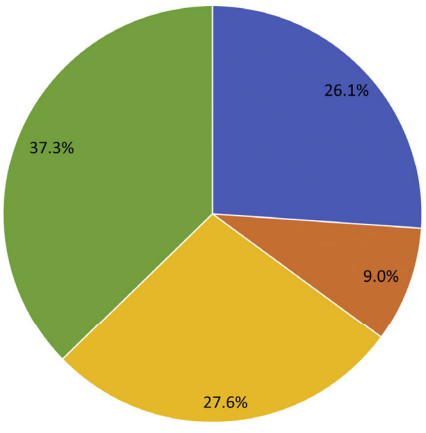
Minneapolis Heart Institute



89.0% failure (n=203)

- 32% Anatomical Reason
- 35% Clinical Risk Exclusion
- 22% Futility Marker

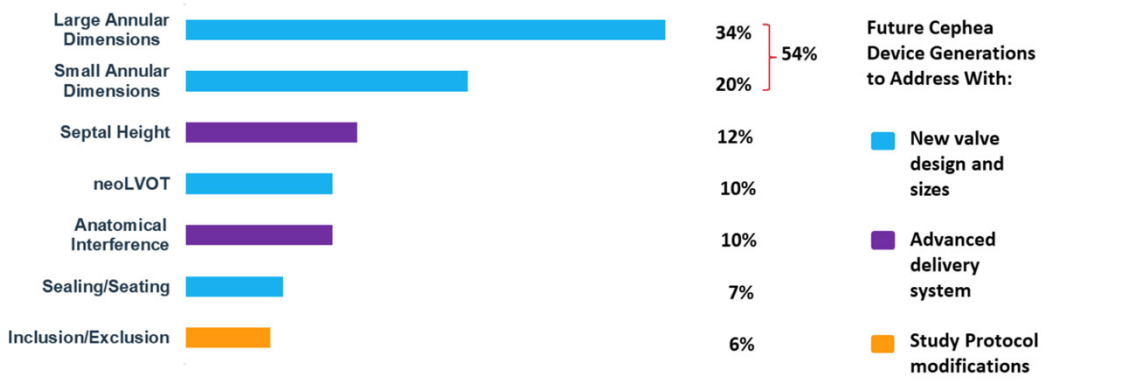
Intrepid Global Pilot Study



Hiroki Niikura et al. J Am Coll Cardiol Intv 2019; 12:196-204.
Meduri CU et al. JACC Card Interventions 2019;12:2402-2412

36

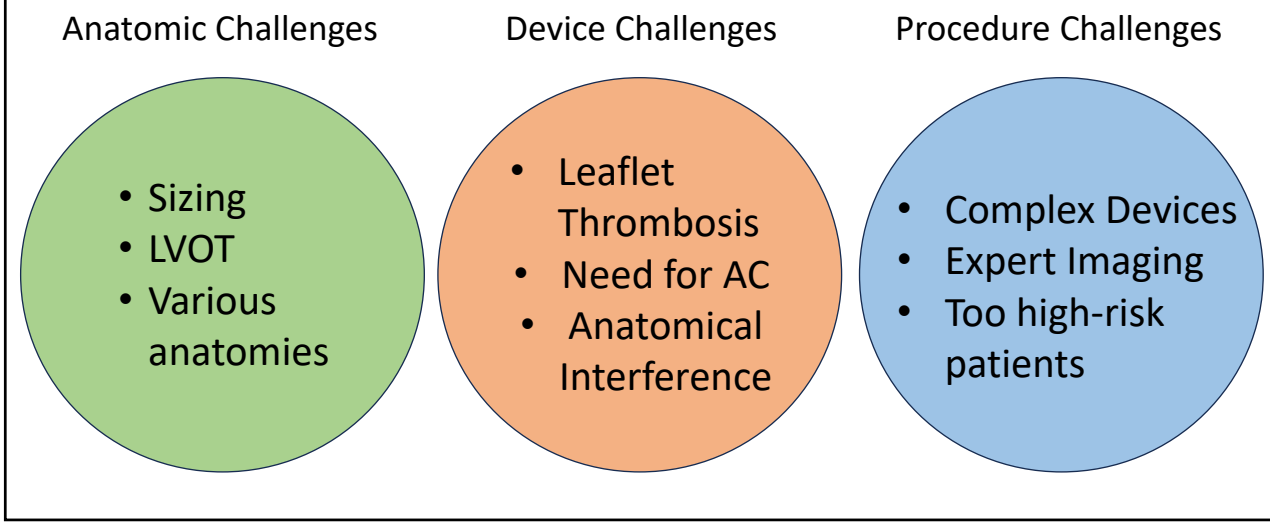
Screen Failure



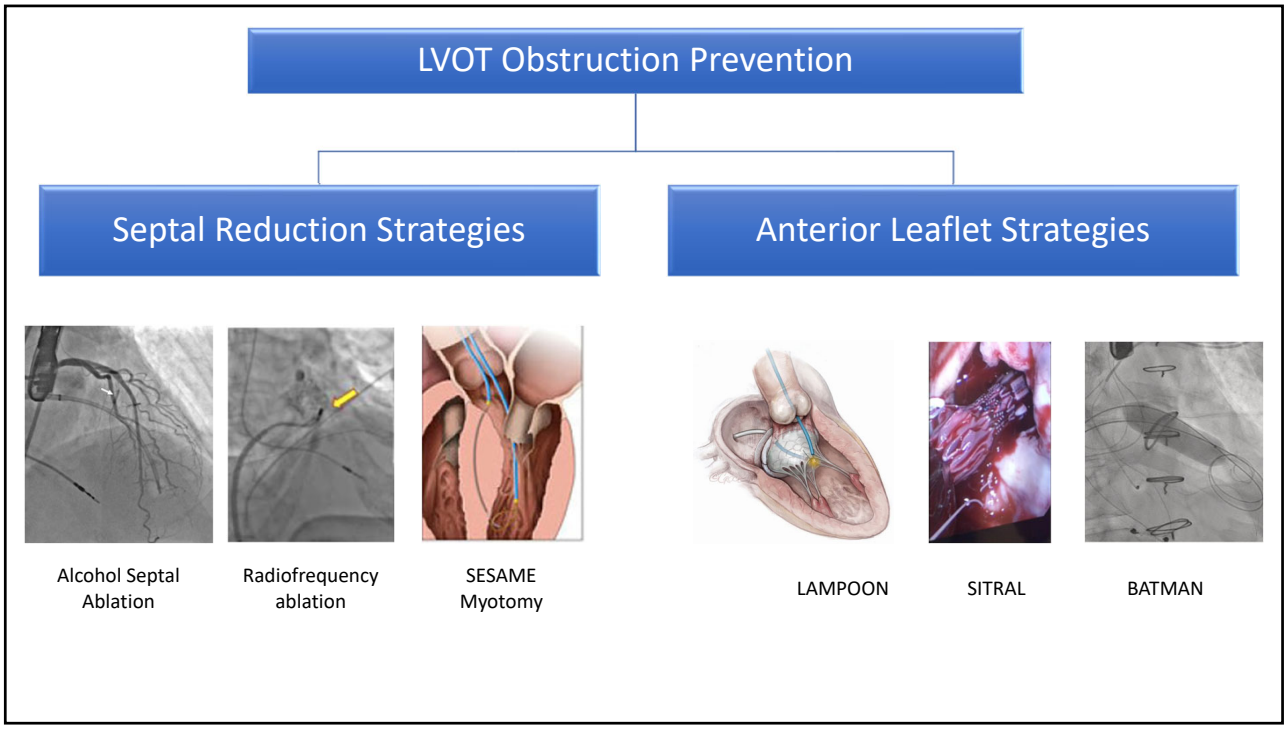
Yadav P. TVT 2023

37

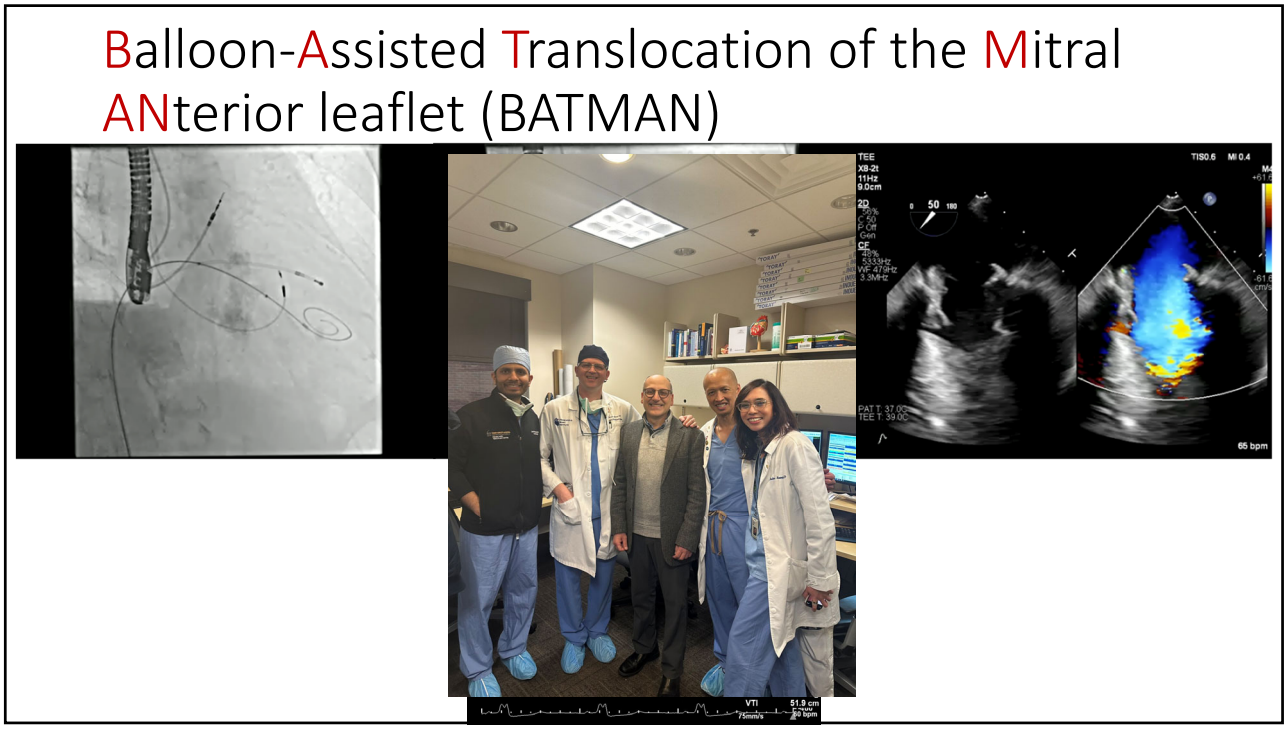
Current Challenges of TMVR



38

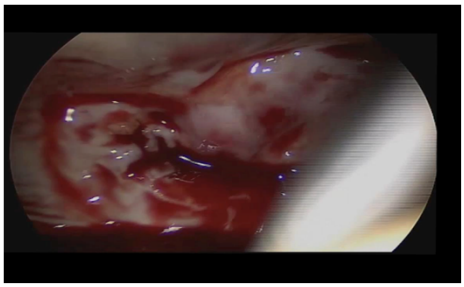

LVOT Obstruction Prevention
Septal Reduction Strategies
Anterior Leaflet Strategies
Alcohol Septal Ablation
Radiofrequency ablation
SESAME Myotomy
LAMPOON
SITRAL
BATMAN

39

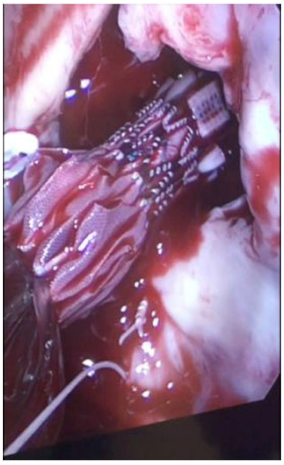

Balloon-Assisted Translocation of the Mitral ANterior leaflet (BATMAN)

40

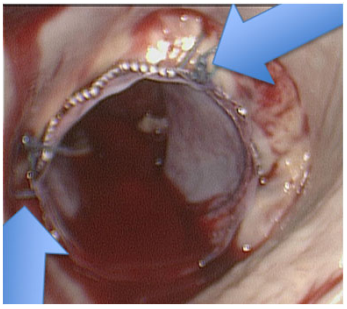
Surgical Implantation of TRanscatheter valve in mitral Annular caLcification (SITRAL)



Remove midportion of anterior leaflet A2 and septum if needed



Orient the valve into standard surgical configuration

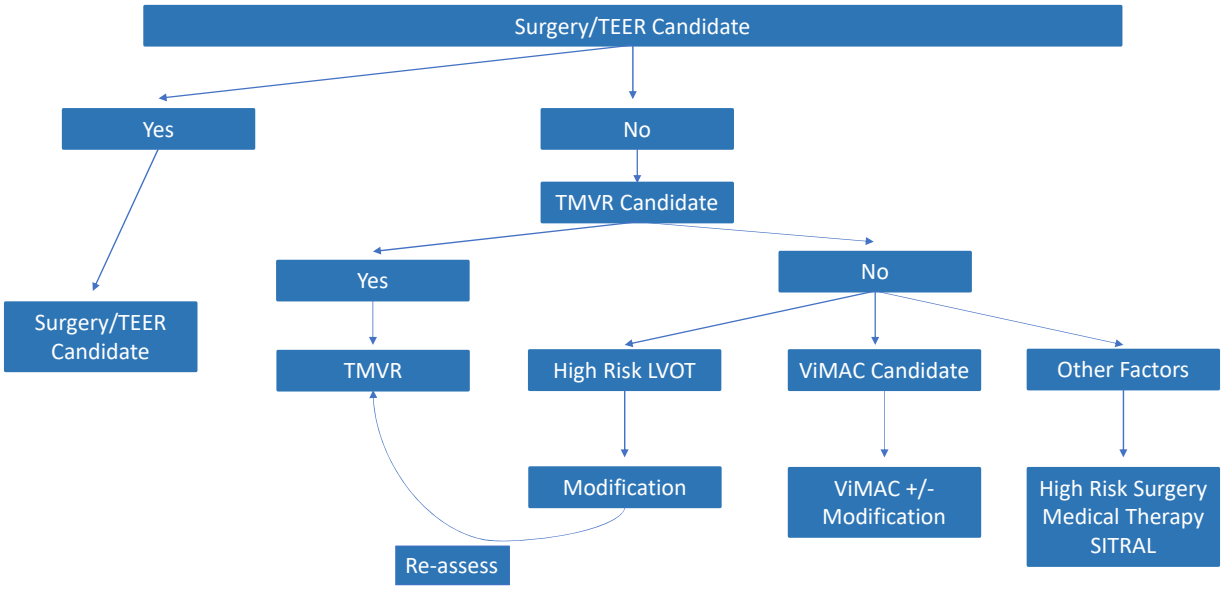


Teflon felt skirt to prevent PVL
Securing sutures

Smith R. TCT 2016

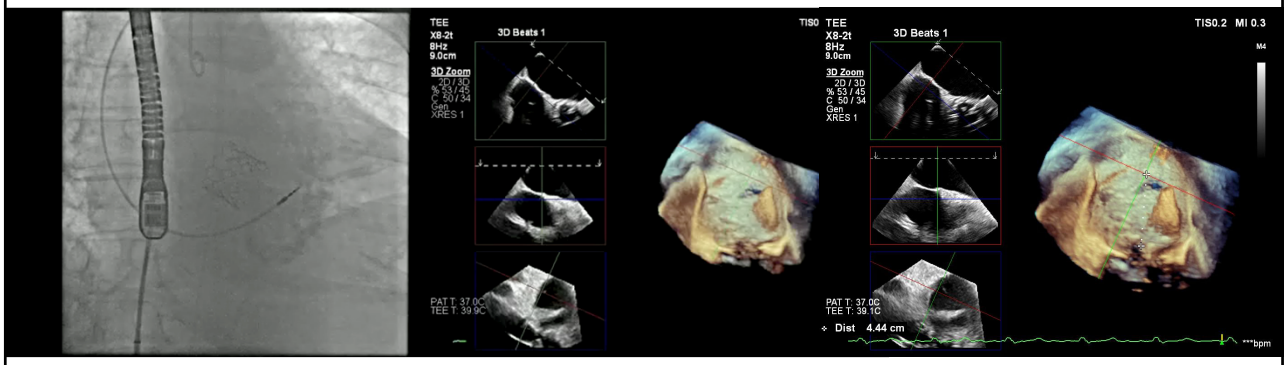
41

Management algorithm



42

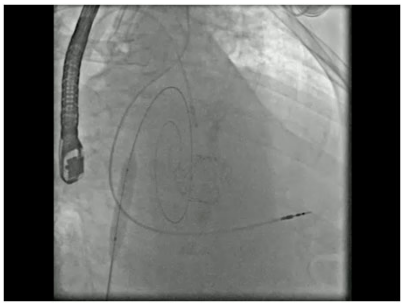
Back to our patient - Transeptal AltaValve



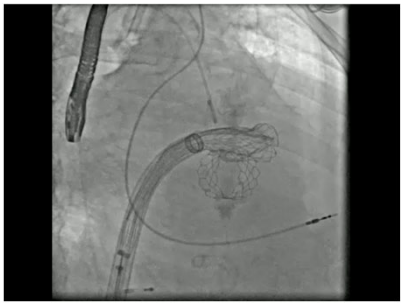
43

Transeptal AltaValve

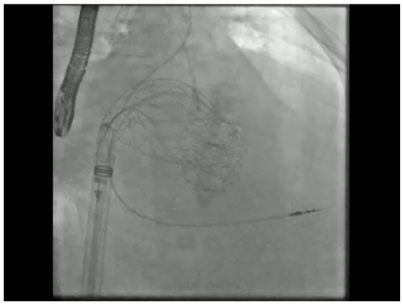
Balloon Septostomy



Valve placement across the annulus



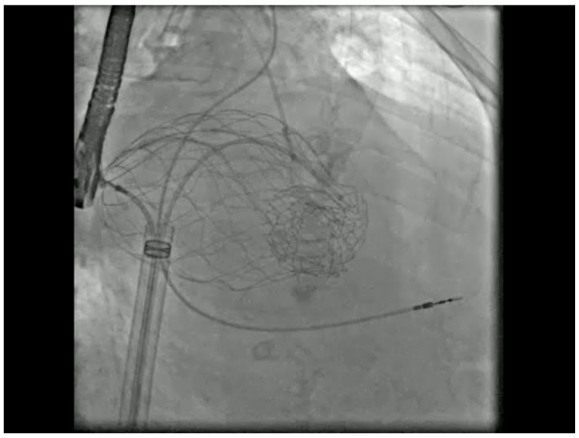
Cage deployment



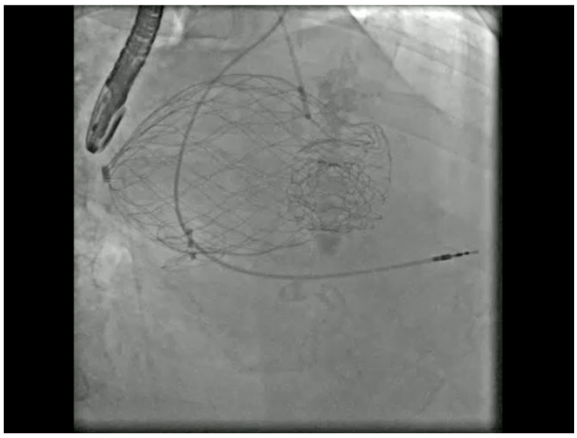
44

Transeptal AltaValve

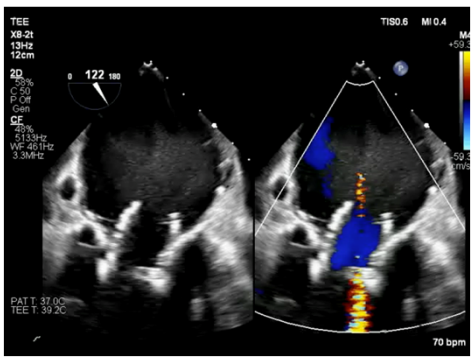
Device release

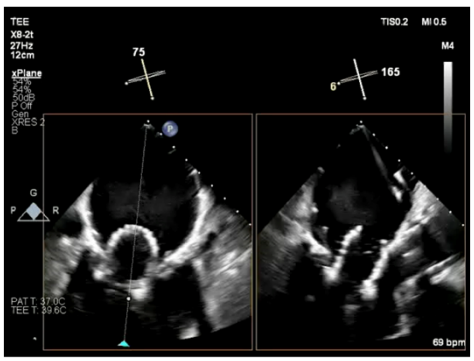


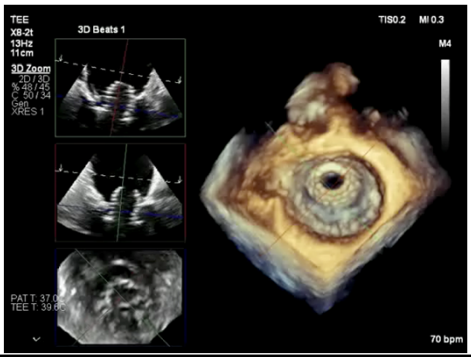
ASD Closure

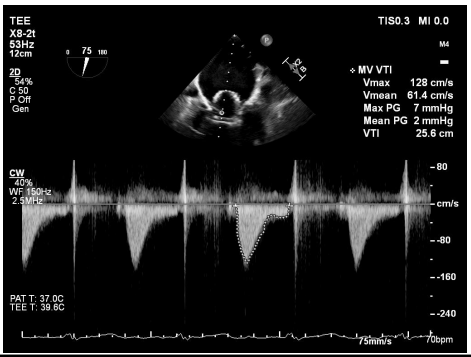


45









46

Case 2

- 84-yo female with severe symptomatic MR, torrential TR, HFpEF (EF 60-65%) and SC-PPM
- Recurrent hospitalizations with HF exacerbation despite being on GDMT
- Underwent Mitral TEER with Mitraclip (NTx1)

47

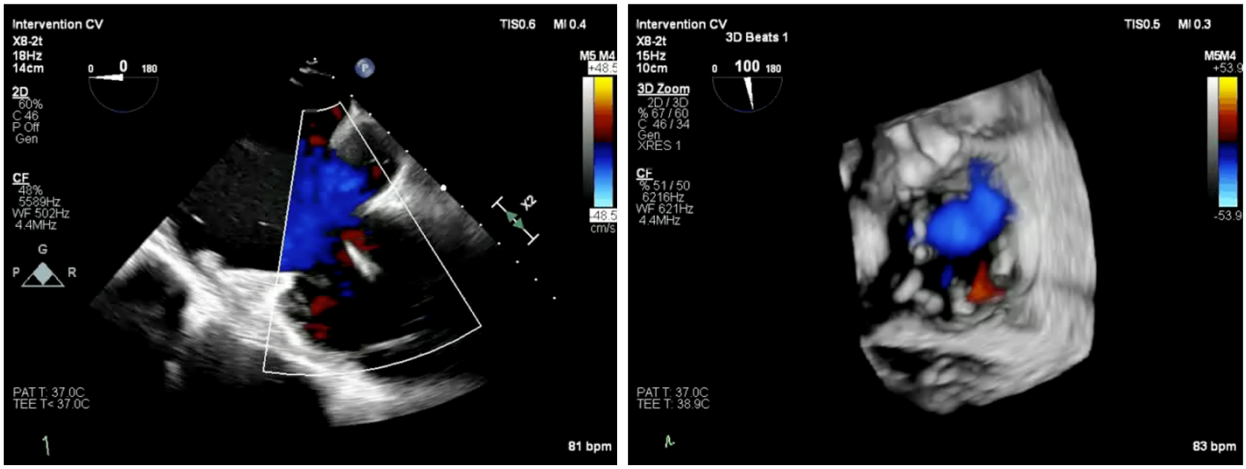
Case 2

- Remains symptomatic despite Mitral TEER with Mitraclip
- On stable dose of Torsemide
- NYHA III
- High surgical risk
- Right heart catheterization:
  - RA - mean 9mmHG (V 15mmHg)
  - RV - 49/1 mmHg (ED 11mmHg)
  - PA - 46/18/28 mmHg
  - PCWP - 10mmHg

48

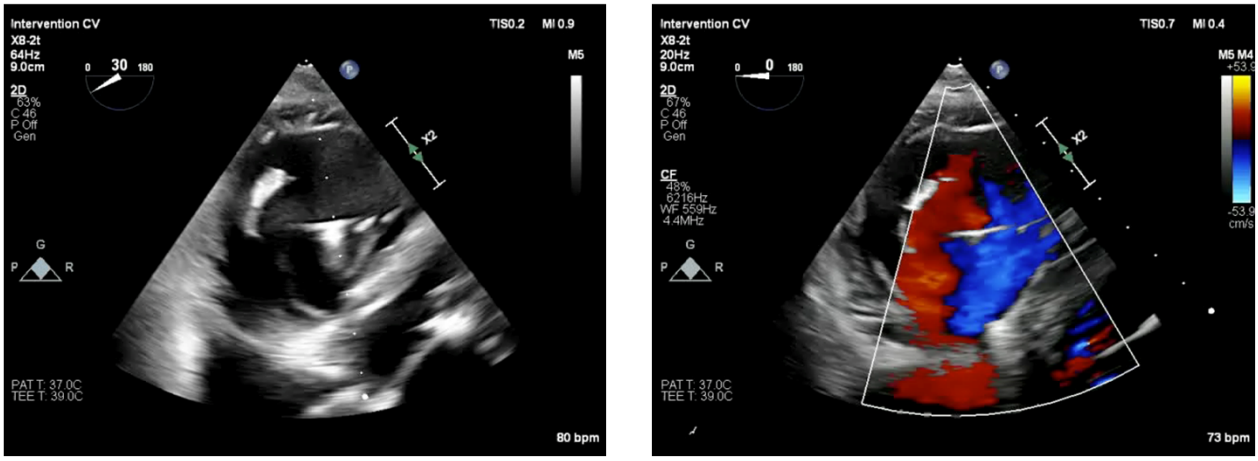
Tricuspid Valve

Torrential TR



49

Deep Transgastric

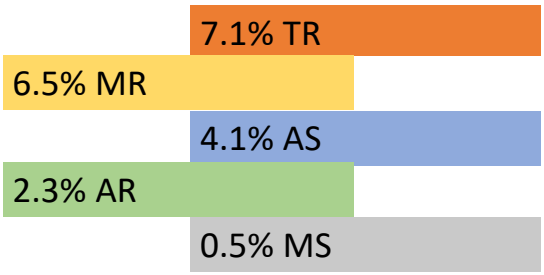


50

Background

- Tricuspid regurgitation is estimated to affect >1.5 million people in the U.S.
- Yearly incidence of about 200,000 patients in the US and >300,000 patients in Europe
- Limited medical therapy options – diuretics
- Severity easily underestimated
- Volume overload well tolerated for years

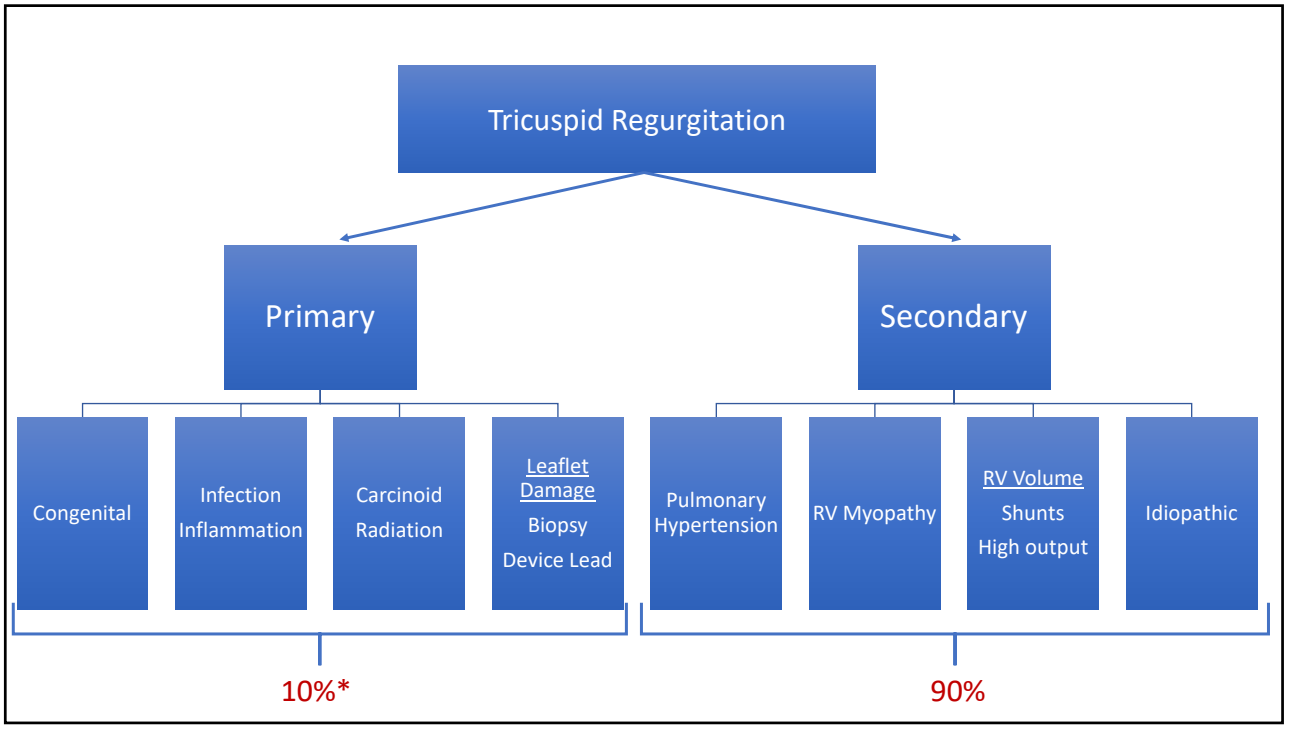
35 US Community/Academic Hospitals >714,000 patients



Prevalence of significant VHD

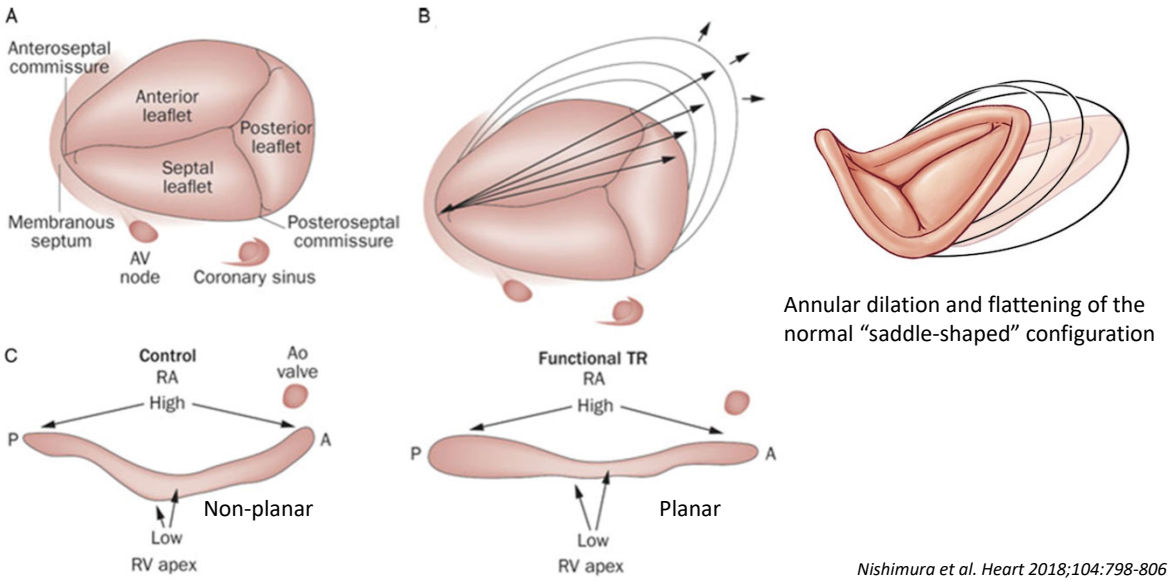
Brennan et al. ACC 2022

51



52

Secondary Tricuspid Regurgitation

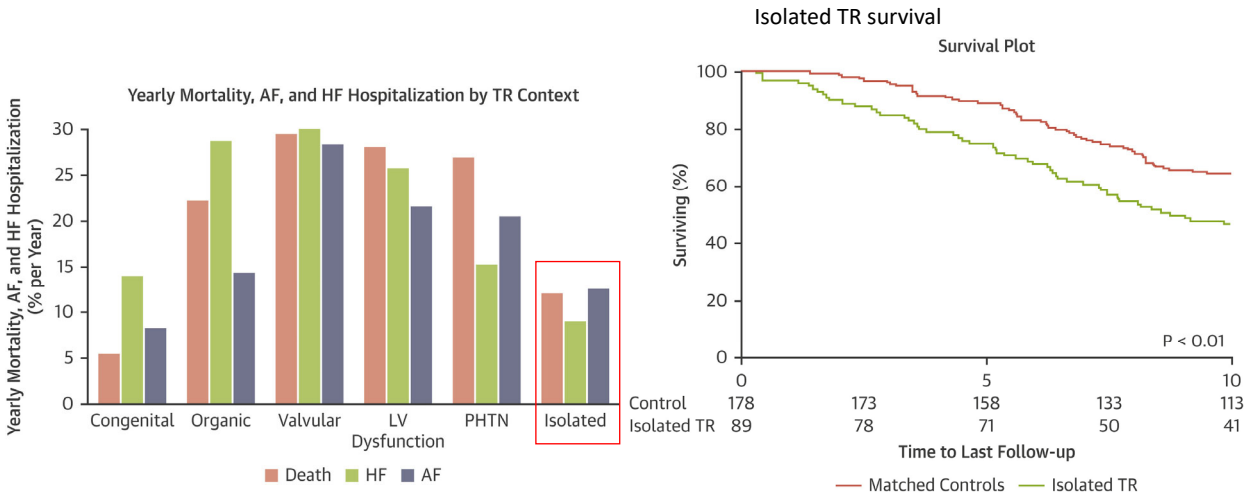


Annular dilation and flattening of the normal "saddle-shaped" configuration

Nishimura et al. Heart 2018;104:798-806

53

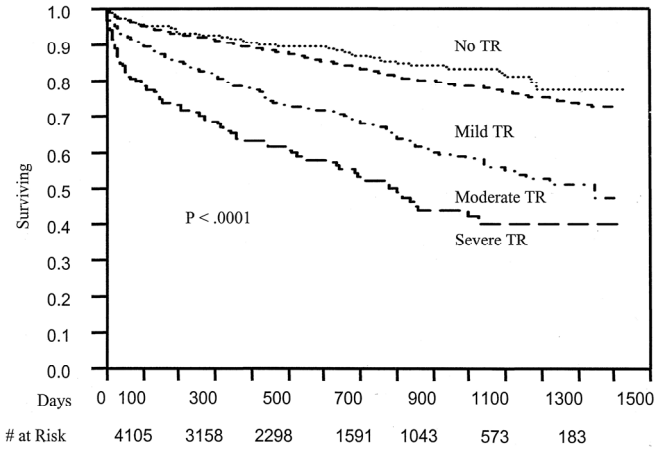
Survival with Tricuspid Regurgitation
Community population (N=1,095)



Topilsky et al. JACC Cardiovasc Imaging. 2019 Mar;12(3):433-442.

54

Survival with Tricuspid Regurgitation
VA study (N=5,223) over 4 years



All patients with (TR)

Nath et al. JACC 2004; 43(3): 405-9

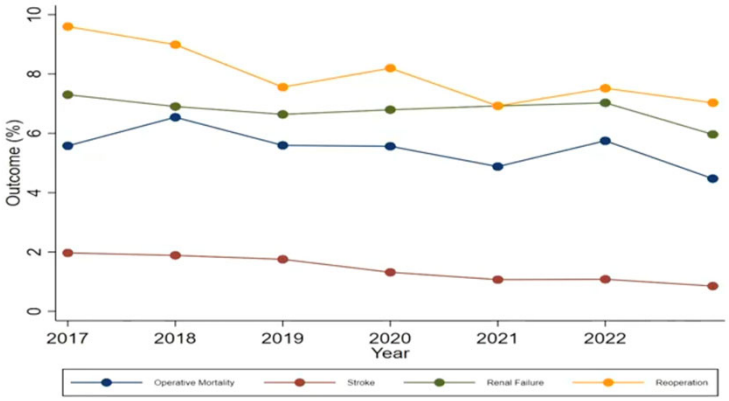
55

STS 2024

The Society of Thoracic Surgeons

Tricuspid Valve Surgery - Outcomes

- STS ACSD Registry
- 18 years or older
- Isolated Tricuspid valve repair or replacement
- July 1, 2017 – June 30, 2023
- 13,587 procedures at 842 participating sites
- ~2,000 cases per year

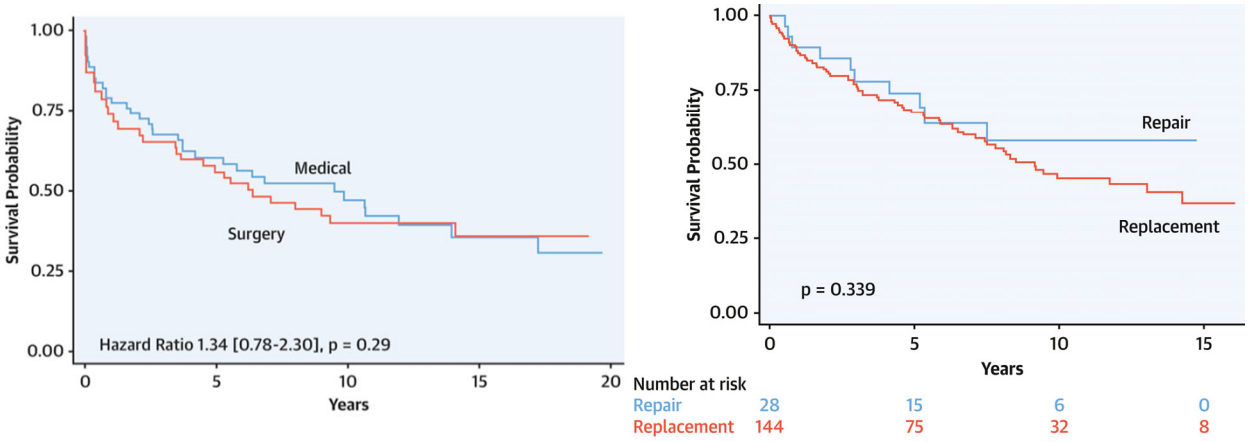


Thourani et al. An Thorac Surg, 2024, In press

56

Long-term Survival - Isolated TR Surgery

Longitudinal echocardiography database (N=3,276)



Axtell et al. JACC 2019; 74(6): 715-25

57

Surgical Intervention Indications

- Left sided surgery, severe TR (I)
- Left sided surgery, progressive TR in the context of either 1) tricuspid annular dilation (tricuspid annulus end diastolic diameter >4.0 cm) or 2) prior signs and symptoms of right-sided HF (IIA)
- Severe primary or secondary TR on GDMT (IIA)
- Asymptomatic severe primary TR with RV dilation or RV systolic dysfunction (IIB)
- Symptomatic severe TR with hx of prior surgery and absence of severe pulmonary hypertension or severe RV systolic dysfunction (IIB)

No class I recommendation for isolated TR

Otto et al. J Am Coll Cardiol. 2021 Feb, 77 (4) e25–e197

58

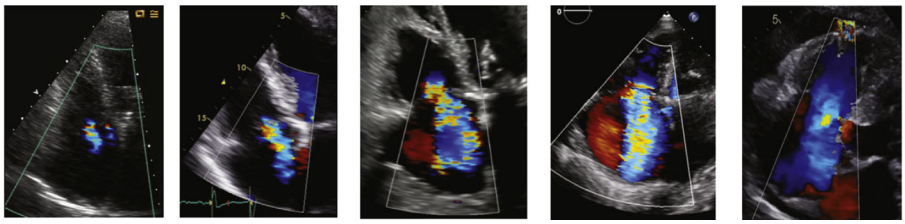
Tricuspid Regurgitation is Prevalent but Rarely Treated with Surgery

59

ECHO - Tricuspid Regurgitation Severity

Parameters	MILD	MODERATE	SEVERE	MASSIVE	TORRENTIAL
Vena Contracta width (biplane average)	<3 mm	3-6.9 mm	7 mm - 13 mm	14-20 mm	≥21 mm
EROA by PISA	<20 mm^2	20-39 mm^2	40-59 mm^2	60-79 mm^2	≥80 mm^2
3D Vena Contracta Area or Quantitative Doppler EROA	-	-	75-94 mm^2	95-114 mm^2	≥115 mm^2

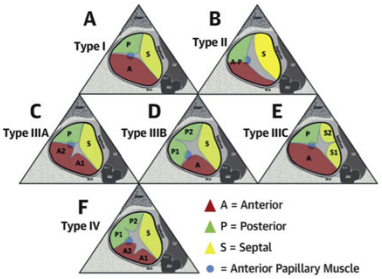
Example:

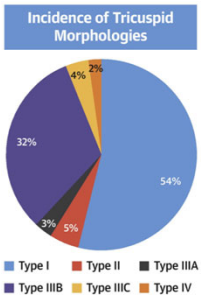


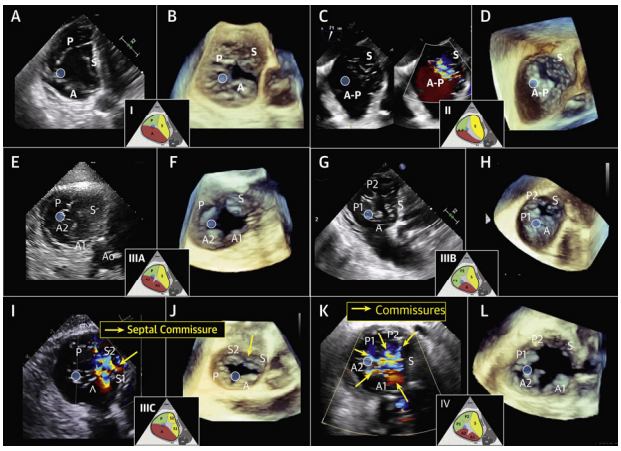
Hahn et al. JACC Cardiol Imag. 2019; 12(3):469-90

60

Tricuspid Valve Nomenclature

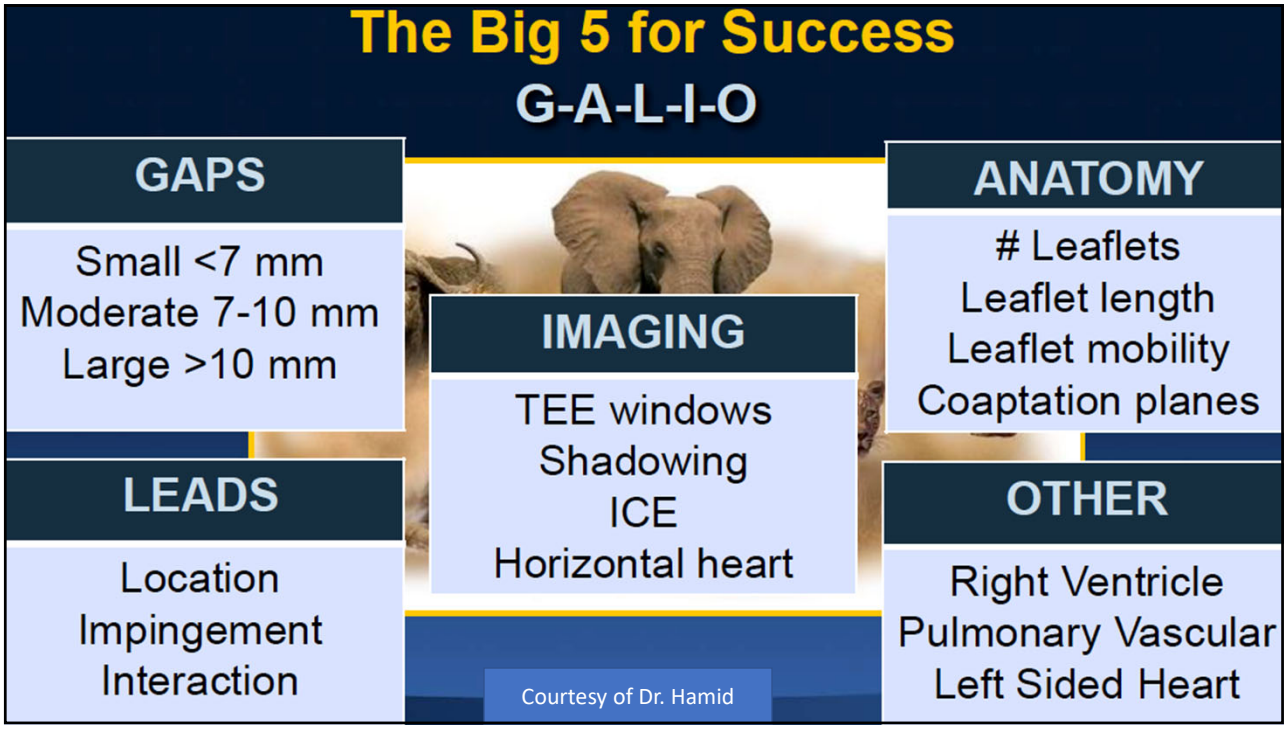






Hahn et al. JACC Cardiol Imag. 2021;14(7):1299-305

61



62

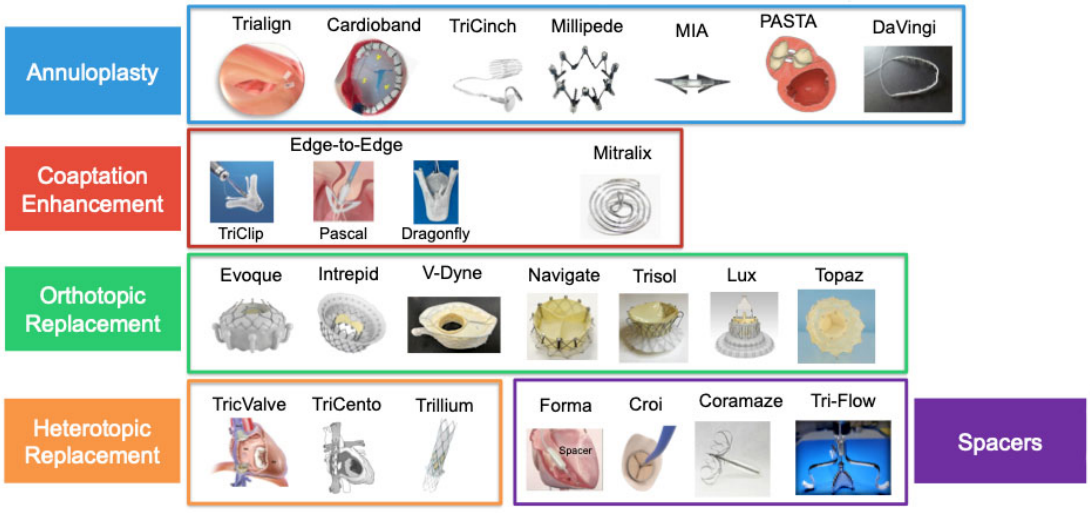
Anatomical Success Predictors

EASY	MEDIUM	HARD
Small (<7mm) gaps	Moderate (>7 but <=10mm) gaps	Large (>10mm) gaps
Septo-anterior jet location	Septo-posterior location	Thick and/or severely restricted leaflets
Favorable leaflet annular index	Type III or IV leaflet morphology	Antero-posterior jet location
Type I/II leaflet morphology	CIED in commissure and/or not a jet location "Non-hostile"	Poor echo visualization (role for ICE)
	Minimal leaflet restriction	Hostile CIED
	Focal primary disease	Horizontal heart (role for ICE)

Hamid N. TVT 2022

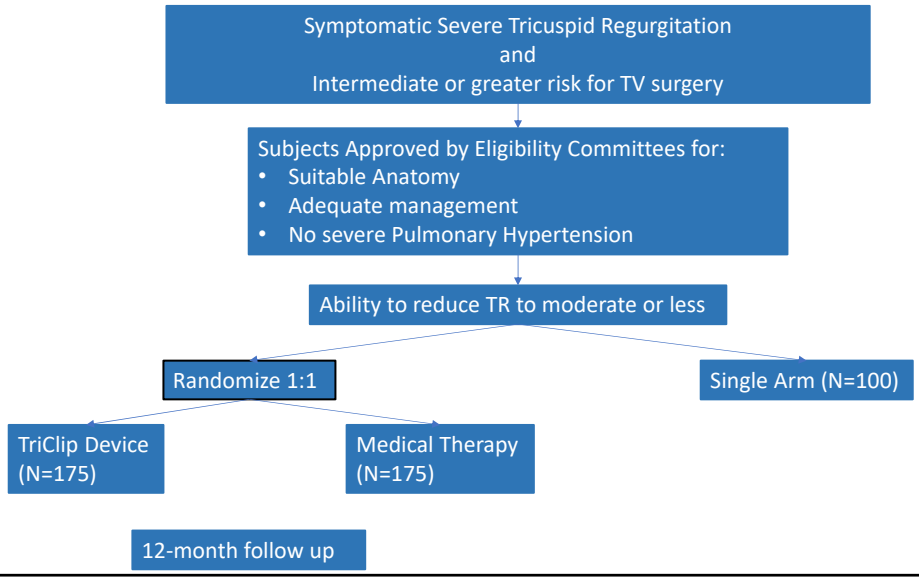
63

Transcatheter Tricuspid Landscape



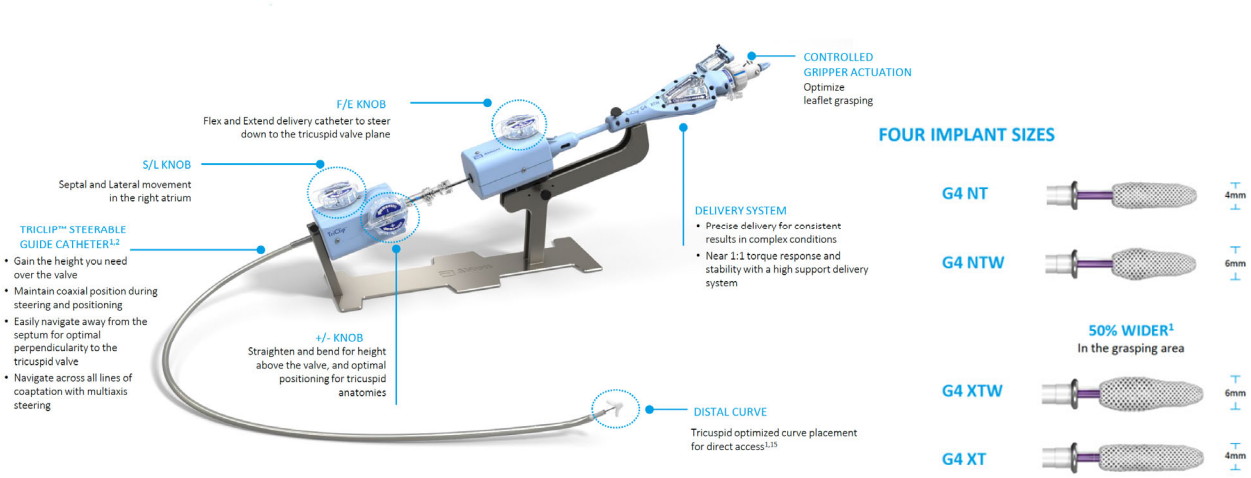
64

TRILUMINATE - Enrollment and Treatment Pathway

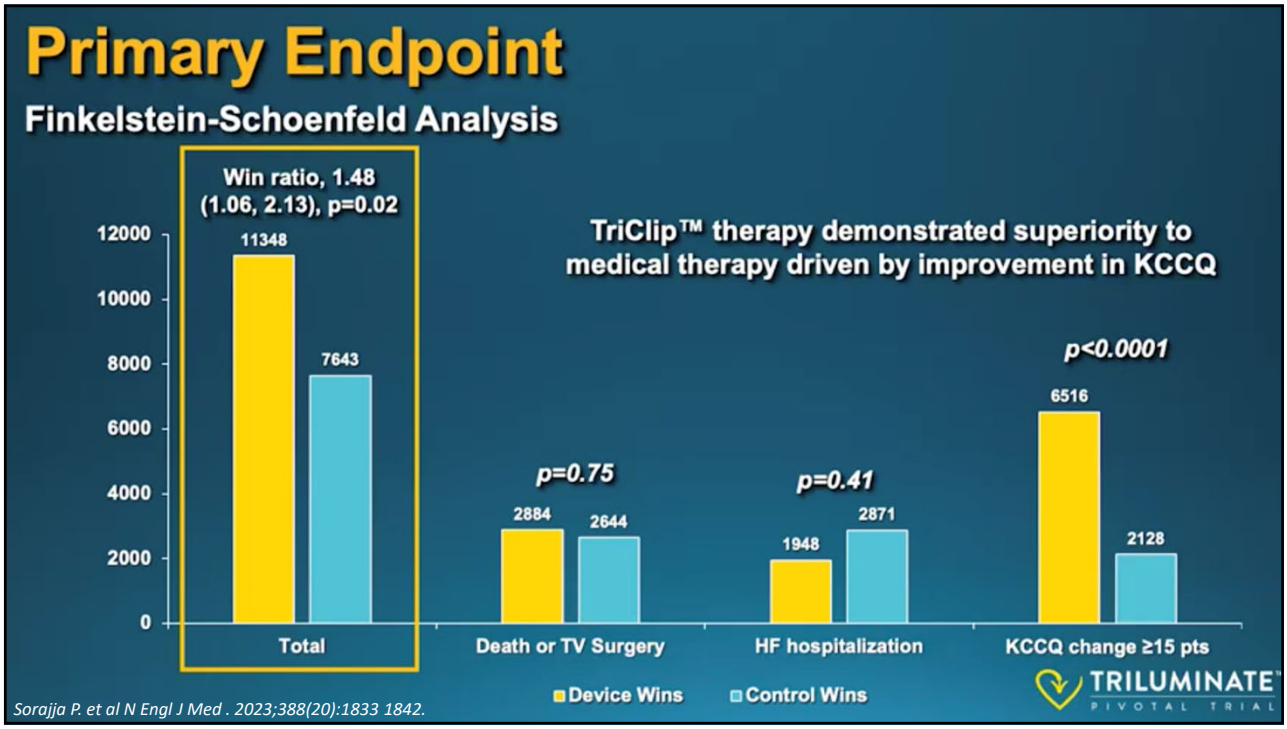


65

TriClip G4 Delivery System



66



67

TRILUMINATE
PIVOTAL TRIAL

30-day Adverse Events

Variable	TRILUMINATE™ Pivotal RCT (Device Arm) N=172	TRILUMINATE™ Pivotal SA N=99	bRIGHT N=511
All-cause Mortality	0.6%	0%	1.0%
Cardiovascular Mortality	0.6%	0%	0.8%
Endocarditis Requiring Surgery	0%	0%	0%
New-onset Renal Failure	1.2%	0%	1.4%
Non-elective CV Surgery, TVRS For Device-related AE	0%	0%	0.2%
Major Bleeding*	5.1%	5%	7.2%
Single Leaflet Device Attachment (SLDA)	7.0%	7.5%	3.8%
Stroke	0.6%	0%	0.4%
Myocardial Infarction	0%	0%	0%
Device Embolization	0%	0%	0%
Device Thrombosis	0%	0%	0%
New CRT/CRT-D/ICD/Permanent Pacemaker	0.6%	0%	0%

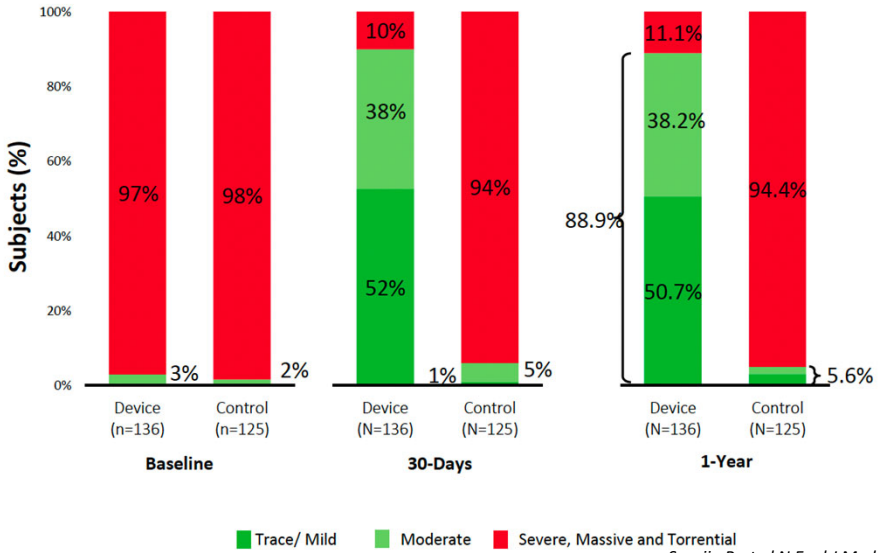
*Defined as bleeding ≥ Type 3 based on a modified Bleeding Academic Research Consortium (BARC) definition

Sorajja P. et al N Engl J Med . 2023;388(20):1833 1842.

68

TRILUMINATE PIVOTAL TRIAL

Reduction in TR Severity

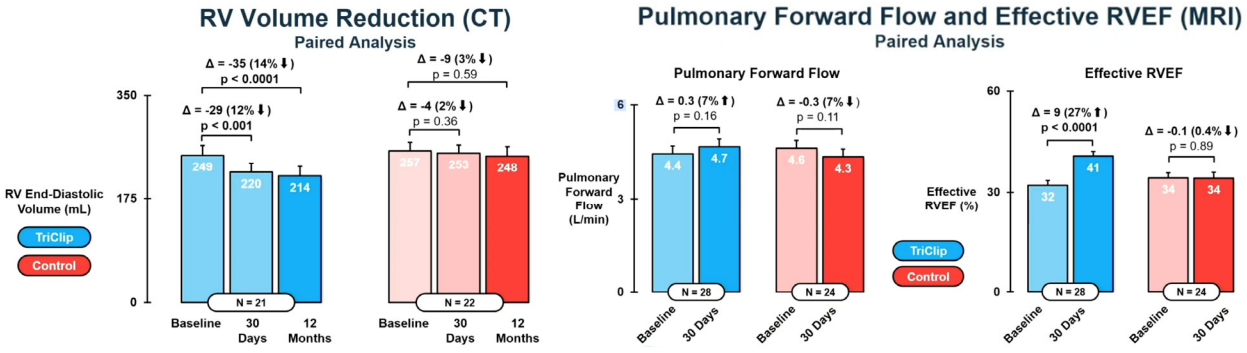


Sorajja P. et al N Engl J Med . 2023;388(20):1833 1842

69

TRILUMINATE PIVOTAL TRIAL

Physiologic Remodeling



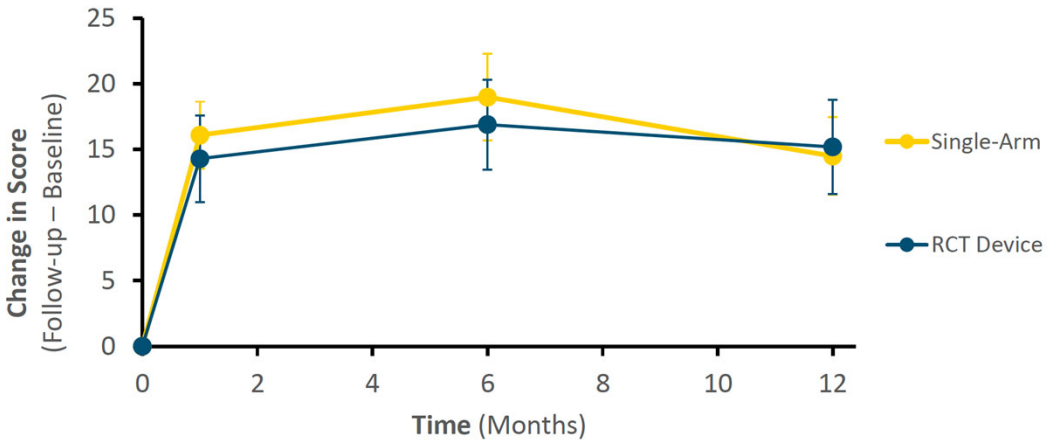
Cavalcante J. TCT 2023

70

TRILUMINATE
PIVOTAL TRIAL

QOL Improvement

No waning effect



Adams D, Sorajja P, et al. TCT 2023

71

FDA Approves TriClip TEER Device for Tricuspid Repair

(UPDATED) The approval was based on positive data from the TRILUMINATE pivotal trial, which included a highly symptomatic population.

by L.A. McKeown | APRIL 02, 2024

ABBOTT RECEIVES FDA APPROVAL FOR TRICLIP™, FIRST-OF-ITS-KIND DEVICE TO REPAIR LEAKY TRICUSPID HEART VALVE

Photos (1)

- TriClip offers a remarkably safe, minimally invasive treatment option for patients in need of tricuspid valve repair but who are unable to withstand surgery
- More than 1.6 million people in the U.S. are affected by tricuspid regurgitation,[1] which can severely impact quality of life
- Data from the TRILUMINATE™ Pivotal trial demonstrated that patients who received TriClip experienced a marked improvement in the severity of their symptoms and quality of life, with benefits sustained at one year

FDA Update: Agency Approves Abbott TriClip to Treat TR

Apr 02, 2024

ACC News Story

First-in-human
2017

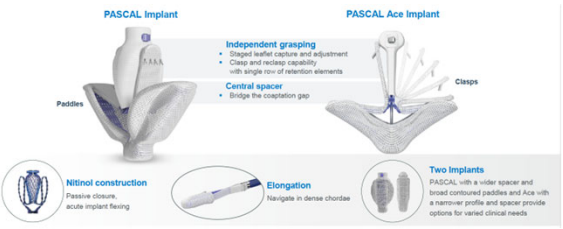
1st Triluminate case
August 28th, 2019

Last Triluminate case
April 2nd, 2024

1st commercial case
April 4th, 2024

72

CLASP II TR trial



Roll-in cohort of up to first 3 patients per site

Patients with symptomatic severe TR despite medical therapy

Multidisciplinary Heart Team Assessment

- *≥ severe TR as assessed by echo core lab*
- *NYHA Class II-IVa*
- *≥ intermediate mortality risk with tricuspid valve surgery*

PASCAL System + OMT **2:1** ***OMT alone***

Primary endpoint (24 months)

Composite endpoint including all-cause mortality, RVAD implantation or heart transplant, tricuspid valve intervention, heart failure hospitalizations, and Quality of Life improvement (measured by KCCQ score)

73

CLASP II TR trial – Roll in Cohort
Enrollment and procedural characteristics

Roll-in patients* N=73

Pending visit n=3
Missed visit n=1
Withdrew n=1

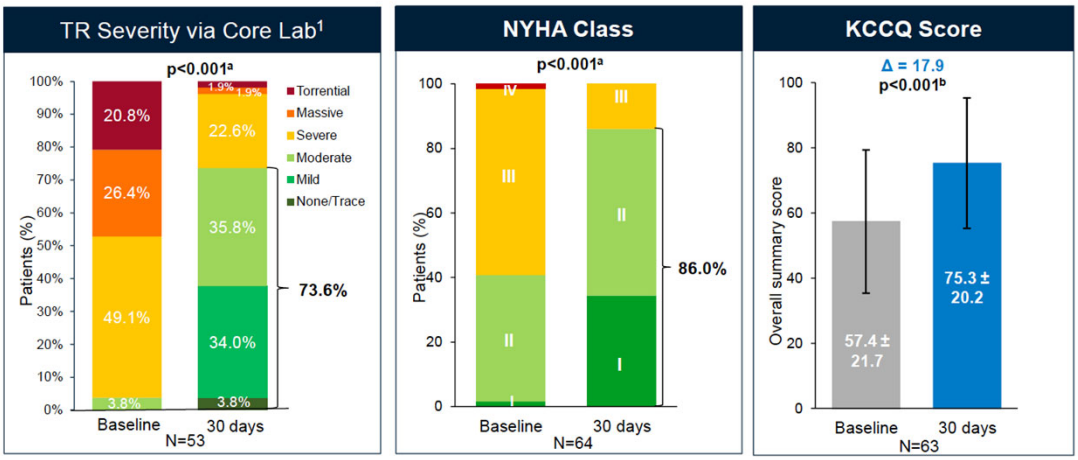
30-day follow up n=68

	% (n/N) or Mean ± SD (N)
Successful implant rate[1]	84.4 (54/64)
PASCAL Ace	88.9 (56/63)
Mean number of devices implanted	1.5 ± 0.6[†]
Device time (implant insertion to guide sheath removal), mins	148.2 ± 71.9[^]
Length of hospital stay (procedure to discharge), days	1.7 ± 1.5[¶]
Discharged to home	100[#]

Lim et al. Catheter Cardiovasc Interv. 2021 Oct;98(4):E637-46.

74

CLASP II TR trial – Roll in Cohort
TR reduction and quality of life improvement



83.0% improved by ≥ 1 TR grade, 62.3% by ≥ 2 grades, and 73.6% reached ≤ moderate TR at 30 days

Lim et al. Catheter Cardiovasc Interv. 2021 Oct;98(4):E637-46.

75

CLASP II TR trial – Roll in Cohort
Major adverse events

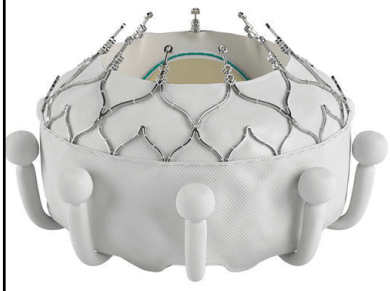
CEC-adjudicated MAEs, N=69*	30 days % (n)
Cardiovascular mortality	0
Myocardial infarction	0
Stroke	0
New need for renal replacement therapy	0
Major cardiac structural complications	0
Non-elective tricuspid valve re-intervention, percutaneous or surgical	0
Severe bleeding	2.9 (2)
Major access site and vascular complications	0
SLDA†	5.8 (4)
Composite MAE rate	8.7 (6)
Other events	
All-cause mortality	0
Heart failure hospitalization	0

Lim et al. Catheter Cardiovasc Interv. 2021 Oct;98(4):E637-46.

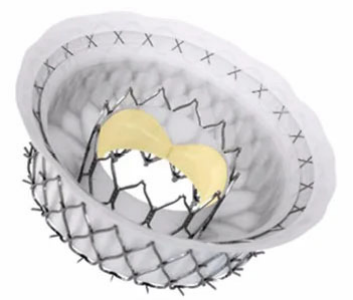
76

Orthotopic Replacement

EVOQUE



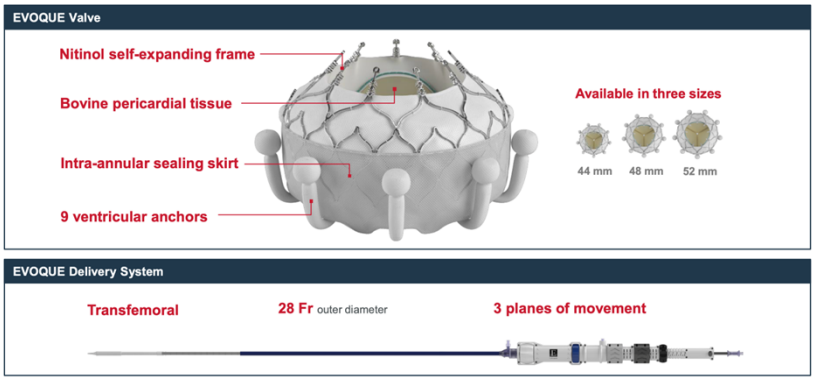
INTREPID



VDYNE

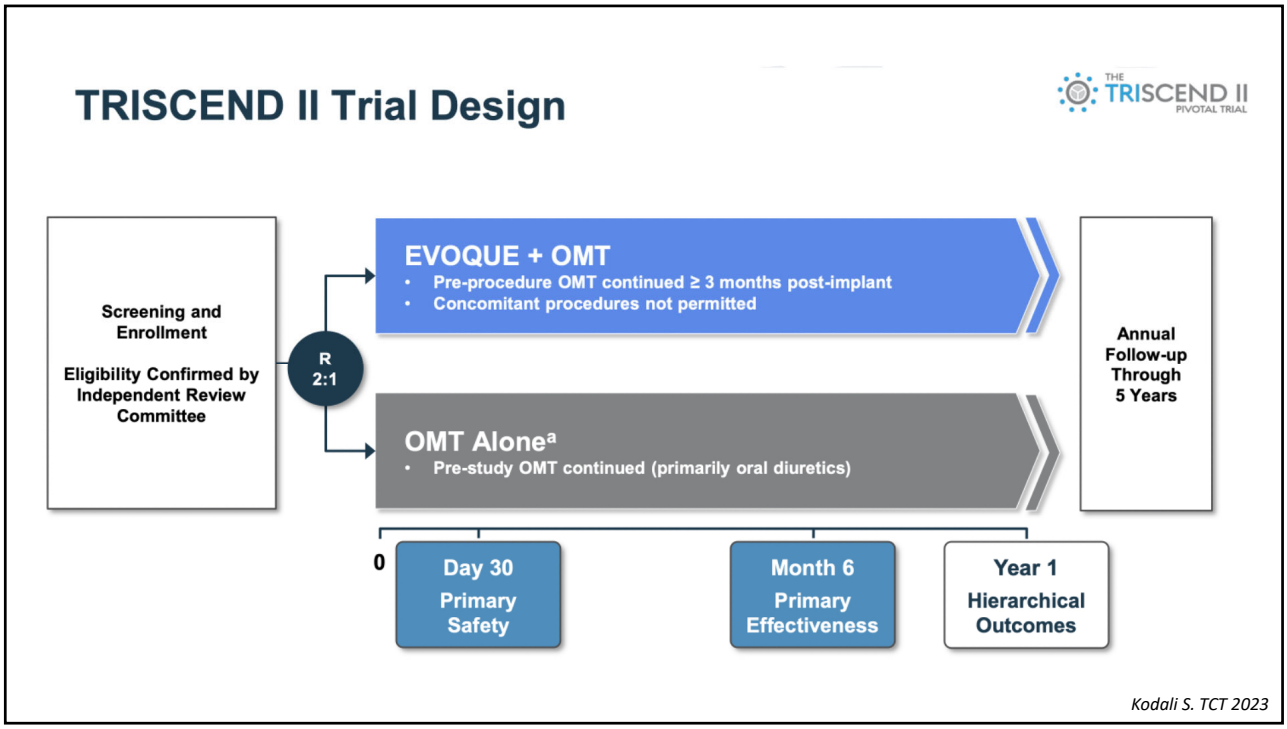
77

EVOQUE Tricuspid Valve Replacement System

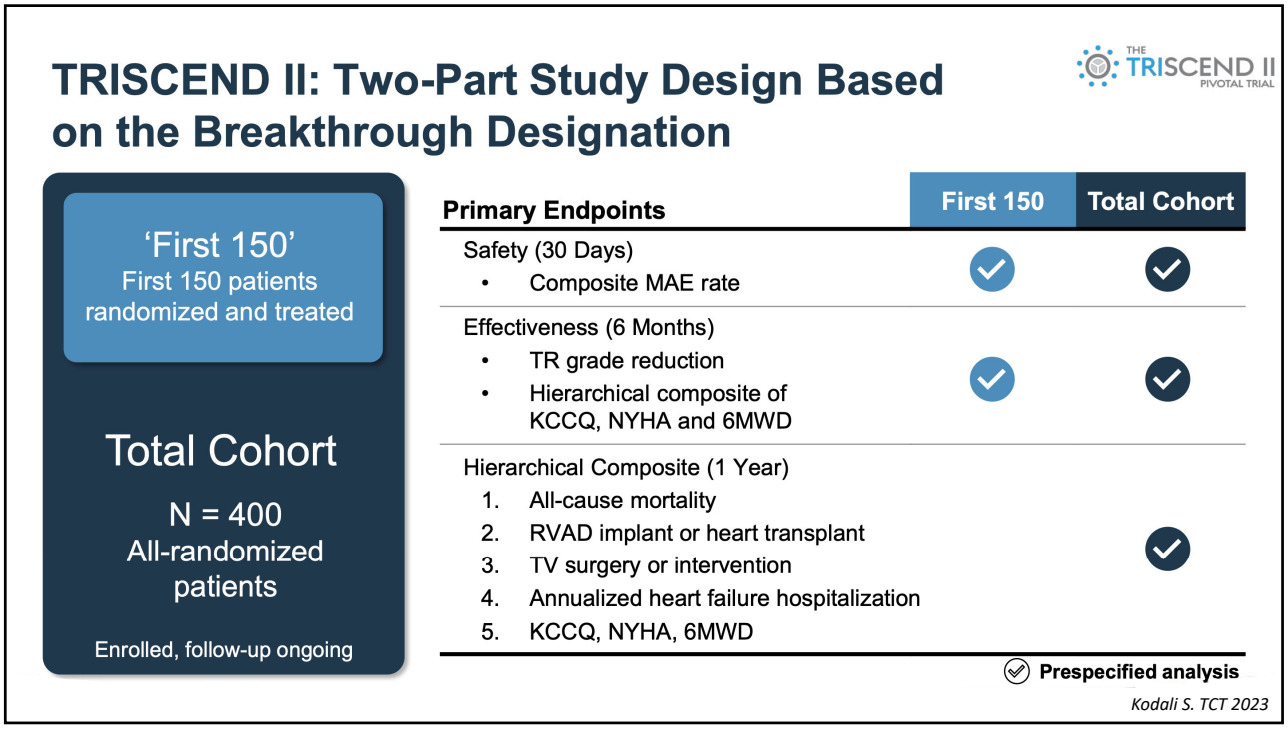


Unique valve design engages leaflets, chords, and annulus to achieve secure placement
Atraumatic anchors compatible with pre-existing **leads** and respect the **native anatomy**
Conforming frame designed to achieve optimal retention force
Multiple sizes offer treatment for a broad range of tricuspid pathologies and anatomies (44, 48 and 52 mm)
28F transfemoral delivery system with **multiple planes of flexion and depth control**

78


TRISCEND II Trial Design
THE TRISCEND II PIVOTAL TRIAL
Screening and Enrollment
Eligibility Confirmed by Independent Review Committee
R 2:1
EVOQUE + OMT
Pre-procedure OMT continued ≥ 3 months post-implant
Concomitant procedures not permitted
OMT Alone[a]
Pre-study OMT continued (primarily oral diuretics)
Annual Follow-up Through 5 Years
0
Day 30 Primary Safety
Month 6 Primary Effectiveness
Year 1 Hierarchical Outcomes
Kodali S. TCT 2023

79


TRISCEND II: Two-Part Study Design Based on the Breakthrough Designation
THE TRISCEND II PIVOTAL TRIAL
'First 150'
First 150 patients randomized and treated
Total Cohort
N = 400
All-randomized patients
Enrolled, follow-up ongoing
Primary Endpoints
First 150
Total Cohort
Safety (30 Days)
Composite MAE rate
Effectiveness (6 Months)
TR grade reduction
Hierarchical composite of KCCQ, NYHA and 6MWD
Hierarchical Composite (1 Year)
1. All-cause mortality
2. RVAD implant or heart transplant
3. TV surgery or intervention
4. Annualized heart failure hospitalization
5. KCCQ, NYHA, 6MWD
Prespecified analysis
Kodali S. TCT 2023

80

THE TRISCEND II PIVOTAL TRIAL

TRISCEND II 30-Day Results

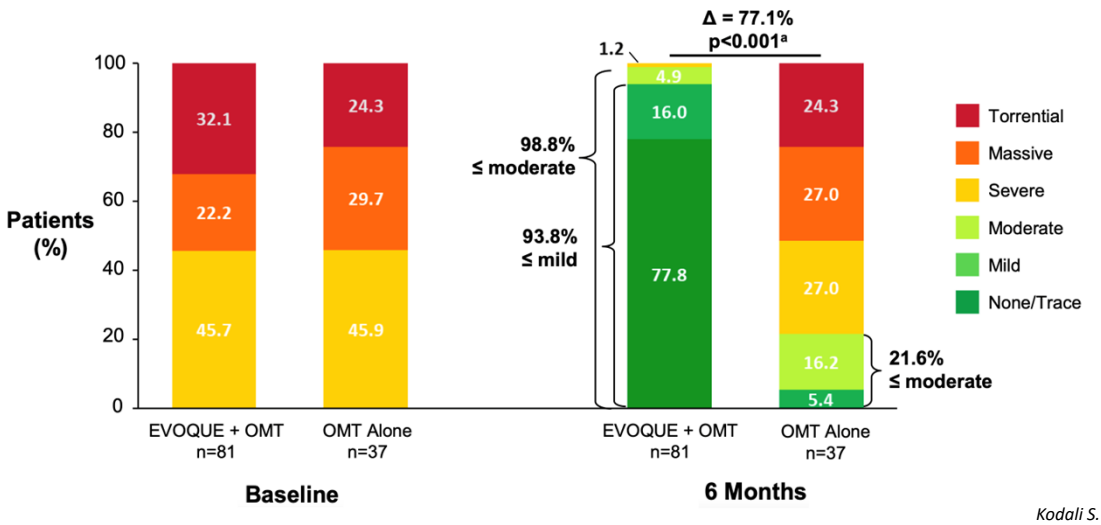
CEC-Adjudicated Major Adverse Events	EVOQUE + OMT N=95 % (n)
Cardiovascular mortality	3.2 (3)
Myocardial infarction	1.1 (1)
Stroke	0.0 (0)
New need for renal replacement therapy	1.1 (1)
Severe bleeding[a]	10.5 (10)
Non-elective TV re-intervention	0.0 (0)
Major access site and vascular complication	3.2 (3)
Major cardiac structural complication	2.1 (2)
Device-related pulmonary embolism	1.1 (1)
Arrhythmia and conduction disorder requiring permanent pacing	14.7 (14)
Composite MAE Rate[b]	**27.4 (26)**

Kodali S. TCT 2023

81

THE TRISCEND II PIVOTAL TRIAL

TR Grade at 6 Months

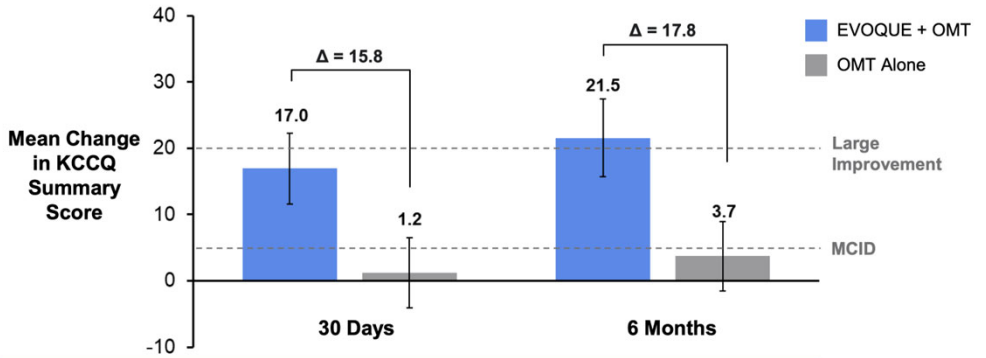


Kodali S. TCT 2023

82

THE TRISCEND II PIVOTAL TRIAL

Changes in KCCQ at 30 days and 6 months



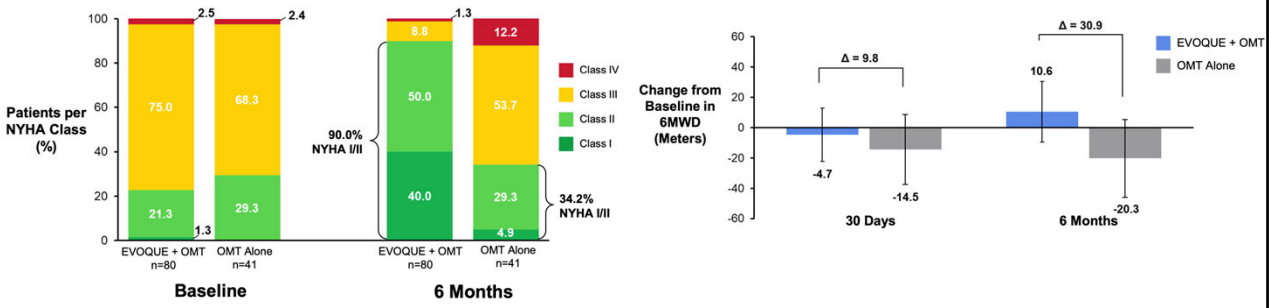
Baseline Mean KCCQ Score	50.6 n=82	48.0 n=45	50.7 n=79	51.2 n=42

Kodali S. TCT 2023

83

THE TRISCEND II PIVOTAL TRIAL

Change in NYHA and 6 MWT



Kodali S. TCT 2023

84

FDA Approves First Transcatheter Tricuspid Valve Replacement Device

(UPDATED) Edwards Lifesciences says there are "favorable trends" in hard outcomes among patients who have completed 1-year follow-up.

by L.A. McKeown | FEBRUARY 02, 2024

FDA Update: Agency Approves EVOQUE System For TR

Feb 02, 2024

ACC News Story

Save to Library Print Font Size AAA

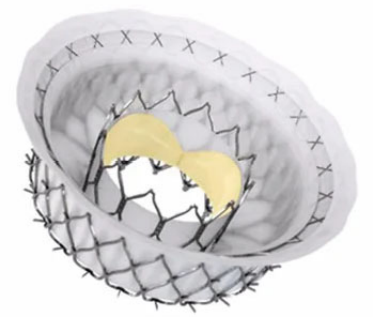
The U.S. Food and Drug Administration (FDA) has approved the EVOQUE tricuspid valve replacement system for the treatment of tricuspid regurgitation (TR). According to an Edwards press release, "it is the first transcatheter therapy to receive [FDA] approval for the treatment of [TR]" and is "indicated for the improvement of health status in patients with symptomatic severe TR despite optimal medical therapy, for whom tricuspid valve replacement is deemed appropriate by a heart team."

Edwards' EVOQUE Valve Replacement System First Transcatheter Therapy to Earn FDA Approval for Tricuspid Valve

IRVINE, Calif.--(BUSINESS WIRE)-- Edwards Lifesciences Corporation (NYSE: EW) today announced the company's EVOQUE tricuspid valve replacement system is the first transcatheter therapy to receive U.S. Food and Drug Administration (FDA) approval for the treatment of tricuspid regurgitation (TR). The EVOQUE system is indicated for the improvement of health status in patients with symptomatic severe TR despite optimal medical therapy (OMT), for whom tricuspid valve replacement is deemed appropriate by a heart team.

85

Intrepid - Tricuspid Valve



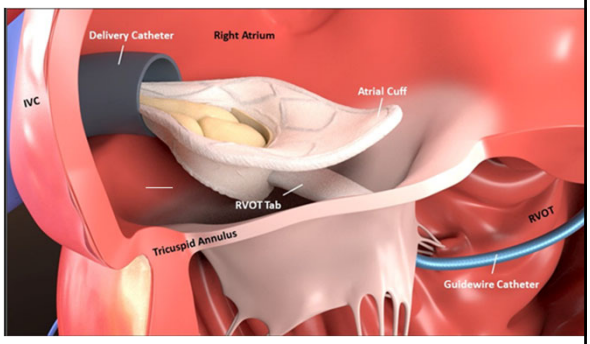
ouses a 29 mm tri-leaflet
ve
livery system - 29Fr system in

ent anchors without leaflet
otational alignment
es (43, 46, 50 mm)
he presence of pacing leads
stent frames may allow for
plantation
sibility trial

86

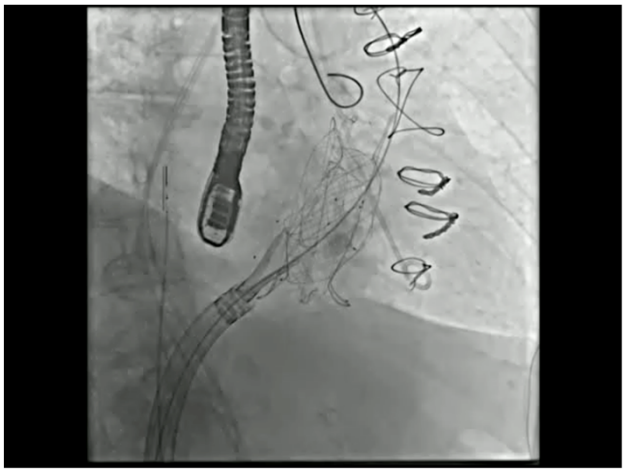
VDYNE Valve

- Side-delivery technology – vertical folding
- 28Fr Transfermoral Delivery catheter
- Double-frame nitinol prosthesis that houses a 30mm porcine trileaflet valve
- Five valve sizes to treat a broader range of patient anatomies (perimeter up to 180mm)
- Securement mechanisms at RVOT, ventricular free wall and posterior septum - (<10% oversizing)
- Flexible -repositionable and retrievable
- No ventricular exclusions - indifferent to ventricular size or shape



87

VDYNE Early Feasibility Study



1st Vdyne EFS case
April 1st, 2024

88

Heterotopic Valve Implantation

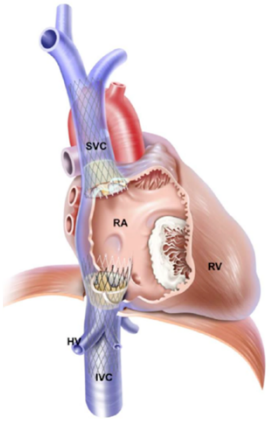
Indications

- Patients unsuitable for TEER/TTVR
- Large gaps, RV dysfunction, Pacer induced TR, large annulus size
- Advanced TV disease

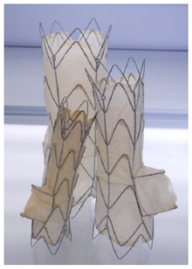
Challenges:

- Ventricularization of RA
- Large & variable SVC/IVC size may require custom-made devices
- Impact of severe RV failure on LV
- Worsening Cardiac Output
- Valve/Device Thrombosis
- Long-term anticoagulation
- Treatment effect durability

TricValve



NVT TriCento

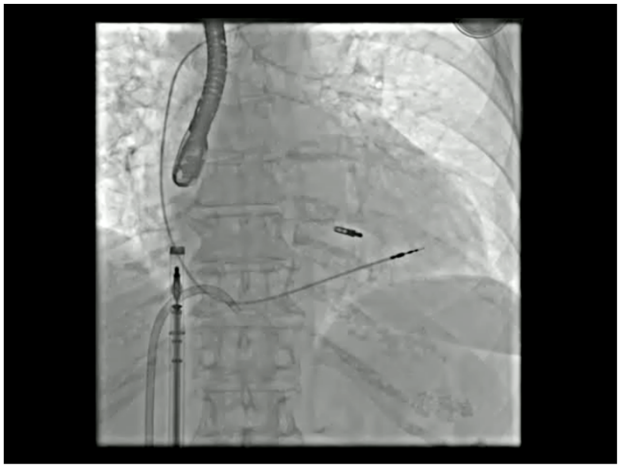


Trillium

Latib A. TVT 2022

89

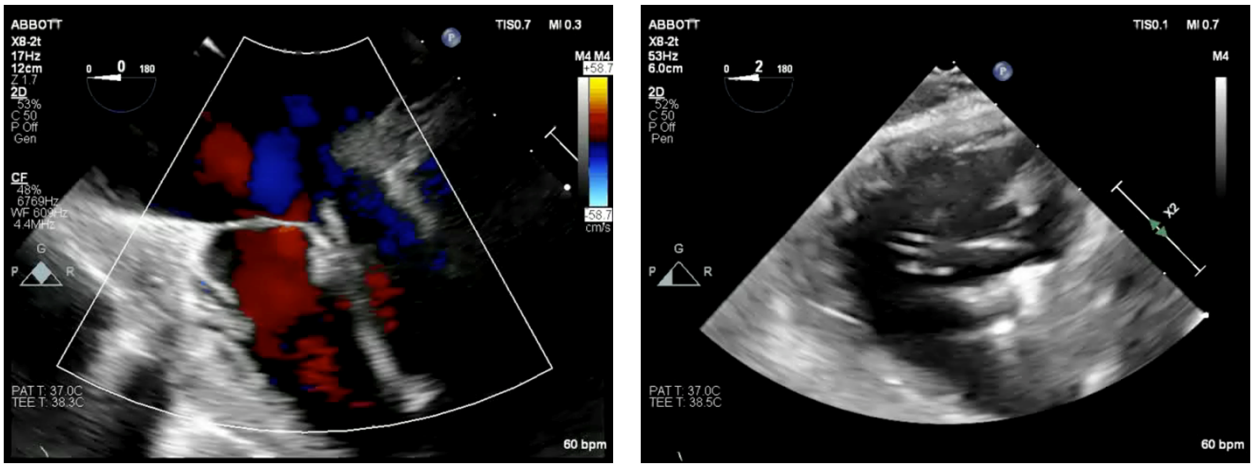
Pacer wire manipulation



GAPS	●
ANATOMY	●
LEADS	● → ●
IMAGING	●
OTHER	●

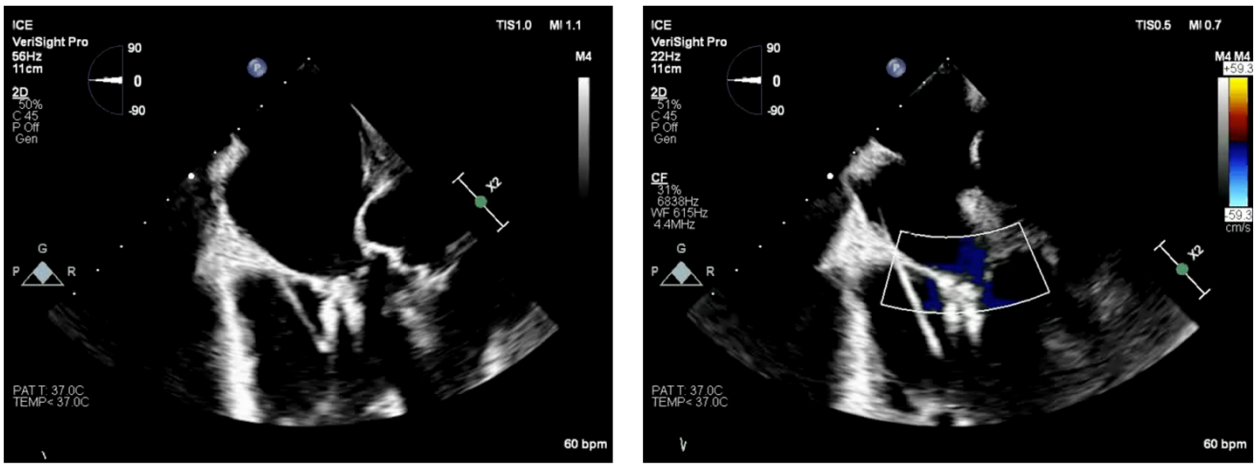
90

After 2nd Clip Deployment



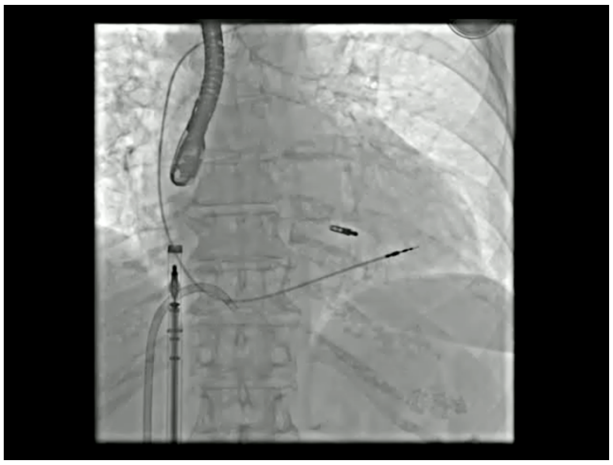
91

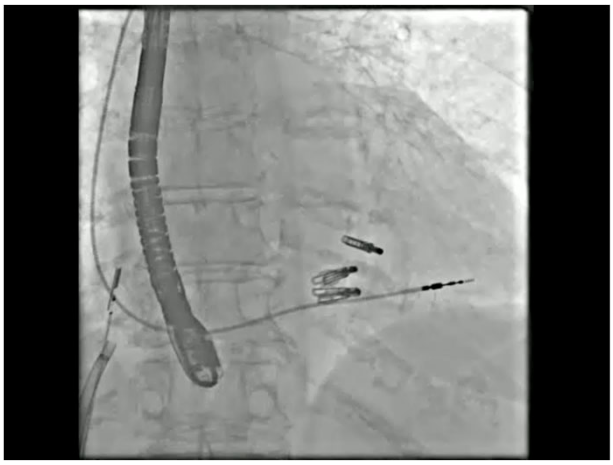
IntraCardiac Echocardiogram



92

Wire release





93

Key Points

- Valvular heart is frequent in aging population – increased complexity
- Surgery “not an option” – age, co-morbities, anatomical factors
- Transcatheter therapies have potential to provide options
- TMVR, TTVR are not TAVR (yet!)
- Improved imaging - ECHO, CT and MRI
- Improved devices respecting anatomy and minimizing interaction
- Multiple dedicated devices at various stages
- Many patients referred for clinical trials are currently excluded

94

Thank you!

Konstantinos.voudris@allina.com

@kvoudris

95