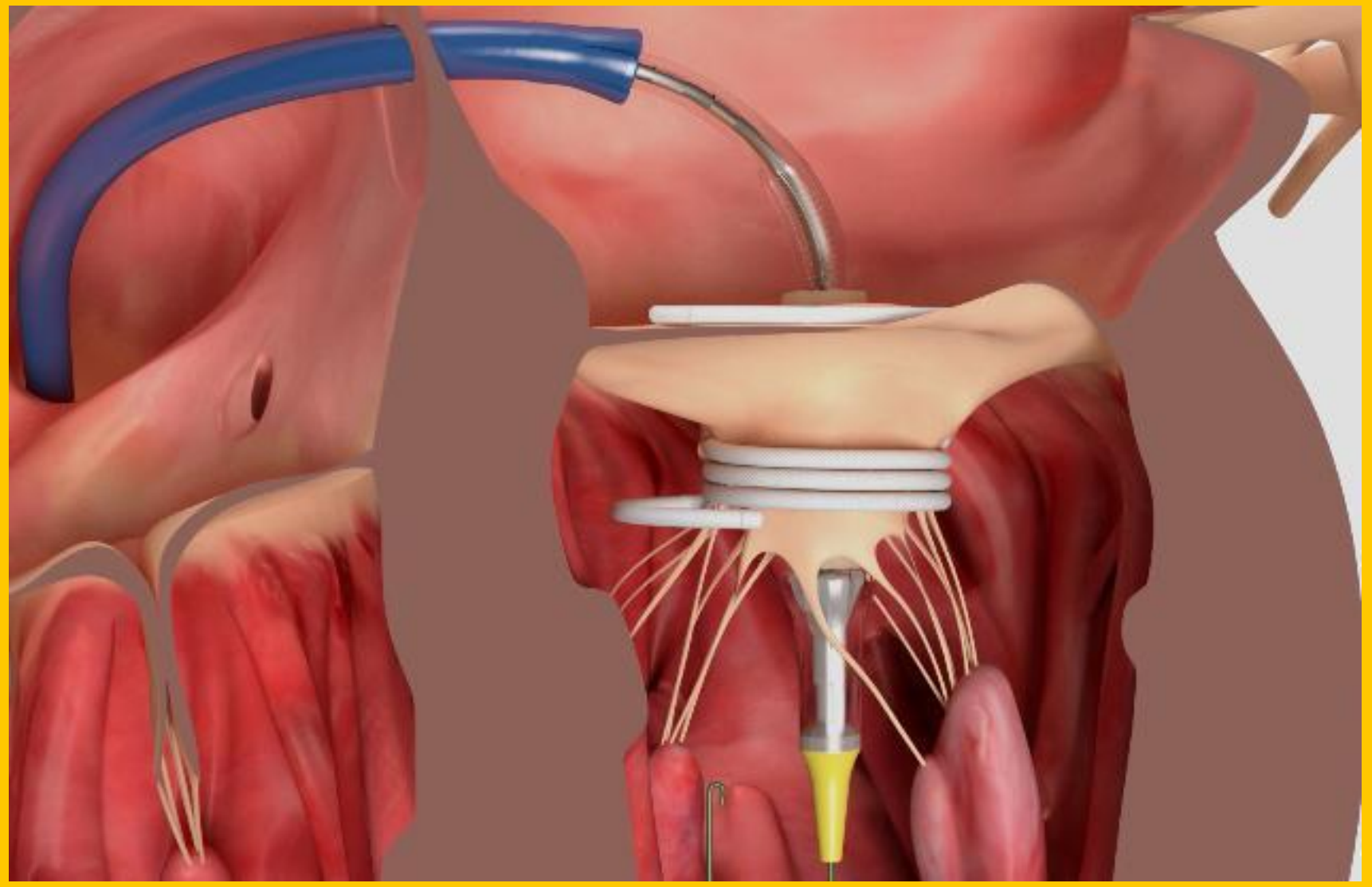


Structural Heart Disease Update 2022

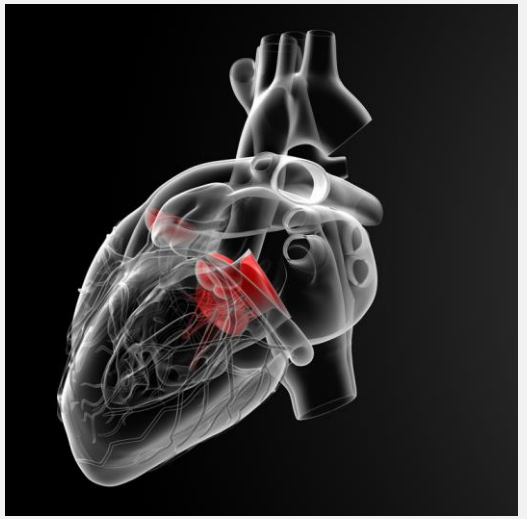
Joseph Tuma, MD

10-20-2022

MONUMENT HEALTH

OBJECTIVES

1. PROVIDE AN OVERVIEW OF CATHETER-BASED STRUCTURAL HEART PROCEDURES CURRENTLY BEING PERFORMED AT MONUMENT HEALTH RAPID CITY IN 2022
2. REVIEW IMPORTANT CLINICAL TRIALS
3. DISCUSS FUTURE DIRECTION OF STRUCTURAL HEART INTERVENTIONS



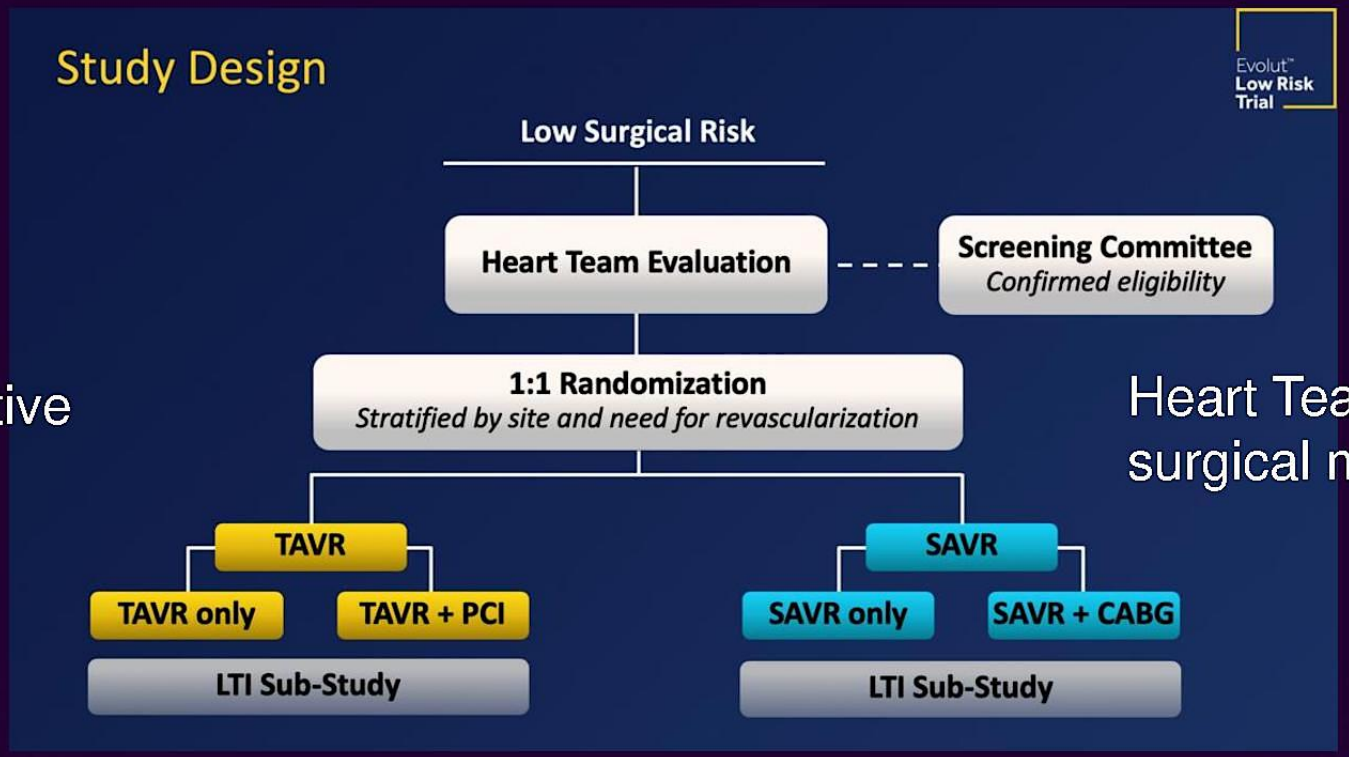
TAVR 2022

A Decade of Randomized Clinical Trials

	Balloon Expandable TAVR	Self-Expanding TAVR
Low Risk	ORIGINAL ARTICLE Transcatheter Aortic-Valve Replacement with a Balloon-Expandable Valve in Low-Risk Patients M.J. Mack, M.B. Leon, V.H. Thourani, R. Makkar, S.K. Kodali, M. Russo, S.R. Kapadia, S.C. Malaisrie, D.J. Cohen, P. Pibarot, J. Leipsic, R.T. Hahn, P. Blanke, M.R. Williams, J.M. McCabe, D.L. Brown, V. Babaliaros, S. Goldman, W.Y. Szeto, P. Genereux, A. Pershad, S.J. Pocock, M.C. Alu, J.G. Webb, and C.R. Smith, for the PARTNER 3 Investigators*	ORIGINAL ARTICLE Transcatheter Aortic-Valve Replacement with a Self-Expanding Valve in Low-Risk Patients Jeffrey J. Popma, M.D., G. Michael Deeb, M.D., Steven J. Yakubov, M.D., Mubashir Mumtaz, M.D., Hemal Gada, M.D., Daniel O'Hair, M.D., Tanvir Bajwa, M.D., John C. Heiser, M.D., William Merhi, D.O., Neal S. Kleiman, M.D., Judah Askew, M.D., Paul Sorajja, M.D., Joshua Rovin, M.D., Stanley J. Chetcuti, M.D., David H. Adams, M.D., Paul S. Teirstein, M.D., George L. Zorn, III, M.D., John K. Forrest, M.D., Didier Tchétché, M.D., Jon Resar, M.D., Antony Walton, M.D., Nicolo Piazza, M.D., Ph.D., Basel Ramlawi, M.D., Newell Robinson, M.D., George Petrossian, M.D., Thomas G. Gleason, M.D., Jae K. Oh, M.D., Michael J. Boulware, Ph.D., Hongyan Qiao, Ph.D., Andrew S. Mugglin, Ph.D., and Michael J. Reardon, M.D., for the Evolut Low Risk Trial Investigators*
Intermediate Risk	D. Craig Miller, M.D., Howard C. Herrmann, M.D., Darshan Doshi, M.D., David J. Cohen, M.D., Augusto D. Pichard, M.D., Samir Kapadia, M.D., Todd Dewey, M.D., Vasilis Babaliaros, M.D., Wilson Y. Szeto, M.D., Mathew R. Williams, M.D., Dean Kereiakes, M.D., Alan Zajarias, M.D., Kevin L. Greason, M.D., Brian K. Whisenant, M.D., Robert W. Hodson, M.D., Jeffrey W. Moses, M.D., Alfredo Trento, M.D., David L. Brown, M.D., William F. Fearon, M.D., Philippe Pibarot, D.V.M., Ph.D., Rebecca T. Hahn, M.D., Wael A. Jaber, M.D., William N. Anderson, Ph.D., Maria C. Alu, M.M., and John G. Webb, M.D., for the PARTNER 2 Investigators*	J. Heiser, R. Lange, W. Merhi, J.K. Oh, P.S. Olsen, N. Piazza, M. Williams, S. Windecker, S.J. Yakubov, E. Grube, R. Makkar, J.S. Lee, J. Conte, E. Vang, H. Nguyen, Y. Chang, A.S. Mugglin, P.W.J.C. Serruys, and A.P. Kappetein, for the SURTAVI Investigators*
High Risk	Craig R. Smith, M.D., Martin B. Leon, M.D., Michael J. Mack, M.D., D. Craig Miller, M.D., Jeffrey W. Moses, M.D., Lars G. Svensson, M.D., Ph.D., E. Murat Tuzcu, M.D., John G. Webb, M.D., Gregory P. Fontana, M.D., Raj R. Makkar, M.D., Mathew Williams, M.D., Todd Dewey, M.D., Samir Kapadia, M.D., Vasilis Babaliaros, M.D., Vinod H. Thourani, M.D., Paul Corso, M.D., Augusto D. Pichard, M.D., Joseph E. Bavaria, M.D., Howard C. Herrmann, M.D., Jodi J. Akin, M.S., William N. Anderson, Ph.D., Duolao Wang, Ph.D., and Stuart J. Pocock, Ph.D., for the PARTNER Trial Investigators*	Neal S. Kleiman, M.D., Stan Chetcuti, M.D., John Heiser, M.D., William Merhi, D.O., George Zorn, M.D., Peter Tadros, M.D., Newell Robinson, M.D., George Petrossian, M.D., G. Chad Hughes, M.D., J. Kevin Harrison, M.D., John Conte, M.D., Brijeshwar Maini, M.D., Mubashir Mumtaz, M.D., Sharla Chenoweth, M.S., and Jae K. Oh, M.D., for the U.S. CoreValve Clinical Investigators*
Extreme Risk	Martin B. Leon, M.D., Craig R. Smith, M.D., Michael Mack, M.D., D. Craig Miller, M.D., Jeffrey W. Moses, M.D., Lars G. Svensson, M.D., Ph.D., E. Murat Tuzcu, M.D., John G. Webb, M.D., Gregory P. Fontana, M.D., Raj R. Makkar, M.D., David L. Brown, M.D., Peter C. Block, M.D., Robert A. Guyton, M.D., Augusto D. Pichard, M.D., Joseph E. Bavaria, M.D., Howard C. Herrmann, M.D., Pamela S. Douglas, M.D., John L. Petersen, M.D., Jodi J. Akin, M.S., William N. Anderson, Ph.D., Duolao Wang, Ph.D., and Stuart Pocock, Ph.D., for the PARTNER Trial Investigators*	Maurice Buchbinder, MD,§§ G. Michael Deeb, MD,‖‖ Blasé Carabello, MD,¶¶ Patrick W. Serruys, MD, PhD,## Sharla Chenoweth, MS,*** Jae K. Oh, MD,††† for the CoreValve United States Clinical Investigators *Boston, Massachusetts; New York, New York; Houston, Texas; Columbus, Ohio; Indianapolis, Indiana; Durham, North Carolina; Detroit and Ann Arbor, Michigan; Pittsburgh, Pennsylvania; Baltimore, Maryland; Palo Alto, California; Rotterdam, the Netherlands; and Minneapolis and Rochester, Minnesota*

EVOLUT LOW RISK TRIAL

Bayesian Adaptive Design



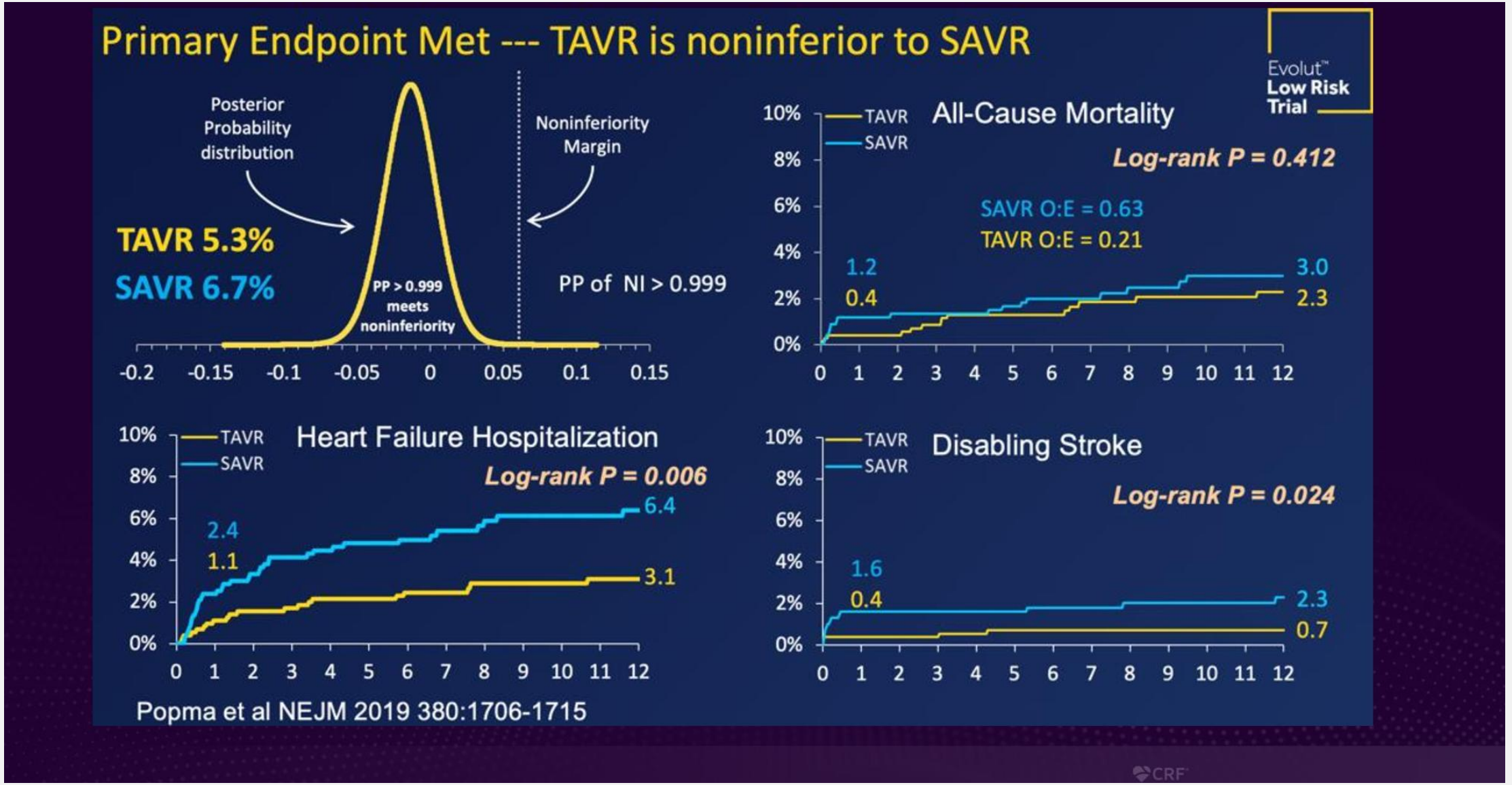
Heart Team < 3% 30-day surgical mortality risk

Primary End point: All-cause mortality / disabling stroke at 2 years

Popma JJ, Deeb GM, Yakubov SJ,... Reardon MJ; Evolut Low Risk Trial Investigators, Transcatheter Aortic-Valve Replacement with a Self-Expanding Valve in Low-Risk Patients. N Engl J Med. 2019 May 2;380(18):1706-1715.

CRF TCT CONNECT

EVOLUT LOW RISK TRIAL



EVOLUT LOW RISK TRIAL

LR RCT 30-Day Composite Safety Endpoint

Evolut™ Low Risk Trial

Bayesian rates as %	TAVR (N=725)	SAVR (N=678)	(95% BCI)
30-Day composite safety endpoint*	5.3	10.7	(-8.3, -2.6)
All-cause mortality	0.5	1.3	(-1.9, 0.2)
Disabling stroke*	0.5	1.7	(-2.4, -0.2)
Life-threatening or disabling bleeding*	2.4	7.5	(-7.5, -2.9)
Acute kidney injury, stage 2-3*	0.9	2.8	(-3.4, -0.5)
Major vascular complication	3.8	3.2	(-1.4, 2.5)
Atrial fibrillation*	7.7	35.4	(-31.8, -23.6)
Permanent pacemaker implant*	17.4	6.1	(8.0, 14.7)
All-cause mortality or disabling stroke*	0.8	2.6	(-3.2, -0.5)
All stroke	3.4	3.4	(-1.9, 1.9)
Aortic valve reintervention	0.4	0.4	(-0.8, 0.7)

* Significantly favors TAVR; * Significantly favors SAVR

BCI = Bayesian credible interval

Popma et al NEJM 2019 380:1706-1715

CRF

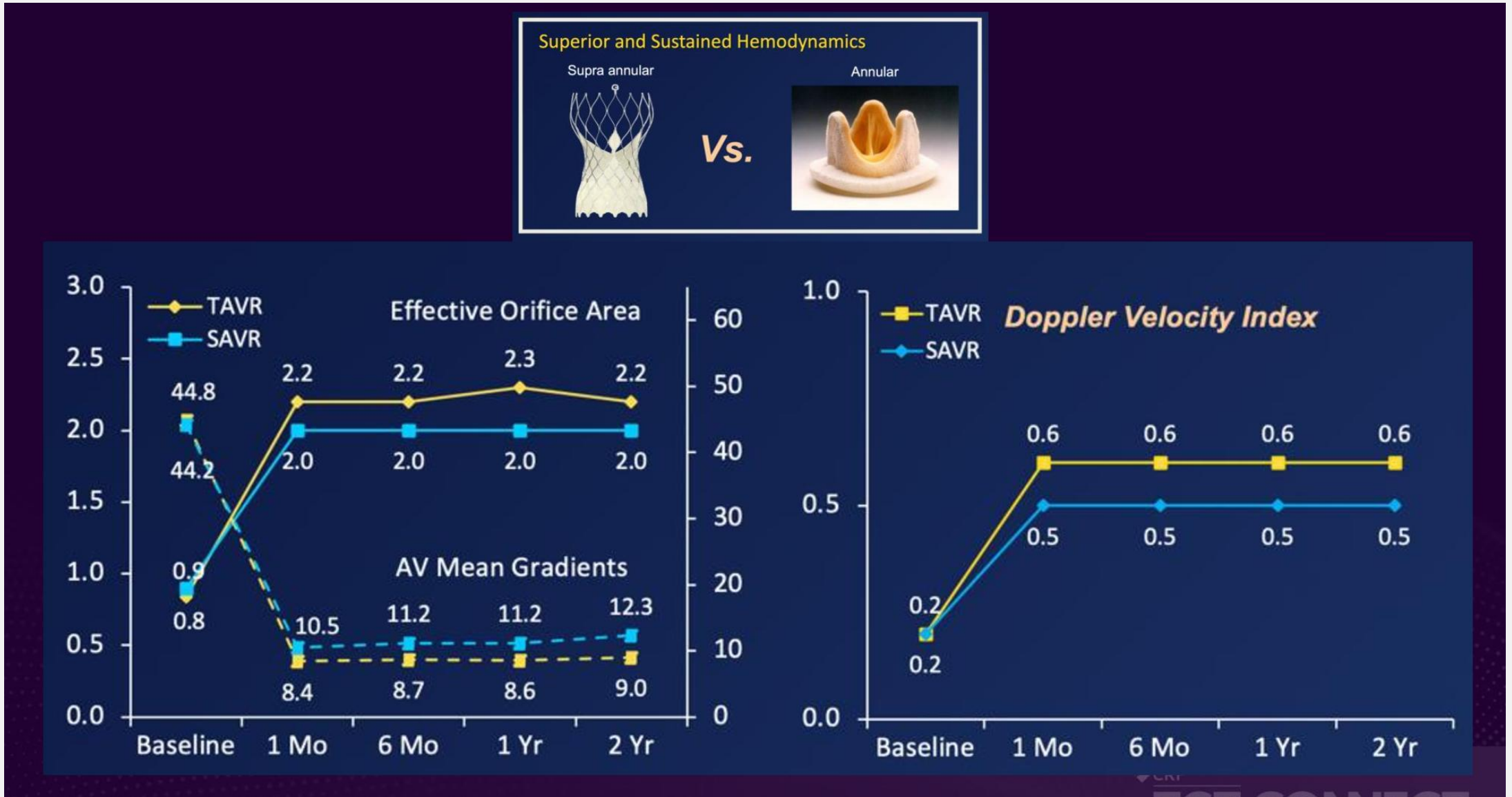
EVOLUT LOW RISK TRIAL

All Hierarchical Secondary Endpoints Met

	TAVR	SAVR	Difference TAVR–SAVR	Posterior Probability
Noninferiority (margin)			(90% BCI)	
Mean gradient at 12 months (5 mmHg)	8.6 ± 3.7	11.2 ± 4.9	-2.6 (-3.1, -2.1)	> 0.999 ✓
Mean EOA at 12 months (0.1 cm^2)	2.3 ± 0.7	2.0 ± 0.6	0.3 (0.2, 0.4)	> 0.999 ✓
Mean NYHA class change (12 months –Baseline) (0.375)	0.9 ± 0.7	1.0 ± 0.7	-0.1 (-0.2, 0.0)	> 0.999 ✓
Mean KCCQ change (12 months –Baseline) (5)	22.2 ± 20.3	20.9 ± 21.0	1.3 (-1.2, 3.8)	> 0.999 ✓
Superiority			(95% BCI)	
Mean gradient at 12 months, mmHg	8.6 ± 3.7	11.2 ± 4.9	-2.6 (-3.2, -2.0)	> 0.999 ✓
Mean EOA at 12 months, cm^2	2.3 ± 0.7	2.0 ± 0.6	0.3 (0.2, 0.4)	> 0.999 ✓
Mean KCCQ change (30 Days–Baseline)	20.0 ± 21.1	9.1 ± 22.3	10.9 (8.6, 13.2)	> 0.999 ✓

Popma et al NEJM 2019 380:1706-1715

EVOLUT LOW RISK TRIAL



EVOLUT LOW RISK TRIAL

JACC REVIEW TOPIC OF THE WEEK: POINT

Raising the Evidentiary Bar for Guideline Recommendations for TAVR

JACC Review Topic of the Week

Sanjay Kaul, MD

ABSTRACT

On August 16, 2019, the U.S. Food and Drug Administration approved expanding the indication for transcatheter aortic valve replacement (TAVR) to low-risk patients with symptomatic severe aortic stenosis. The decision was based on the results of 2 pivotal trials that confirmed superiority (PARTNER [Placement of Aortic Transcatheter Valve] 3) or noninferiority (Evolut Low Risk [LR]) of TAVR as compared with SAVR at 1- and 2-year follow-up, respectively. As compared with intermediate-risk cohorts, the sample size in these trials was smaller and the total number of primary endpoint events was nearly 3 times as low (193 vs. 615). The total number of deaths from any cause or disabling stroke at 1 year in the low-risk cohorts was 62, which is substantially lower than the numbers in intermediate-, high-, and inoperable-risk cohorts. In Evolut LR, only 137 of 1,403 patients (9.8%) completed the 2-year follow-up, with 91.2% requiring model-based imputation. Thus, the quantum of evidence is insufficient for endorsing TAVR as the preferred intervention for these patients. (J Am Coll Cardiol 2020;76:985-91) © 2020 by the American College of Cardiology Foundation.

Transcatheter aortic valve replacement (TAVR) has revolutionized the treatment of symptomatic aortic stenosis, offering a less invasive alternative to surgery. The 2017 American College of Cardiology/American Heart Association focused update on the valvular heart disease guideline recommends TAVR as Class I, Level of Evidence: (LOE) A therapy for symptomatic patients at high and prohibitive risk and as Class IIa, LOE: B therapy for symptomatic patients at intermediate risk (1). For patients who are at low risk, the guideline recommends surgical aortic valve replacement (SAVR) as the preferred therapy (Class I, LOE: B). TAVR is currently approved for patients who are inoperable or at high, intermediate, or low risk for SAVR based on the results of landmark randomized trials (Central Illustration). The expansion of the Food and Drug Administration-approved indication to low-risk patients (1), defined as a 30-day surgical mortality risk of <3% to 4%, was based on the results from 2 recently published pivotal trials (2,3). A previous randomized trial conducted in an all-comers patient population recruited from 3 Nordic countries (n = 2661, where 82% were considered low-risk patients, reported no difference in the primary composite outcome of death from any cause, stroke, or myocardial infarction at 1 year between TAVR using a CoreValve self-expanding bioprosthesis and SAVR (4). The PARTNER 3 trial confirmed superiority of the balloon-expandable SAPIEN 3 bioprosthesis (Edwards Lifesciences Corp., Irvine, California) over SAVR for the outcome of death, any stroke, or rehospitalization at 1 year (3). The Evolut Low Risk (LR) trial confirmed noninferiority of the self-expanding CoreValve (Medtronic, Minneapolis, Minnesota) or Evolut bioprostheses (Edwards Lifesciences) for the outcome

From the Department of Cardiology, Cedars-Sinai Medical Center, and the David Geffen School of Medicine, University of California, Los Angeles, California. Dr. Kaul has reported that he has no relationships relevant to the contents of this paper to disclose. The author attests that are in compliance with human studies committees and animal welfare regulations of the author's institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the JACC author instructions page.

Manuscript received May 4, 2020; accepted May 5, 2020.

https://doi.org/10.1016/j.jacc.2020.05.069

ISSN 0735-1097/$36.00

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Evolut LR
(STS 1.9, 30-day mortality 1.3%)

TAVR vs. SAVR

Benefit

- 24 disabling strokes prevented
- 34 HF hospitalizations prevented
- 57 fewer major bleeding events
- 19 fewer AKI events
- 285 fewer atrial fibrillation cases
- Superior functional capacity
- Shorter hospital stay
- Avoidance of sternotomy/bypass

Risk

- No excess major vascular AEs
- 314 excess mild PVR
- 126 excess pacemaker
- No excess valve thrombosis

Kaul S., Raising the Evidentiary Bar for Guideline Recommendations for TAVR: JACC Review Topic of the Week., J Am Coll Cardiol. 2020 Aug 25;76(8):985-991.

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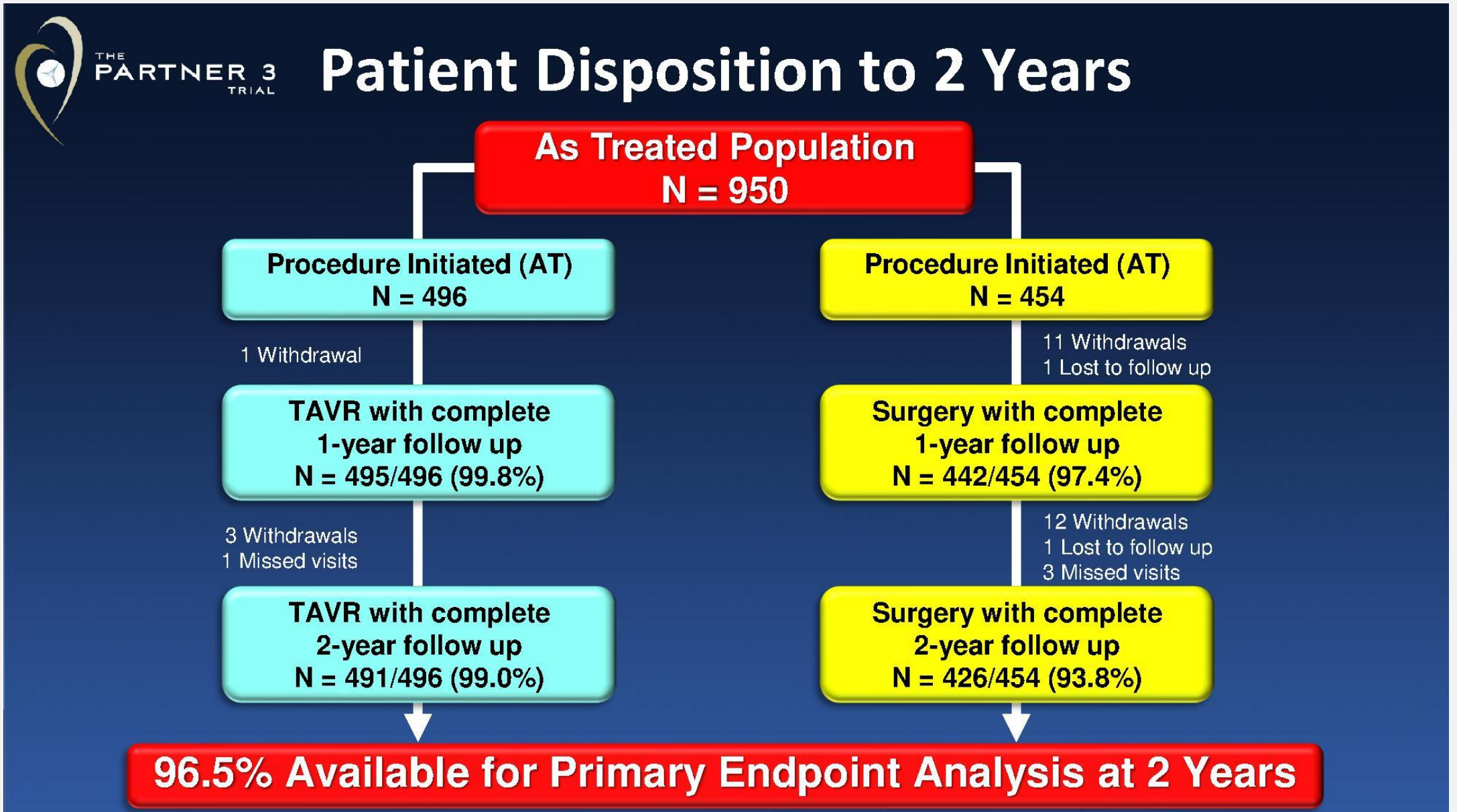
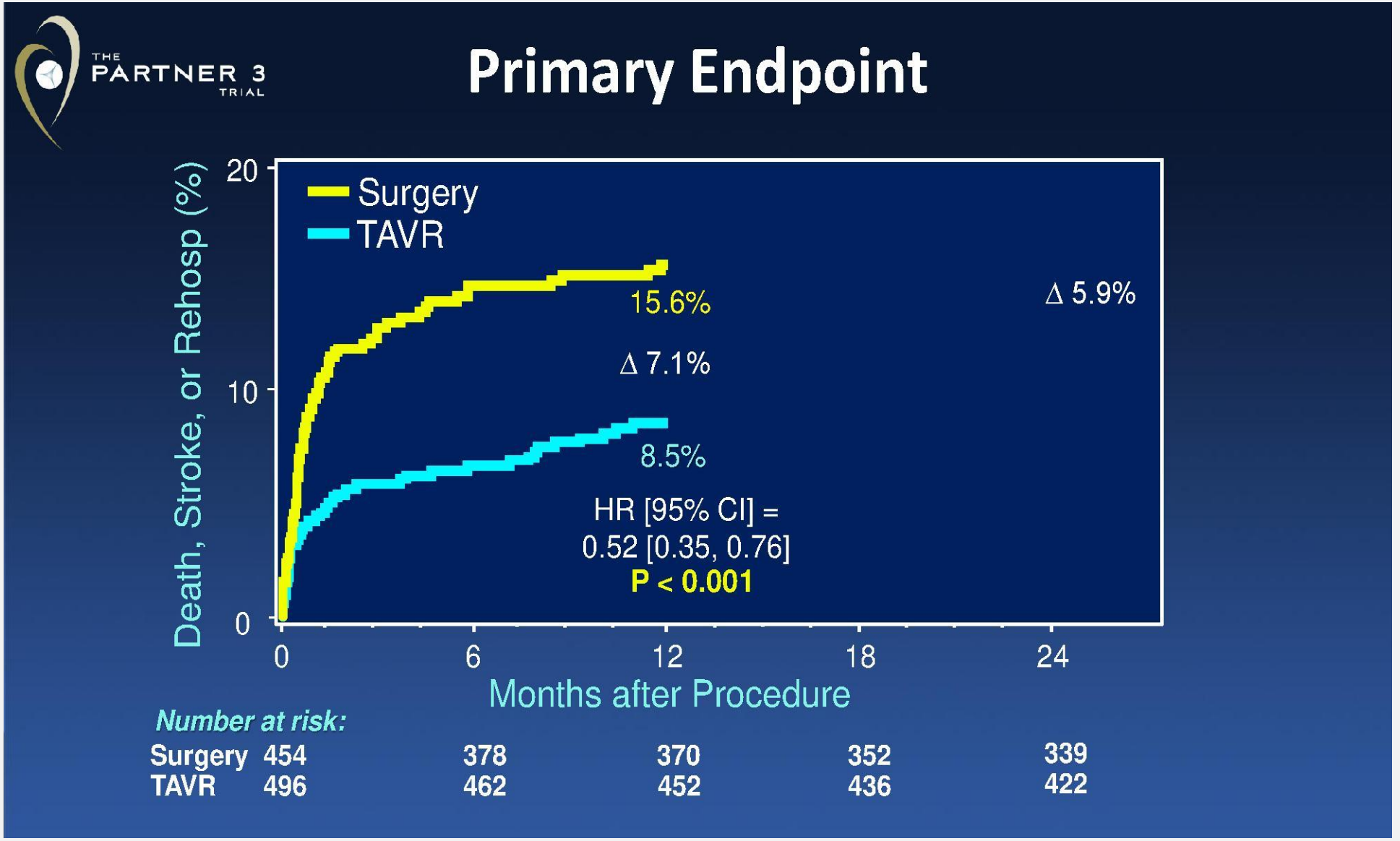
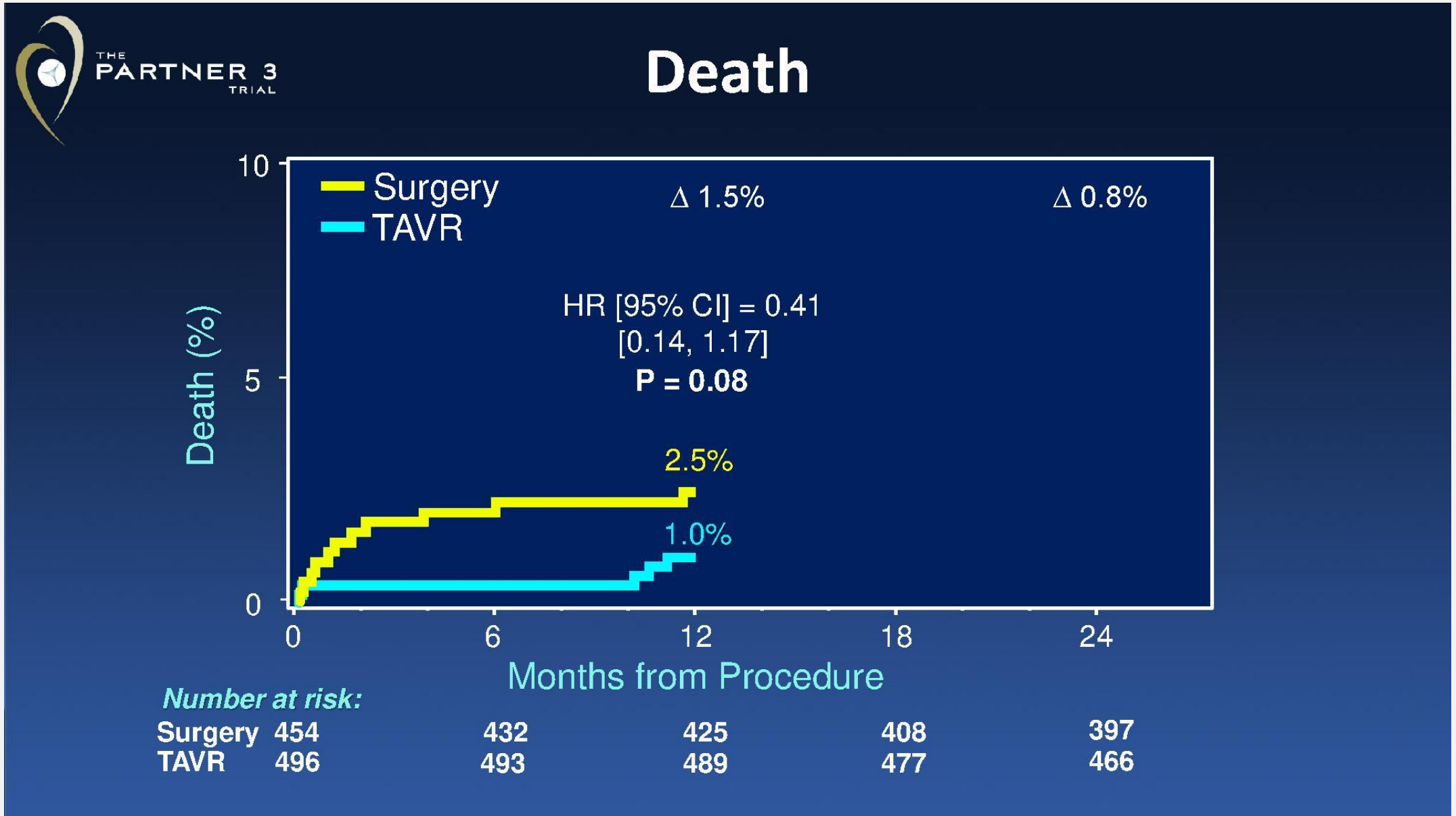
PARTNER 3 LOW RISK TRIAL



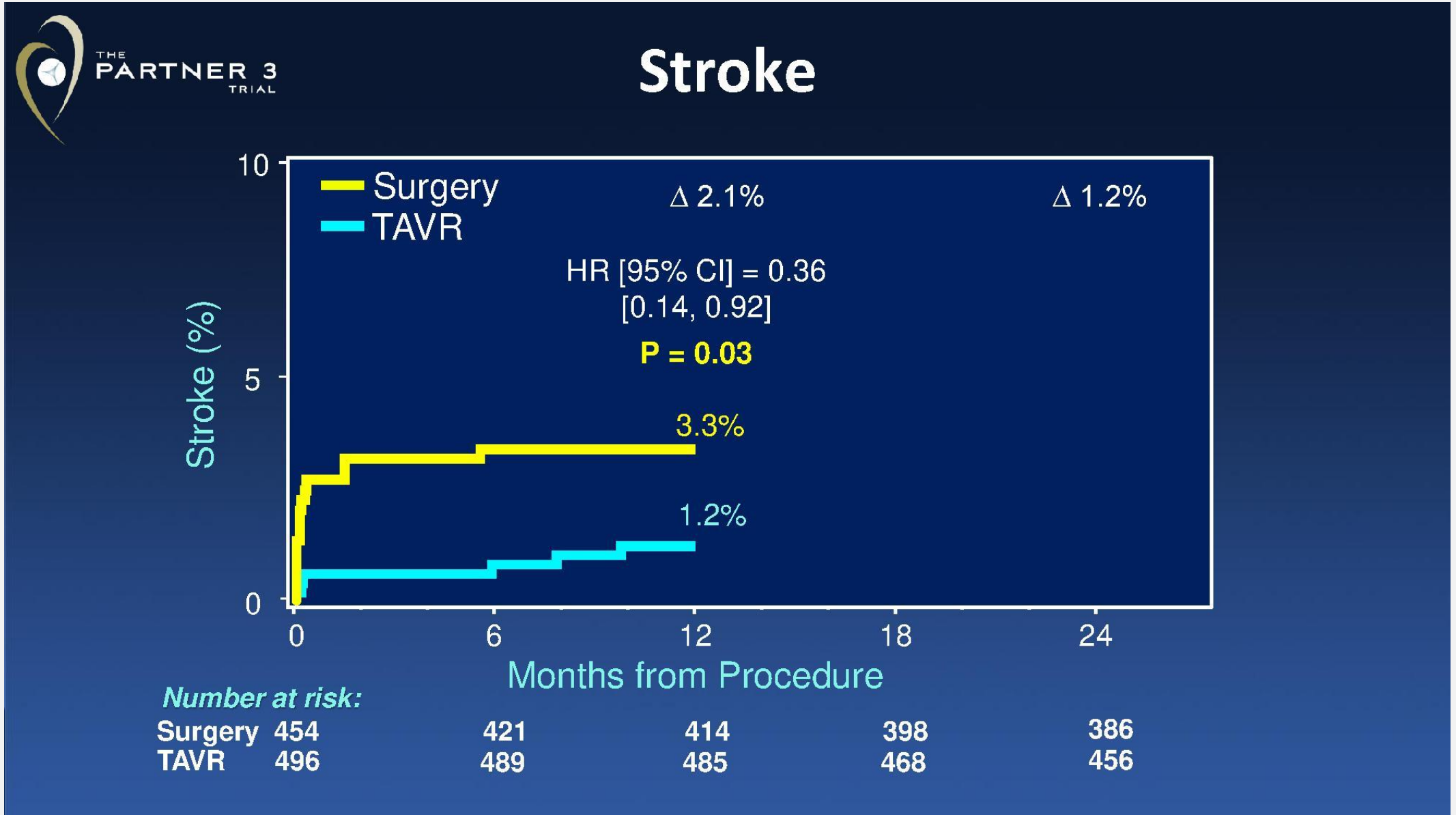
PARTNER 3 LOW RISK



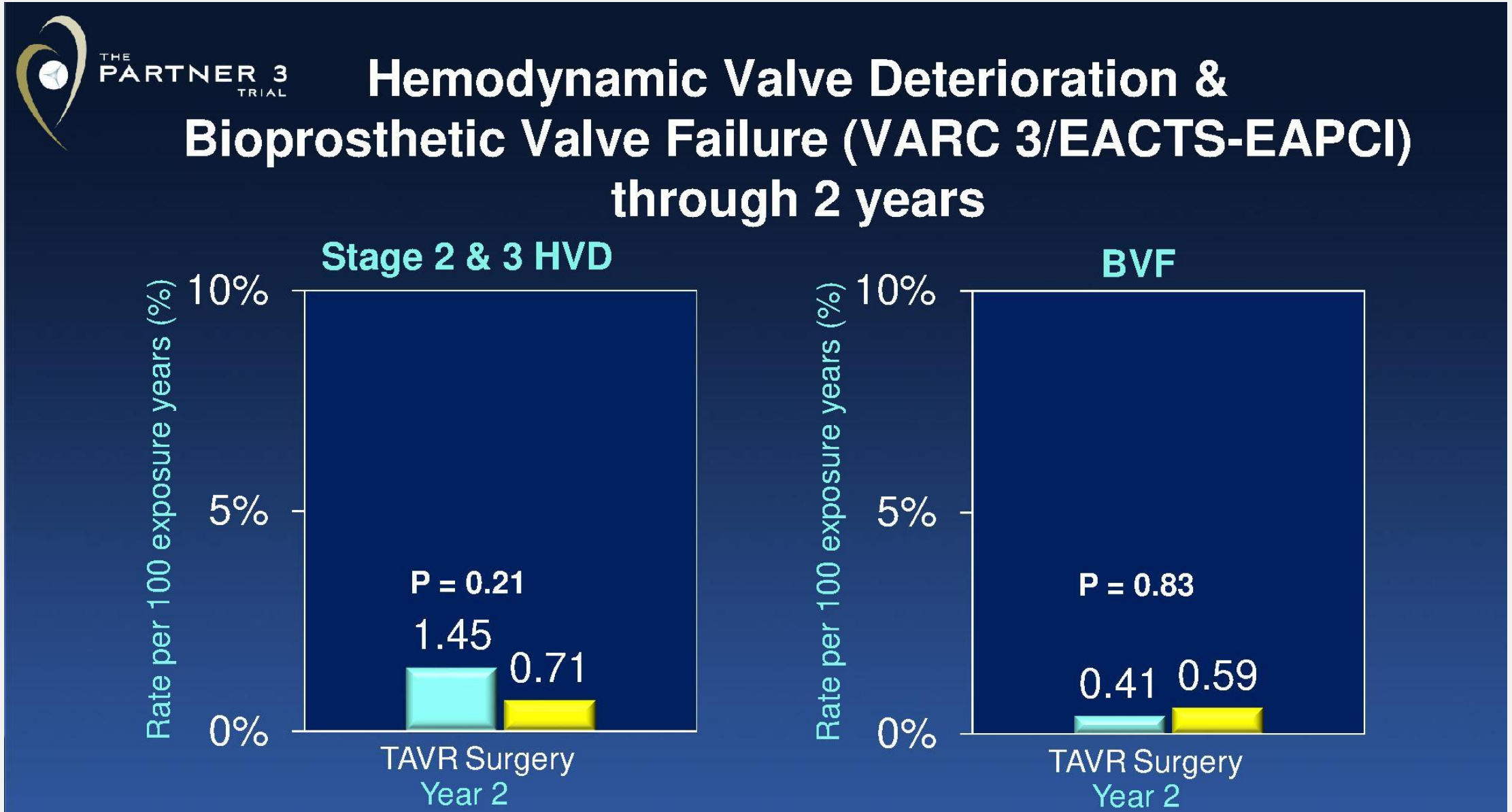
PARTNER LOW RISK TRIAL



PARTNER LOW RISK TRIAL



PARTNER LOW RISK TRIAL



SEVERE AS WITH NO SYMPTOMS: UPDATES FROM SURGICAL TRIALS, EARLY TAVR, AND EVOLVE

Opposing Approaches to Asymptomatic Severe Aortic Stenosis

Surveillance

- Guidelines recommend a strategy of conservative management if asymptomatic
  - AVR only if symptoms or LVEF decreases
- **Predicated on the assumption that risk of death with prognosis and long-term impact of asymptomatic SAS is negligible**

AVR

SEVERE AS WITH NO SYMPTOMS: UPDATES FROM SURGICAL TRIALS, EARLY TAVR, AND EVOLVE

Risk of Sudden Death in AS Patients

ORIGINAL RESEARCH

American Heart Association | American Stroke Association.

Sudden Death in Patients With Severe Aortic Stenosis: Observations From the CURRENT AS Registry

Tomohiko Taniguchi, MD; Takeshi Morimoto, MD, MPH; Hiroki Shiomi, MD; Kenji Ando, MD; Norio Kanamori, MD; Koichiro Murata, MD; Takeshi Kitai, MD; Yuichi Kawase, MD; Chisato Izumi, MD; Takao Kato, MD; Katsuhisa Ishii, MD; Kazuya Nagao, MD; Yoshihisa Nakagawa, MD; Mamoru Toyofuku, MD; Naritatsu Saito, MD; Kenji Minatoya, MD; Takeshi Kimura, MD; on behalf of the CURRENT AS Registry Investigators*

Background—The annual incidence of sudden death has been reported to be low (<1%/year) in asymptomatic patients with severe aortic stenosis (AS), and there is a paucity of data on the risk factors of sudden death in patients with severe AS.

Methods and Results—We evaluated the incidence and risk factors of sudden death during the median follow-up period of 1334 days in the Contemporary Outcomes After Surgery and Medical Treatment in Patients With Severe Aortic Stenosis (CURRENT AS) registry enrolling 3815 consecutive patients with severe AS between 2003 and 2011. The mean age was 78 years, and the prevalences of male sex and prior myocardial infarction were 38% and 8%, respectively. Sudden death occurred in 175 patients without aortic valve replacement. The cumulative 5-year incidences of sudden death, censored at aortic valve replacement, which accounted for the competing risk, were 9.2% in symptomatic patients and 7.2% (1.4%/year) in asymptomatic patients (P<0.001). Among 82 asymptomatic patients experiencing sudden death, 54 patients (66%) died abruptly without any preceding symptoms, and 35 (65%) of these sudden deaths occurred within 3 months of the last clinical follow-up visit. Independent risk factors for sudden death were hemodialysis (hazard ratio [HR] 3.63; 95% confidence interval [CI] 2.42-5.43), prior myocardial infarction (HR 2.11; 95% CI 1.28-3.50), body mass index <22 (HR 1.51; 95% CI 1.03-2.21), peak aortic jet velocity ≥5 m/s (HR 1.76; 95% CI 1.12-2.78), and left ventricular ejection fraction <60% (HR 1.52; 95% CI 1.08-2.14).

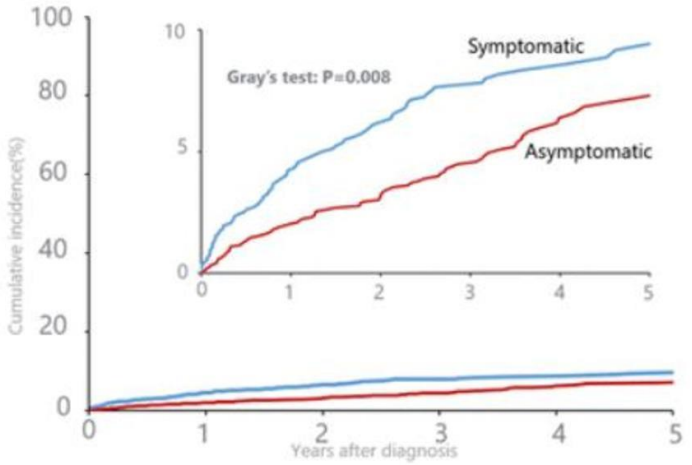
Conclusions—The incidence of sudden death in asymptomatic patients with severe AS might be higher than that reported in previous reports. Several baseline clinical and echocardiographic characteristics were associated with increased risk of sudden death.

Clinical Trial Registration—URL: www.umin.ac.jp/ctr/index.htm. Unique identifier: UMIN000012140. (***J Am Heart Assoc.* 2018;7:e008397. DOI: 10.1161/JAHA.117.008397.)**

Key Words: aortic stenosis • aortic valve replacement • sudden death

The **cumulative 5-year incidence of sudden death** was significantly higher in symptomatic patients than in asymptomatic patients (9.2% [N=93/2005] versus 7.2% [N=82/1808], P=0.008; 1.8%/year and 1.4%/year)

Sudden death
with censoring at AVR/TAVI



Interval	0d	30d	1y	3y	5y
Symptomatic group					
N of patients with at least 1 event		12	51	79	86
N of patients at risk	2005	1481	673	298	81
Cumulative incidence		0.6%	4.2%	7.7%	9.2%
Asymptomatic group					
N of patients with at least 1 event		3	30	59	75
N of patients at risk	1808	1673	1209	643	135
Cumulative incidence		0.2%	2.1%	5.1%	7.2%

Kaplan-Meier curves for sudden death: symptomatic and asymptomatic patients with severe after excluding 2 patients whose symptomatic status was not available. Cumulative incidence of sudden death was estimated by the Gray method, taking the competing risk of death other than sudden death. indicates aortic stenosis; aortic valve

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Opposing Approaches to Asymptomatic Severe Aortic Stenosis

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- Guidelines recommend a strategy of conservative management if asymptomatic
  - AVR only if symptoms or LVEF decreases
- **Predicated on the assumption that risk of death with prognosis and long-term impact of asymptomatic SAS is negligible**

AVR

- Concern for adverse outcomes (eg, irreversible myocardial changes, long-term morbidity, and sudden death)
- Improved outcomes after AVR
  - both TAVR and SAVR
- Under recognition of symptoms
  - Stress test are underutilized

SEVERE AS WITH NO SYMPTOMS: UPDATES FROM SURGICAL TRIALS, EARLY TAVR, AND EVOLVE

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JANUARY 9, 2020 VOL. 382 NO. 2

Early Surgery or Conservative Care for Asymptomatic Aortic Stenosis

Duk-Hyun Kang, M.D., Ph.D., Sung-Ji Park, M.D., Ph.D., Seung-Ah Lee, M.D., Sahmin Lee, M.D., Ph.D., Dae-Hee Kim, M.D., Ph.D., Hyung-Kwan Kim, M.D., Ph.D., Sung-Cheol Yun, Ph.D., Geu-Ru Hong, M.D., Ph.D., Jong-Min Song, M.D., Ph.D., Cheol-Hyun Chung, M.D., Ph.D., Jae-Kwan Song, M.D., Ph.D., Jae-Won Lee, M.D., Ph.D., and Seung-Woo Park, M.D., Ph.D.

RECOVERY TRIAL Very severe asymptomatic aortic stenosis were randomized in a 1:1 open-label fashion to either early surgical aortic valve replacement (AVR) (n = 73) or watchful waiting (n = 72).

- Total screened: 273
- Total number of enrollees: 145
- Duration of follow-up: 6.2 years
- Mean patient age: 64.2 years
- Percentage female: 51%

Inclusion criteria:

- Age 20-80 years
- Very severe aortic stenosis (aortic valve area [AVA] 0.75 cm2, peak velocity ≥4.5 m/sec, or mean gradient ≥50 mm Hg)
- Lack of symptoms

Exclusion criteria:

- Exertional dyspnea, syncope, presyncope, or angina
- LVEF <50%
- Clinically significant aortic regurgitation or mitral valve disease
- Prior cardiac surgery
- Positive cardiac stress test
- Medical conditions such as cancer

SEVERE AS WITH NO SYMPTOMS: UPDATES FROM SURGICAL TRIALS, EARLY TAVR, AND EVOLVE

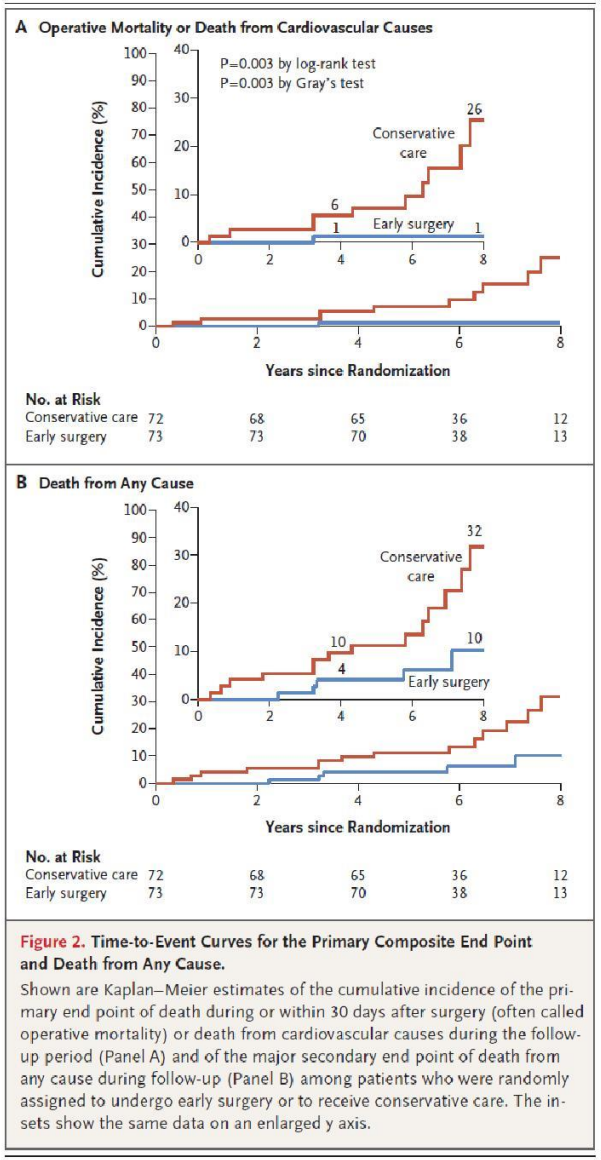


Figure 2. Time-to-Event Curves for the Primary Composite End Point and Death from Any Cause.

Shown are Kaplan–Meier estimates of the cumulative incidence of the primary end point of death during or within 30 days after surgery (often called operative mortality) or death from cardiovascular causes during the follow-up period (Panel A) and of the major secondary end point of death from any cause during follow-up (Panel B) among patients who were randomly assigned to undergo early surgery or to receive conservative care. The insets show the same data on an enlarged y axis.

Table 2. Primary and Secondary End Points.

Outcome	Conservative Care (N=72)	Early Surgery (N=73)	Hazard Ratio (95% CI)*
	number (percent)		
Primary end point: operative mortality or death from cardiovascular causes during follow-up†	11 (15)	1 (1)	0.09 (0.01–0.67)‡
Secondary end points			
Death from any cause	15 (21)	5 (7)	0.33 (0.12–0.90)§
Clinical thromboembolic event	4 (6)	1 (1)	0.30 (0.04–2.31)§
Stroke	3	1	
Myocardial infarction	1	0	
Repeat aortic-valve surgery	2 (3)	0	0.19 (0.10–8.00)§
Hospitalization for heart failure	8 (11)	0	0.05 (0.00–1.05)§

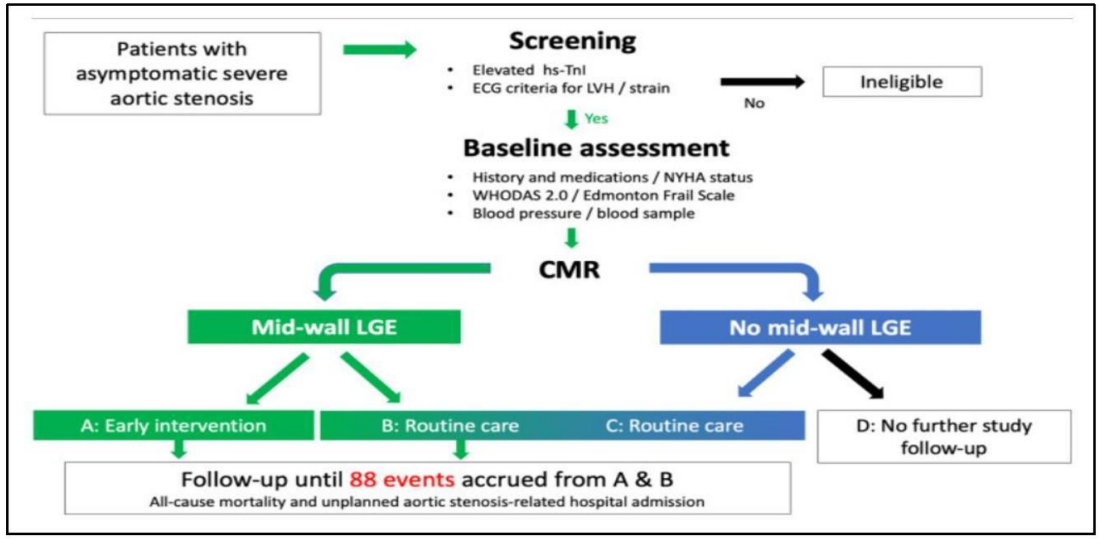
* The 95% confidence intervals have not been adjusted for multiple comparisons, and therefore inferences drawn from these intervals may not be reproducible.
† Operative mortality was defined as death during or within 30 days after surgery.
‡ This hazard ratio was calculated with the use of a Fine and Gray competing-risks analysis.
§ This hazard ratio was calculated with the use of stratified Cox proportional-hazards models with Firth correction.

Conclusions: After median follow up of 6 years, the RECOVERY trial (Randomized Comparison of Early Surgery versus Conventional Treatment in Very Severe Aortic Stenosis) reported a marked reduction among those randomized to early surgical AVR in a **composite of all-cause-death within 30 days of surgery, or cardiovascular death at any time.** (hazard ratio, 0.09 (95% CI, 0.01-0.67]: P = 0.003).

N Engl J Med 2020;382:111-9.
DOI: 10.1056/NEJMoa1912846

SEVERE AS WITH NO SYMPTOMS: UPDATES FROM SURGICAL TRIALS, EARLY TAVR, AND EVOLVE

Early Valve Replacement Guided by Biomarkers of Left Ventricular Decompensation in Asymptomatic Patients with Severe Aortic Stenosis (EVOLVED) trial



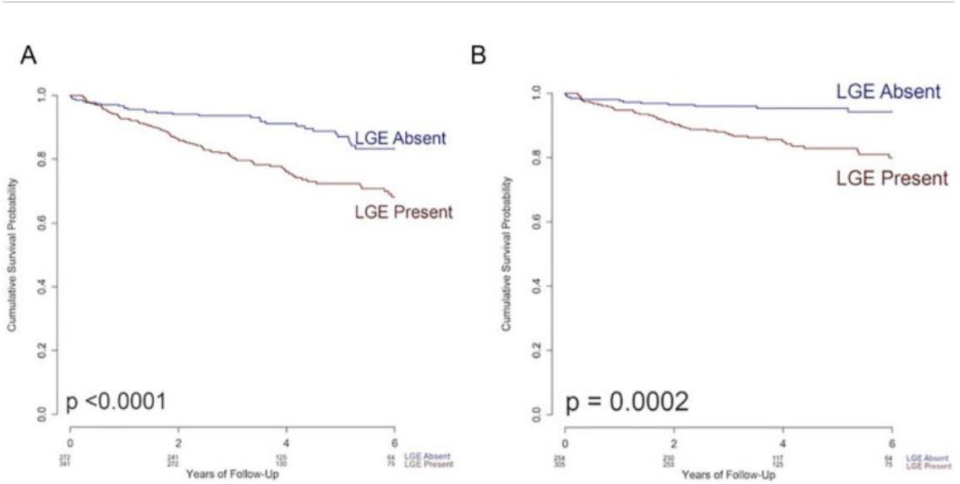


Figure 2. Late gadolinium enhancement and all-cause and cardiovascular mortality.

Kaplan-Meier curves demonstrating the association between late gadolinium enhancement on cardiac magnetic resonance and all-cause (**A**) and cardiovascular (**B**) mortality in patients with severe AS. Figures from Musa et al.[21]

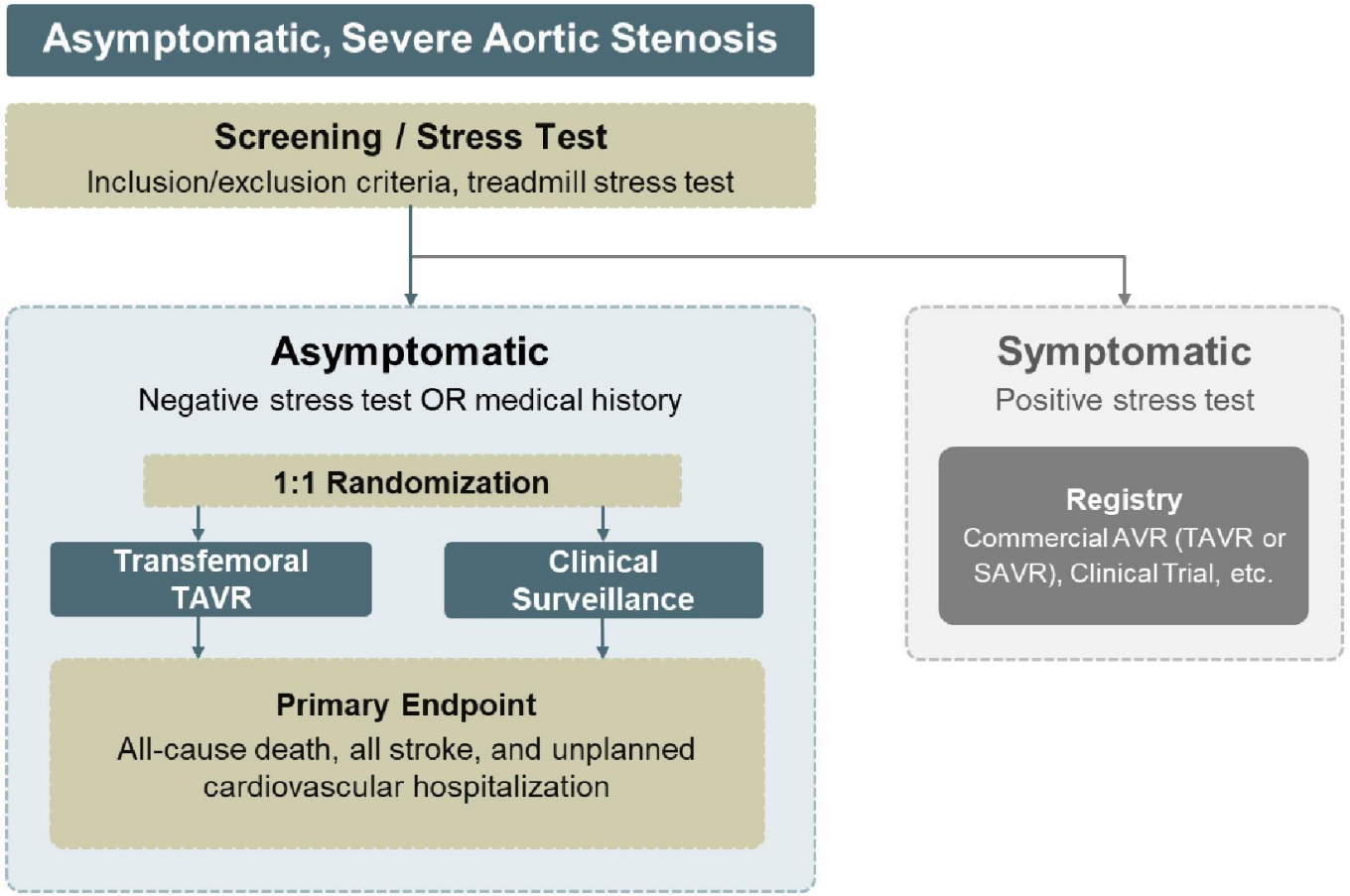
The EVOLVED trial is the first multicenter randomized controlled trial to compare early aortic valve replacement to routine care in asymptomatic patients with severe aortic stenosis and midwall LGE.

Late gadolinium enhancement (LGE) on cardiac MRI

- allows **direct imaging of replacement myocardial fibrosis**, which occurs in a midwall (nonischemic) distribution in AS (not from prior MI)
- is an **independent predictor of mortality** in patients with AS; this has been a consistent finding in multiple separate cohorts and multicenter studies.
- Once established, replacement fibrosis progresses rapidly and **does not regress** after AVR.
- proportionate effect on clinical outcomes has been demonstrated: **the more LGE, the worse the long-term prognosis**.
- midwall LGE as an early marker of LV decompensation that **can be used to trigger AVR** in patients with asymptomatic severe AS.

SEVERE AS WITH NO SYMPTOMS: UPDATES FROM SURGICAL TRIALS, EARLY TAVR, AND EVOLVE

EARLY TAVR Study Flow



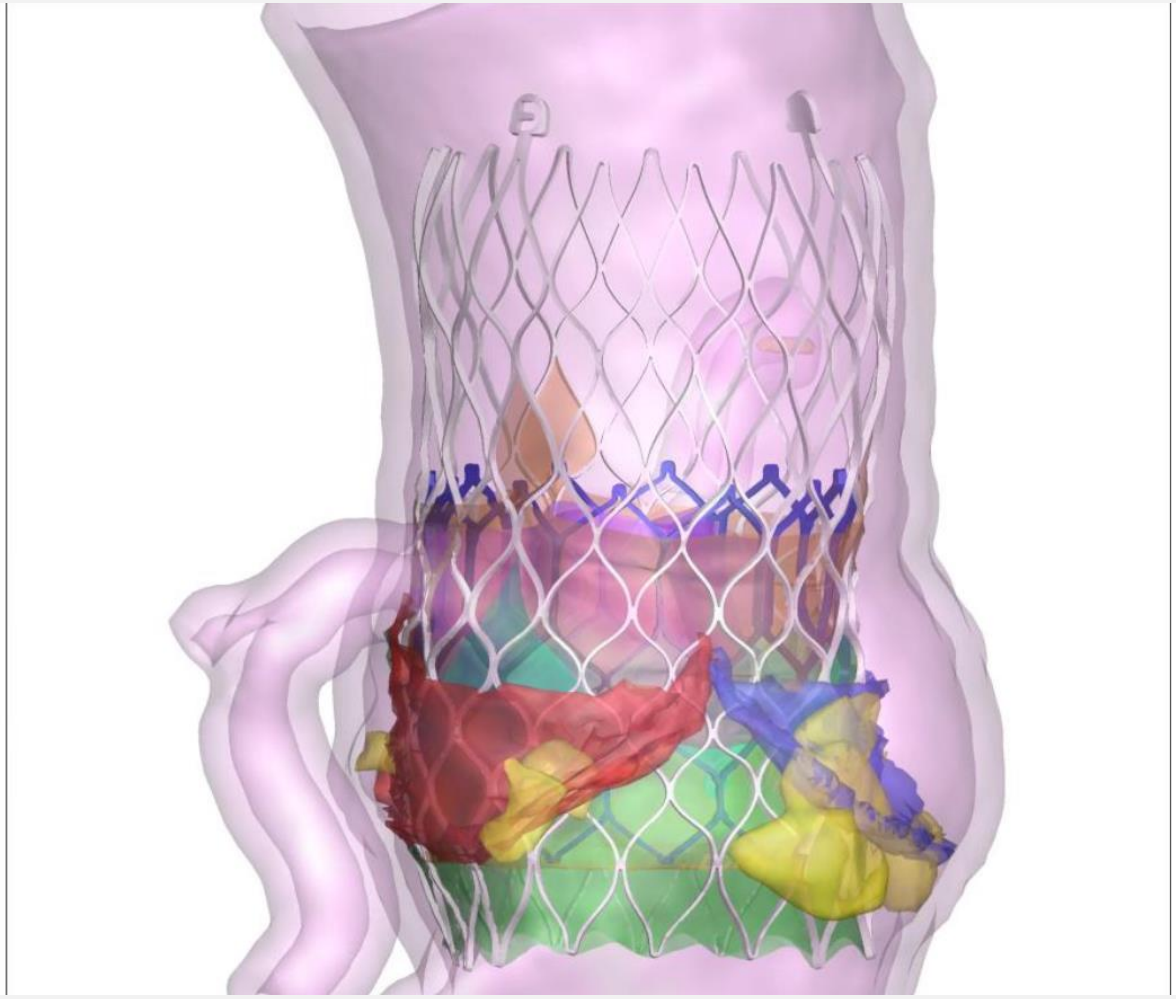
EXPAND TAVR II TRIAL

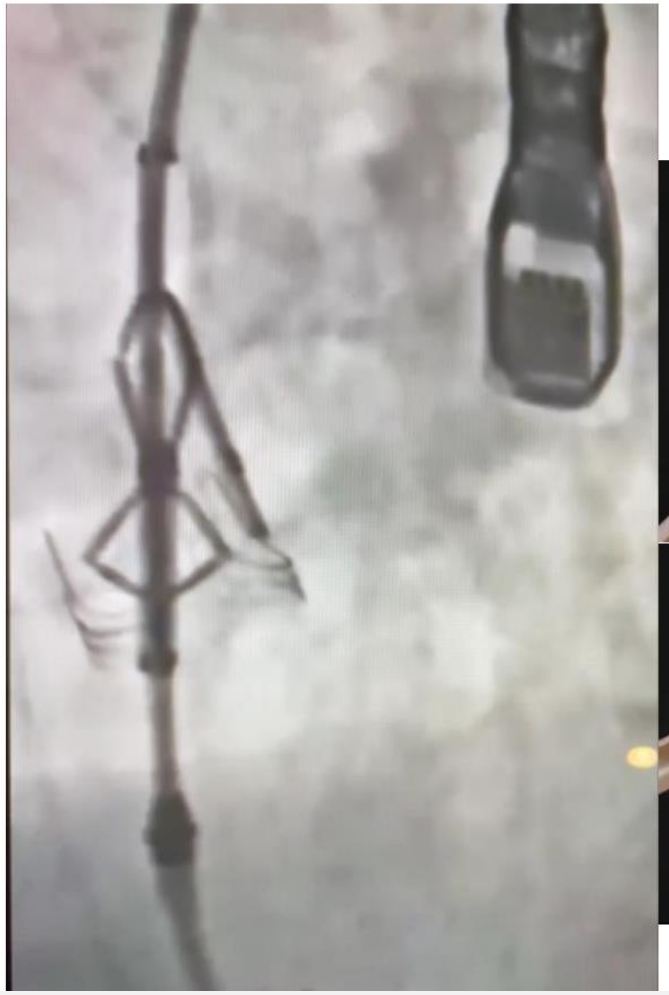
-The EXPAND TAVR II Pivotal Trial is a multi-center, prospective trial conducted in the U.S., Canada, Japan, Australia, and New Zealand.

-This global trial will evaluate the safety and effectiveness of the Medtronic Evolut PRO+ TAVR System and guideline-directed management and therapy (GDMT) compared to GDMT alone in the moderate, symptomatic aortic stenosis patient population. The data may be used to support future regulatory submissions to expand the current indications for the Evolut TAVR platform.

-Monument Health selected as one of the 50 US sites for this trial

TAVR IN TAVR WITH BASILICA





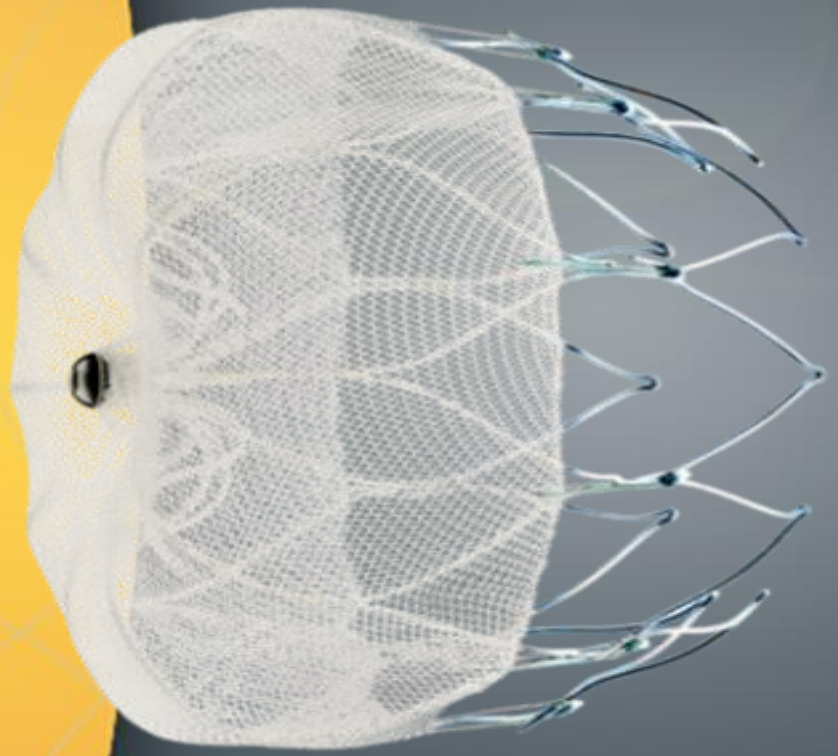
TAVR PATIENT #7
5/2015

(PHOTO SHOWN WITH PATIENTS' PERMISSION)

LEFT ATRIAL APPENDAGE OCCLUSION

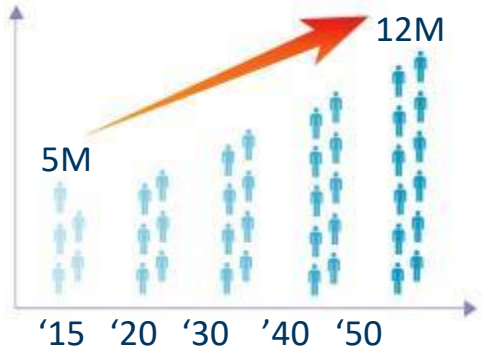
Boston Scientific

Non-Valvular Atrial Fibrillation (NVAF), Stroke, and Current Treatment Options



AF IS A GROWING PROBLEM ASSOCIATED WITH GREATER MORBIDITY AND MORTALITY

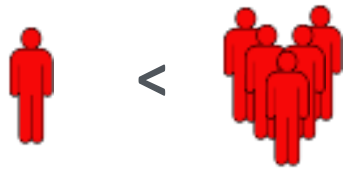
AF = most common cardiac arrhythmia, and growing



~5 M

people with AF in U.S., expected to more than double by 2050[1]

AF increases risk of stroke



5x

greater risk of stroke with AF[2]

- Higher stroke risk for older patients and those with prior stroke or TIA
- 15-20% of all strokes are AF-related
- AF results in greater disability compared to non-AF-related stroke

AF-RELATED STROKES ARE DEBILITATING

WATCHMAN™
LEFT ATRIAL APPENDAGE
CLOSURE DEVICE

Stroke

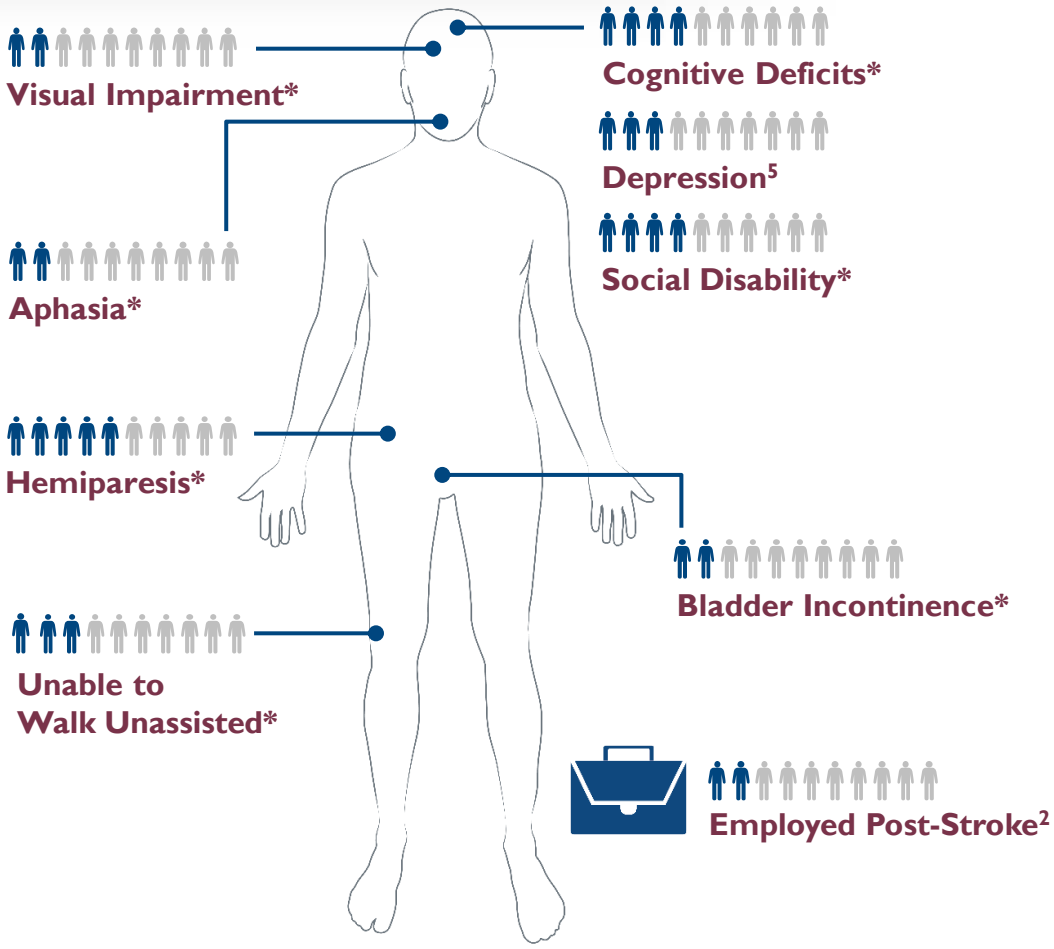
#1 cause of **adult disability** worldwide[1]

AF-related Stroke

1.5X higher **disability**[3**]

2X higher **mortality**[3**]

70% result in **death or permanent disability**[6]



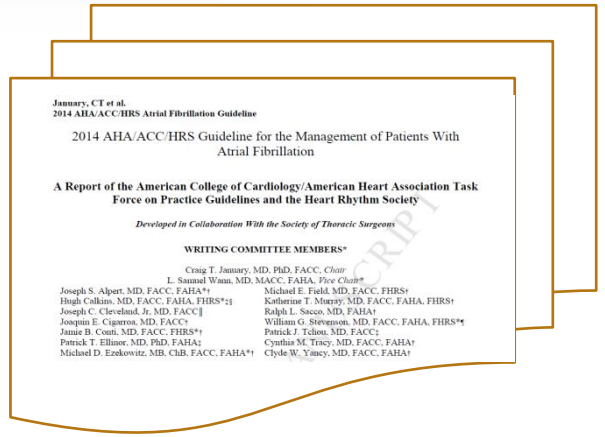
*at 6 months post-stroke[4]

**compared with stroke patients without AF

[1]Chee and Tan. *Med J Malaysia* 69.3 (2014): 119-23. [2]Sreedharan et al. *Journ of the neurological sciences* 332.1 (2013): 97-101. [3]Lamassa et al. *Stroke* 32.2 (2001): 392-398.[4]Kelly-Hayes et al. *Journ of Stroke and Cerebrovascular Diseases* 12.3 (2003): 119-126. [5]Loo and Gan. *International Journ of Stroke* 7.2 (2012): 165-167. [6]Holmes DR, *Seminars in Neurology* 2010;30:528–536.

2014 ACC/AHA/HRS TREATMENT GUIDELINES TO PREVENT THROMBOEMBOLISM IN PATIENTS WITH AF

- Assess stroke risk with CHA_2DS_2-VASc score
  - Score 1: Annual stroke risk 1%, oral anticoagulants or aspirin may be considered
  - Score ≥2: Annual stroke risk 2%-15%, **oral anticoagulants are recommended**


January, CT et al.
2014 AHA/ACC/HRS Atrial Fibrillation Guideline

2014 AHA/ACC/HRS Guideline for the Management of Patients With Atrial Fibrillation

A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and the Heart Rhythm Society

Developed in Collaboration With the Society of Thoracic Surgeons

WRITING COMMITTEE MEMBERS*

2014 AHA/ACC/HRS Guideline for the Management of Patients with AF

- **Balance stroke risk reduction benefit vs. bleeding risk**

CHA_2DS_2 VASc Score	Recommendation
0	No anticoagulant
1	Aspirin (81-325 mg daily) or warfarin (INR 2-3)
≥2	Oral anticoagulants are recommended (warfarin (INR 2-3), dabigatran, rivaroxaban or apixaban

January, CT. et al. 2014 AHA/ACC/HRS Guideline for the Management of Patients With Atrial Fibrillation. JACC. 2014; doi: 10.1016/j.jacc.2014.03.022

ANTICOAGULANT THERAPY CARRIES RISK OF INTRACEREBRAL HEMORRHAGE OR DEATH

VALIDATED SCORING SYSTEMS TO ASSESS STROKE RISKS

CHA_2DS_2VASc Score (Stroke Risk)[3]

	Condition	Points
C	Congestive heart failure	1
H	Hypertension (SBP>160)	1
A_2	Age ≥ 75 years	2
D	Diabetes mellitus	1
S_2	Prior stroke, TIA or thromboembolism	2
V	Vascular disease (PAD, MI)	1
A	Age 65-74 years	1
Sc	Sex category (Female)	1
	TOTAL POINTS	

Score	Yearly Stroke Risk (%)		
	No Warfarin	With Aspirin[2]	With Warfarin[2]
0	0	0	0
1	1.3	1.0	0.5
2	2.2	1.8	0.8
3	3.2	2.6	1.1
4	4.0	3.2	1.4
5	6.7	5.4	2.3
6	9.8	7.8	3.4

VALIDATED SCORING SYSTEMS TO ASSESS BLEEDING RISKS

WATCHMAN™
LEFT ATRIAL APPENDAGE
CLOSURE DEVICE

HAS-BLED Score (Bleeding risk with warfarin)[4]

	Condition	Points
H	Hypertension	1
A	Abnormal renal/liver function (1 pt each)	1 or 2
S	Hemorrhagic Stroke	1
B	Bleeding history or disposition	1
L	Labile INRs	1
E	Elderly [4]	1
D	Current drugs (medication) or alcohol use (1pt each)	1 or 2
	TOTAL POINTS	

Score	Yearly Major Bleeding Risk %
0	1.13
1	1.02
2	1.88
3	3.74
4	8.70
5+	Not well validated

DIFFICULT TO STRIKE BALANCE IN STROKE AND BLEEDING RISK

WATCHMAN™
LEFT ATRIAL APPENDAGE
CLOSURE DEVICE

CHA_2DS_2-VASc* Score	Annual % Stroke Risk
0	0
1	1.3
2	2.2
3	3.2
4	4.0
5	6.7

HAS-BLED** Score	Annual % Bleed Risk
0	0.9
1	3.4
2	4.1
3	5.8
4	8.9
5	9.1

* 2014 AHA / ACC / HRS Guidelines
** Lip. JACC (2011)

BLEEDING RISK INCREASES OVER PATIENTS' LIFETIME

WATCHMAN™
LEFT ATRIAL APPENDAGE
CLOSURE DEVICE

HAS-BLED Score	Annual % Bleed Risk*	10-Year Bleeding Risk (%)**
0	0.9	8.6
1	3.4	29.2
2	4.1	34.2
3	5.8	45.0
4	8.9	60.6
5	9.1	61.5

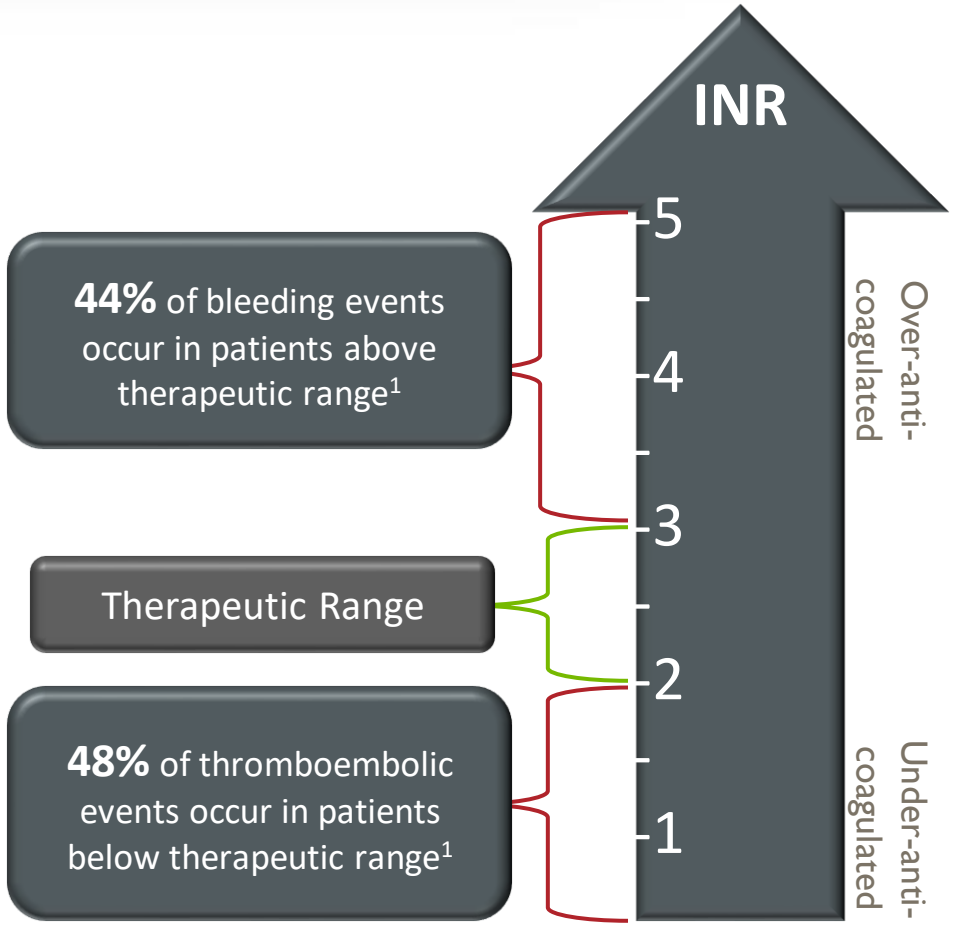
** Assumes constant risk despite increasing age and bleeding risk is independent from bleeding risk in previous years

STROKE TREATMENT OPTION: WARFARIN

WATCHMAN™
LEFT ATRIAL APPENDAGE
CLOSURE DEVICE

Warfarin is an effective means of stroke reduction in patients with AF but can present challenges

- Many patients spend a significant amount of time outside of the therapeutic range.
- Warfarin tops the list for emergency hospitalizations for adverse drug events in older Americans[2]



1 Oake N, et al. *Can Med Assoc J.* 2007:176(11);1589–1594
2 Budnitz, MD, MPH. et al. *Annals of Internal Medicine.* 2007:147(11); 229

ADHERENCE TO DOACS

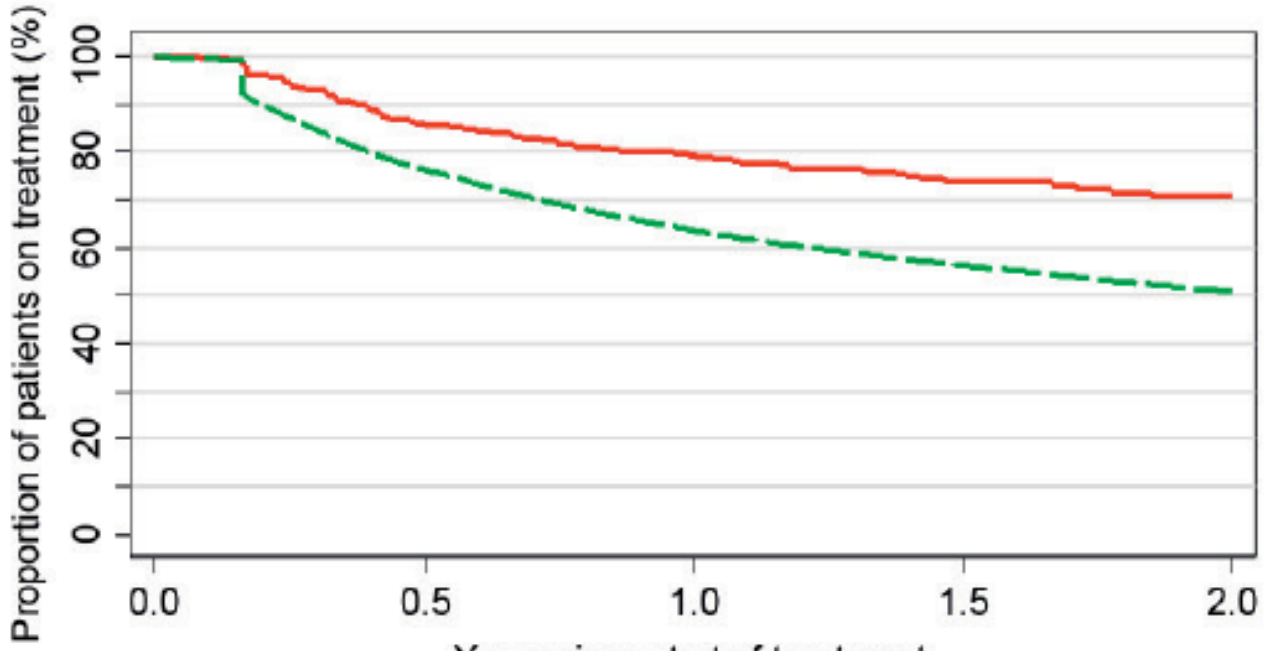
- A retrospective study of 64,661 patients found that only 47.5% of patients on DOACs had >80% adherence during a median follow-up period of 1.1 years
  - Apixaban: 52.1%
  - Rivaroxaban: 47.6%
  - Dabigatran: 45.9%

- DOAC adherence was higher than warfarin
  - Warfarin: 38.7%

Yao X. J Am Heart Assoc. 2016;5:e003074

DESPITE NOAC ADOPTION AND ABILITY TO SWITCH NOACS, ADHERENCE TO ANTICOAGULATION REMAINS A CHALLENGE

~30% of NOAC patients stop taking any drug at 2 years



NOAC	914	651	342	139	41
VKA	12307	8453	5762	3915	2506

Martinez C, et al. *Thromb Haemost.* 2015 Dec 22;115(1):31-9.

DOAC TRIALS
ADHERENCE AND BLEEDING ISSUES

Treatment	Study Drug Discontinuation Rate	Major Bleeding (rate/year)
Rivaroxaban[1]	24%	3.6%
Apixaban[2]	25%	2.1%
Dabigatran[3] (150 mg)	21%	3.3%
Edoxaban[4] (60 mg / 30 mg)	33 % / 34%	2.8% / 1.6%
Warfarin[1-4]	17 – 28%	3.1 – 3.6%

For those that remain adherent, there is an annual <u>compounding</u> bleeding risk

1Connolly, S. NEJM 2009; 361:1139-1151 – 2 yrs follow-up (Corrected) 2Patel, M. NEJM 2011; 365:883-891 – 1.9 yrs follow-up, ITT 3Granger, C NEJM 2011; 365:981-992 – 1.8 yrs follow-up, 4Giugliano, R. NEJM 2013; 369(22): 2093-2104 – 2.8 yrs follow-up.

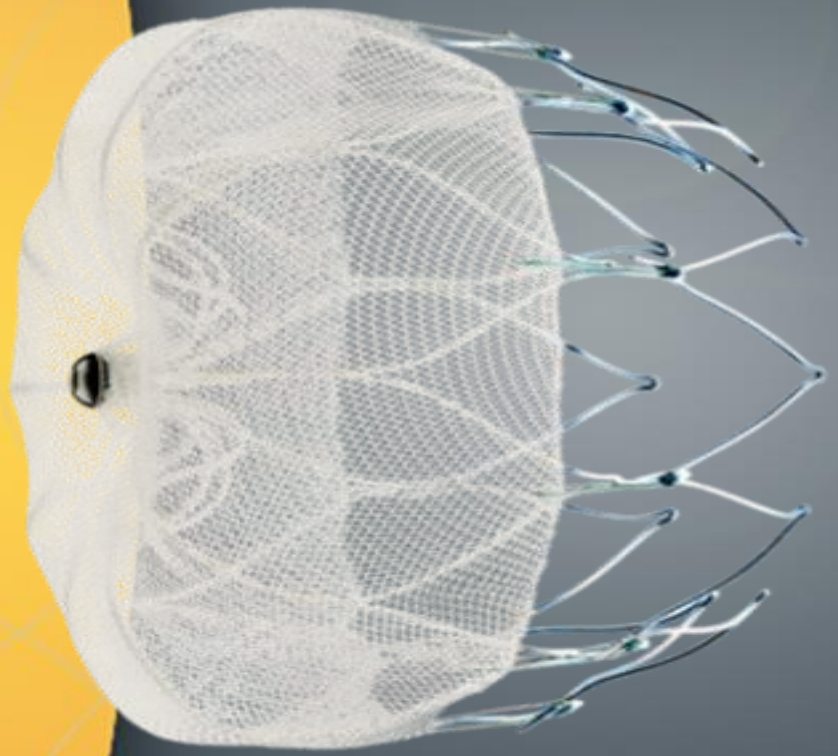
Results from different clinical investigations are not directly comparable.
Information provided for educational purposes only

NON-VALVULAR ATRIAL FIBRILLATION (NVAF), STROKE, AND CURRENT TREATMENT OPTIONS

WATCHMAN™
LEFT ATRIAL APPENDAGE
CLOSURE DEVICE

- AF is a Growing Problem Associated with Greater Morbidity and Mortality
  - 5x increased risk of stroke
  - 95% of clots formed in LA come from LAA
- Current treatments with warfarin or DNOACS are effective, but many patients stop taking the medications
  - ~1 in 4 patients discontinue blood thinners after 2 years
- Anti-coagulation bleeding risk compounds over time; may not be viable as a long-term solution for some patients

Left Atrial Appendage Closure (LAAC) with WATCHMAN



CONNECTION BETWEEN NVAF-RELATED STROKE AND THE LEFT ATRIAL APPENDAGE

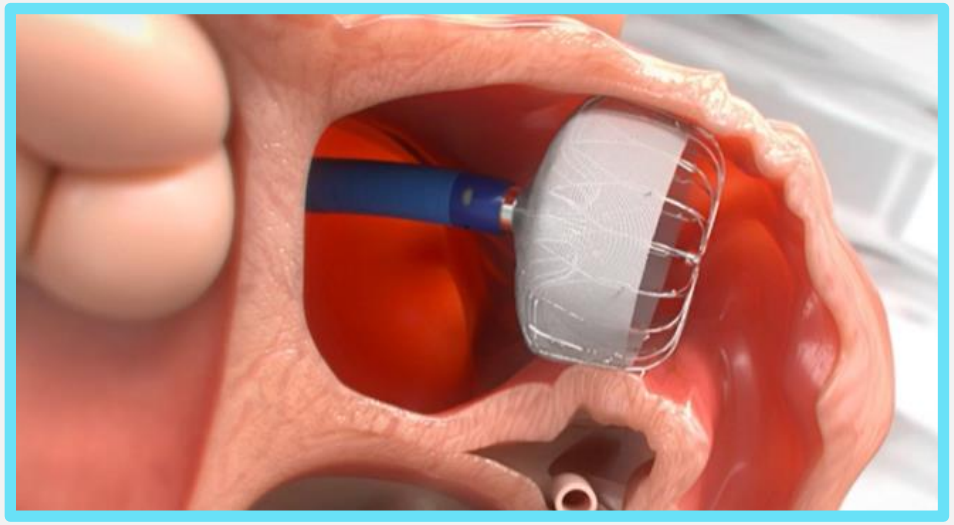
AF Creates Environment for Thrombus Formation in Left Atrium

- Stasis-related LA thrombus is a predictor of TIA[1] and ischemic stroke[2].
- In non-valvular AF, >90% of stroke-causing clots that come from the left atrium are formed in the LAA[3].

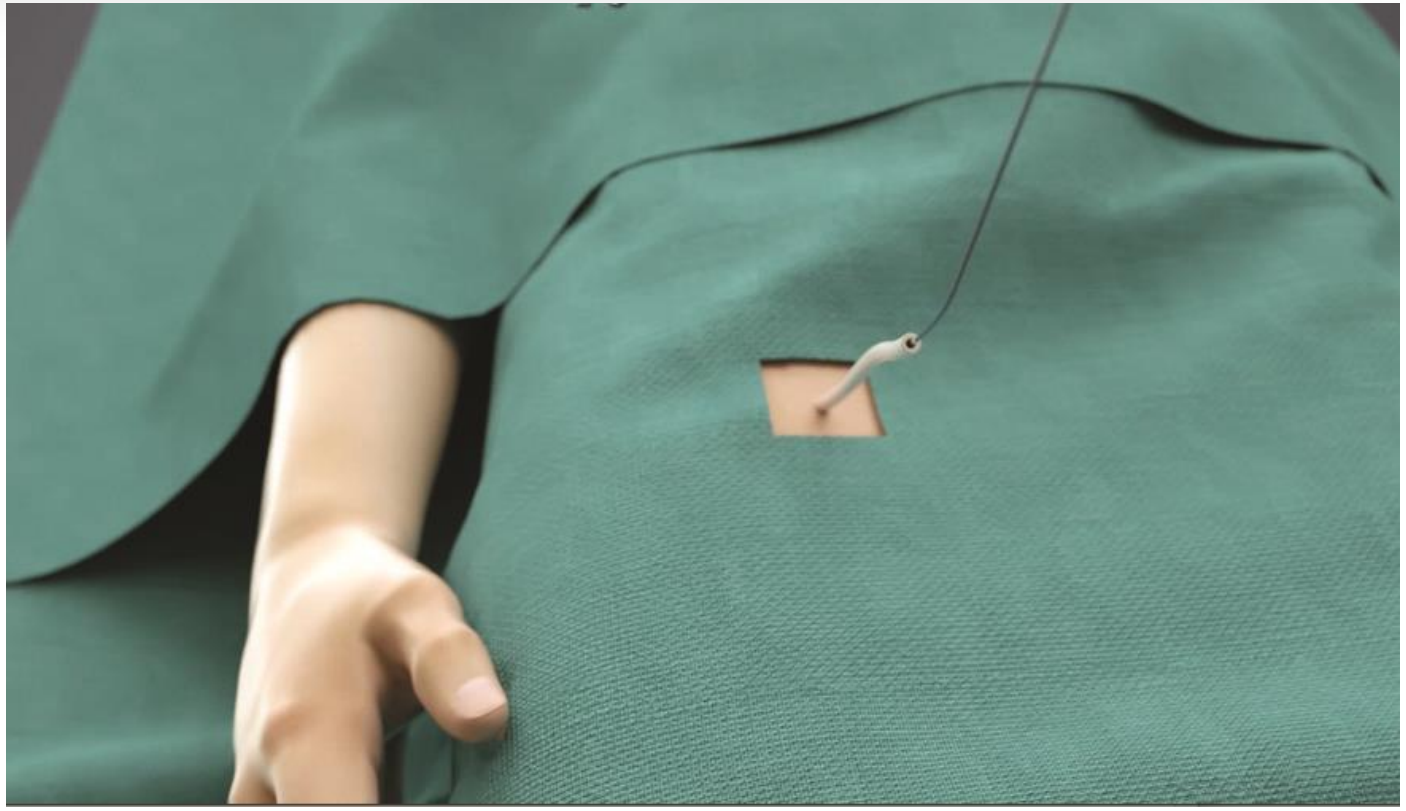
1. Stoddard et al. Am Heart J. (2003); 2. Goldman et al. *J Am Soc Echocardiogr* (1999)
3 Blackshear JL. Odell JA., *Annals of Thoracic Surg* (1996)

WATCHMAN LAAC Device:
A One-Time Procedure

- One-time implant that does not need to be replaced
- Performed in a cardiac cath lab/EP suite by a Heart Team
- Transfemoral Access:
  - Catheter advanced to the LAA via the femoral vein
  - Does not require open heart surgery
- General anesthesia (typical)
- < 1 hour procedure (typical)
- Same day discharge (typical)

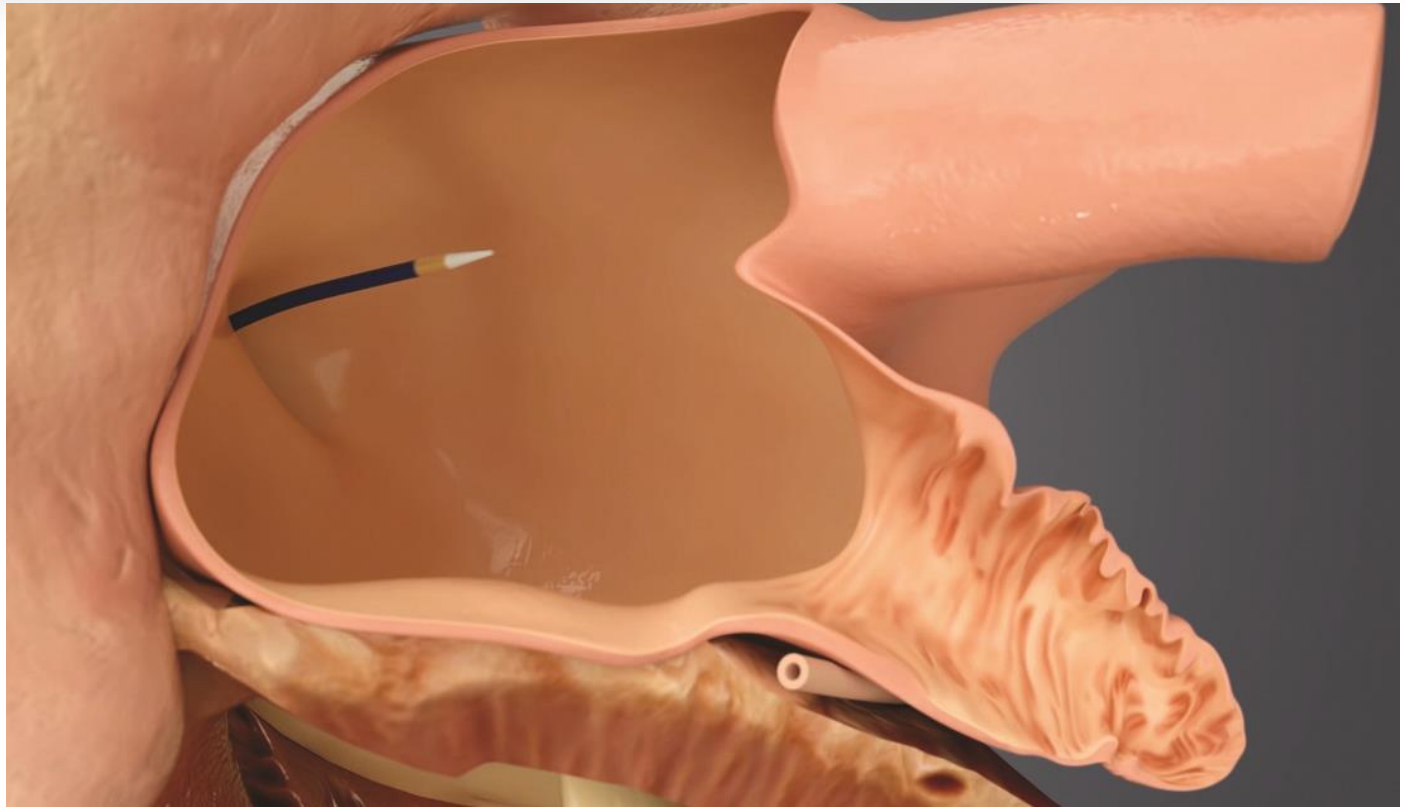


WATCHMAN IMPLANT PROCEDURE: PERCUTANEOUS ACCESS



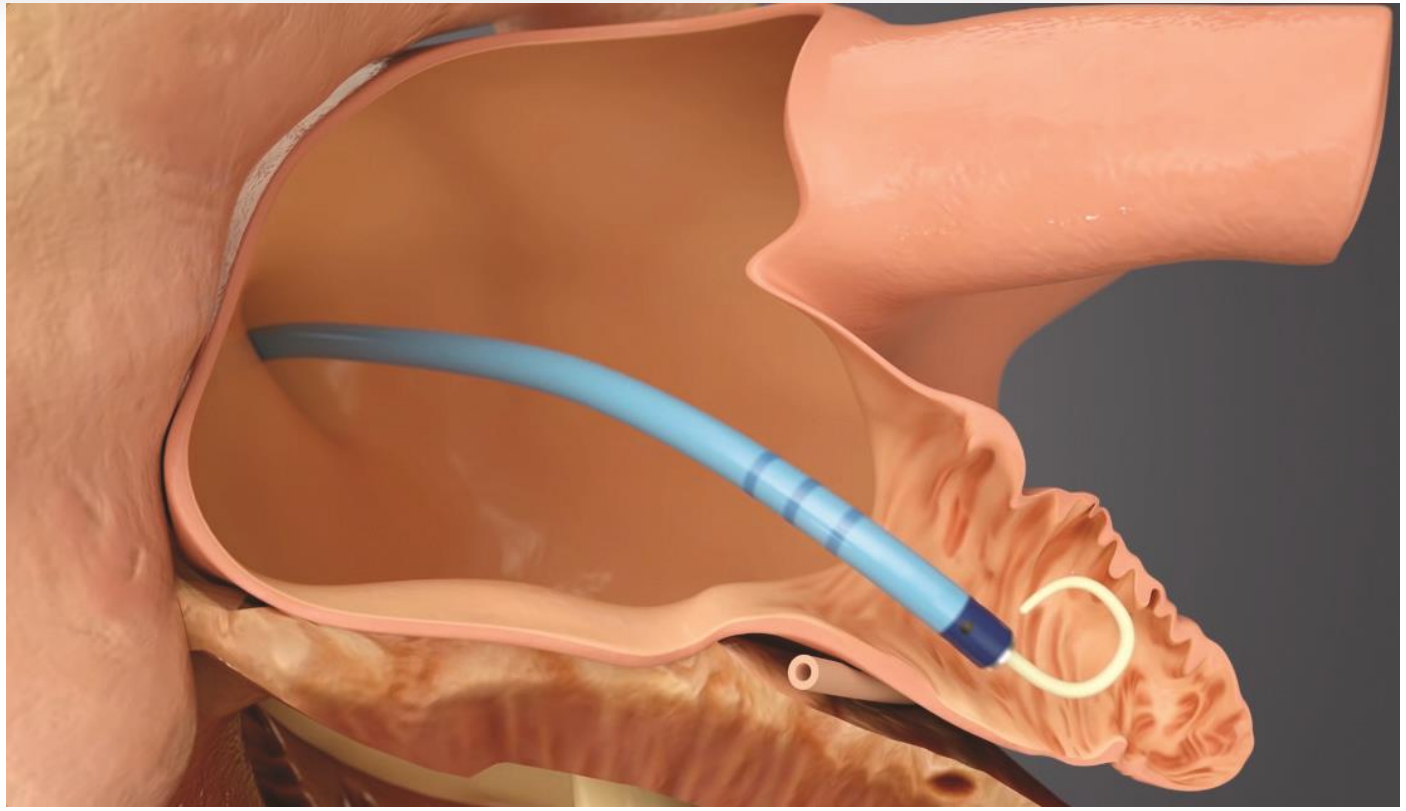
Using a standard percutaneous technique, a guidewire and vessel dilator are inserted into the femoral vein.

WATCHMAN IMPLANT PROCEDURE: IMAGING AND TRANSSEPTAL ACCESS



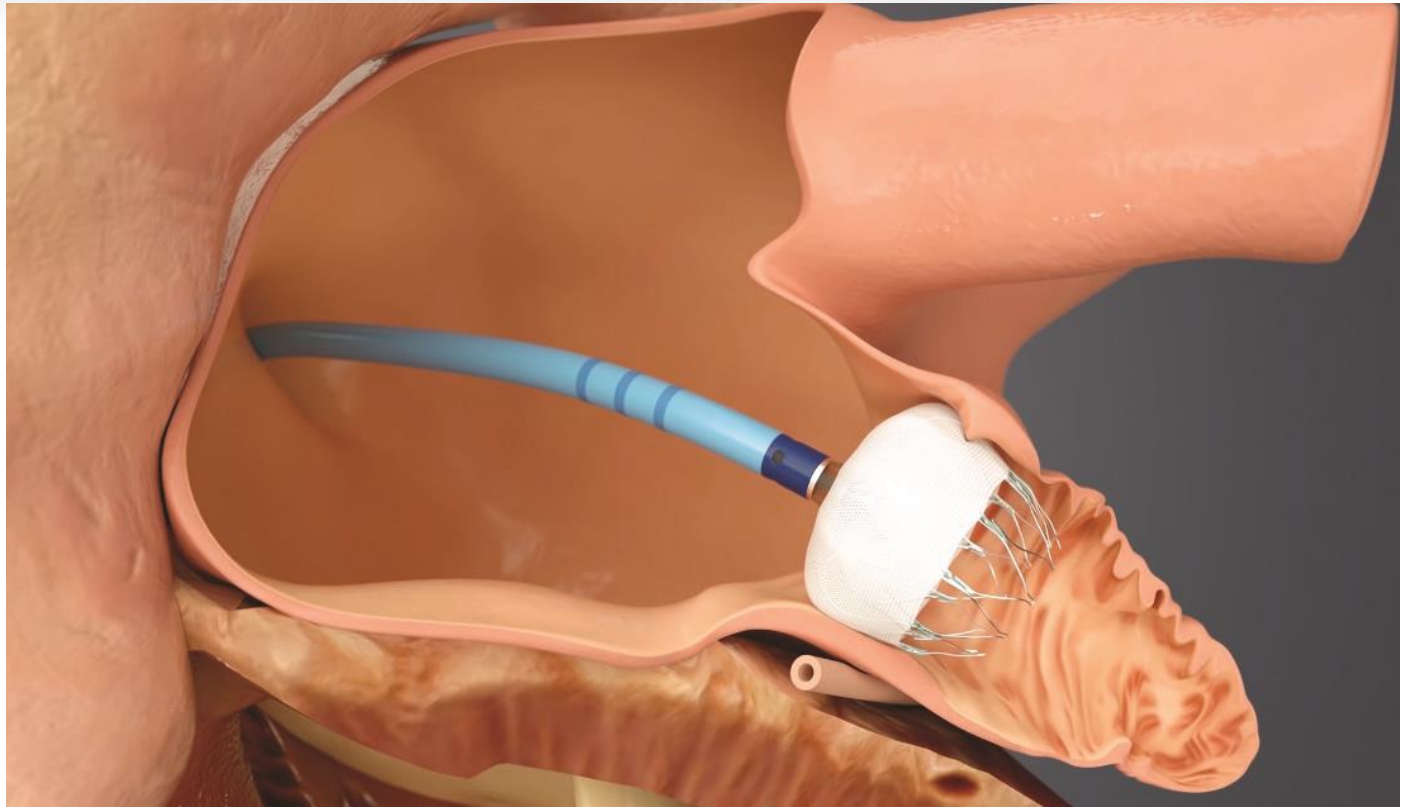
The interatrial septum is crossed using a standard transseptal access system and the procedure is performed with fluoroscopy and transesophageal echocardiography (TEE)

WATCHMAN IMPLANT PROCEDURE: NAVIGATING TO THE LAA



Access sheath is advanced over the guidewire into the left atrium and then navigated into the distal portion of the LAA over a pigtail catheter.

WATCHMAN IMPLANT PROCEDURE: NAVIGATING TO THE LAA



WATCHMAN is then deployed and released in the LAA.

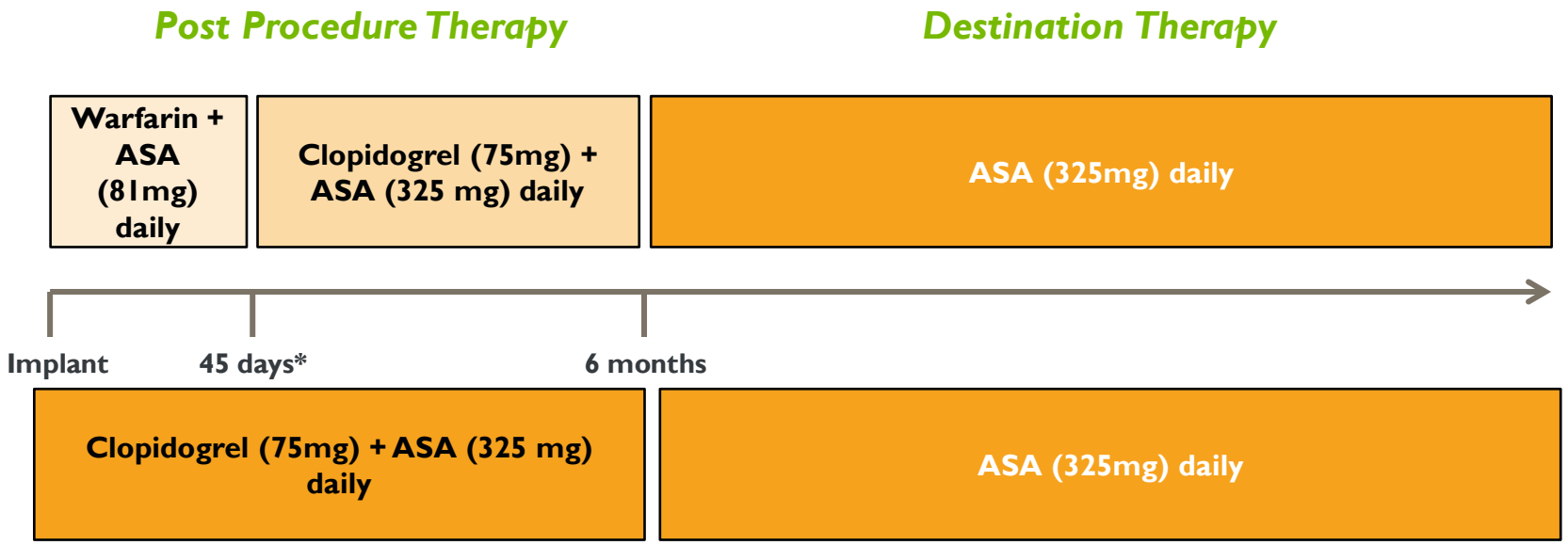
WATCHMAN IMPLANT PROCEDURE: HEALING AFTER ~45 DAYS

WATCHMAN™
LEFT ATRIAL APPENDAGE
CLOSURE DEVICE

Heart tissue grows over the WATCHMAN Implant, and the LAA is permanently sealed after approximately 45 days

TIMELINE OF ADJUNCTIVE PHARMACOTHERAPY IN WATCHMAN DEVICE PATIENTS

WATCHMAN™
LEFT ATRIAL APPENDAGE
CLOSURE DEVICE

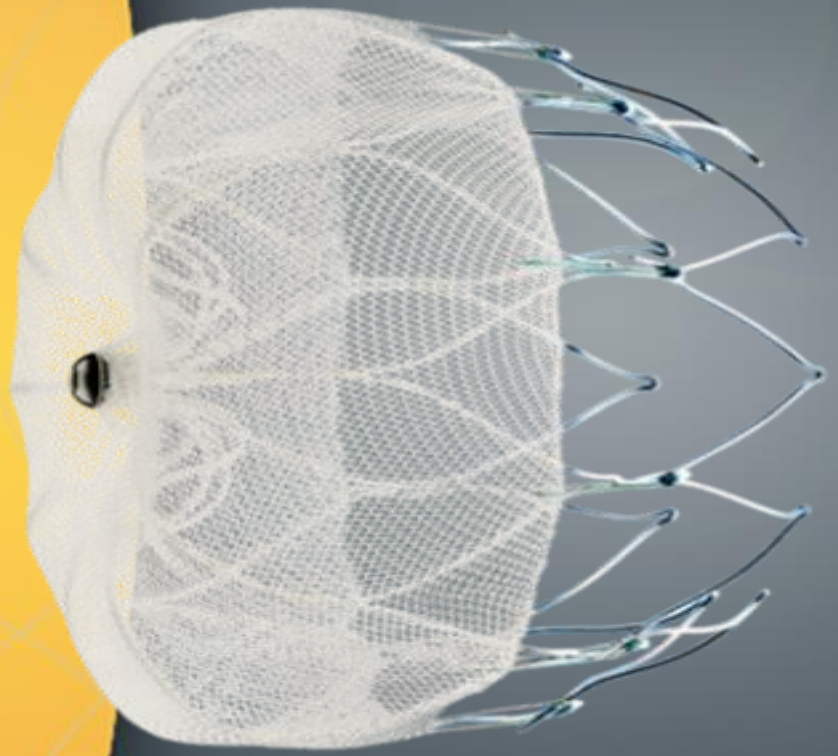


*if leak >5mm, patients remained on warfarin + ASA until seal documented, skipping the clopidogrel + ASA pharmacotherapy

Price, M. J., V. Y. Reddy, et al. JACC: CV Interv 2015; 8(15): 1925-1932

Clinical Data:

Efficacy and Safety



WATCHMAN IS THE MOST STUDIED LAAC DEVICE- MOST PATIENTS AND ONLY ONE WITH LONG-TERM CLINICAL DATA

WATCHMAN™
LEFT ATRIAL APPENDAGE
CLOSURE DEVICE

Key Trials	N	Highlights
PROTECT AF[1] (2005-2008)	707	Prospective, randomized 2:1, non-inferiority trial of LAA closure vs. warfarin.
CAP[2] (2008-2010)	566	Prospective registry allowing continued access to the WATCHMAN Device and gain further information prior to PMA approval.
PREVAIL[3] (2010-2012)	407	Prospective, randomized 2:1, non-inferiority trial to collect additional information on the WATCHMAN Device.
CAP2 (2012-2014)	579	Prospective registry allowing continued access to the WATCHMAN Device prior to PMA approval.
EWOLUTION[4] (2013-2015)	1025	Prospective, multi-center, all-comers registry capturing current practice in Europe with WATCHMAN implantation
Total patients	**>3,000**	**~6,000 Patient-Years of Follow-up**

The EWOLUTION Registry is a European prospective registry which reflects CE Mark indications for use ,which differ from the FDA indications for use.

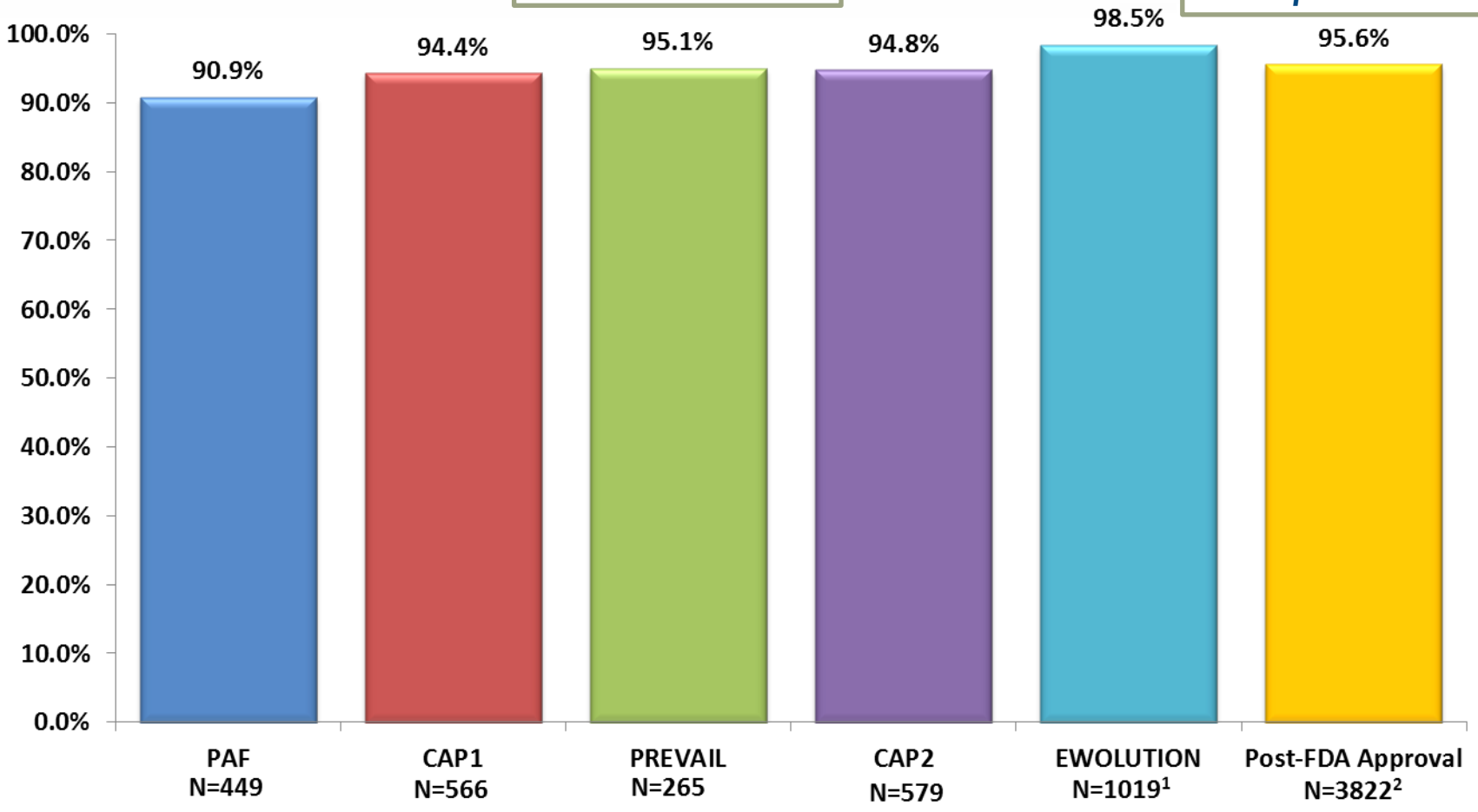
1 Reddy, et al. JAMA. 2014 ;312(19): 1988-1998.; 2 Reddy VY et al. Circulation. 2011; 123:417-424.
3 Holmes et al., JACC 2014,;4(1): 1-11. 4. Boersma LVA, et al. HRJ 2017; *In Press.*

PROCEDURAL SUCCESS

WATCHMAN™
LEFT ATRIAL APPENDAGE
SURE DEVICE

~50% new operators

~70% new operators performed 50% of procedures



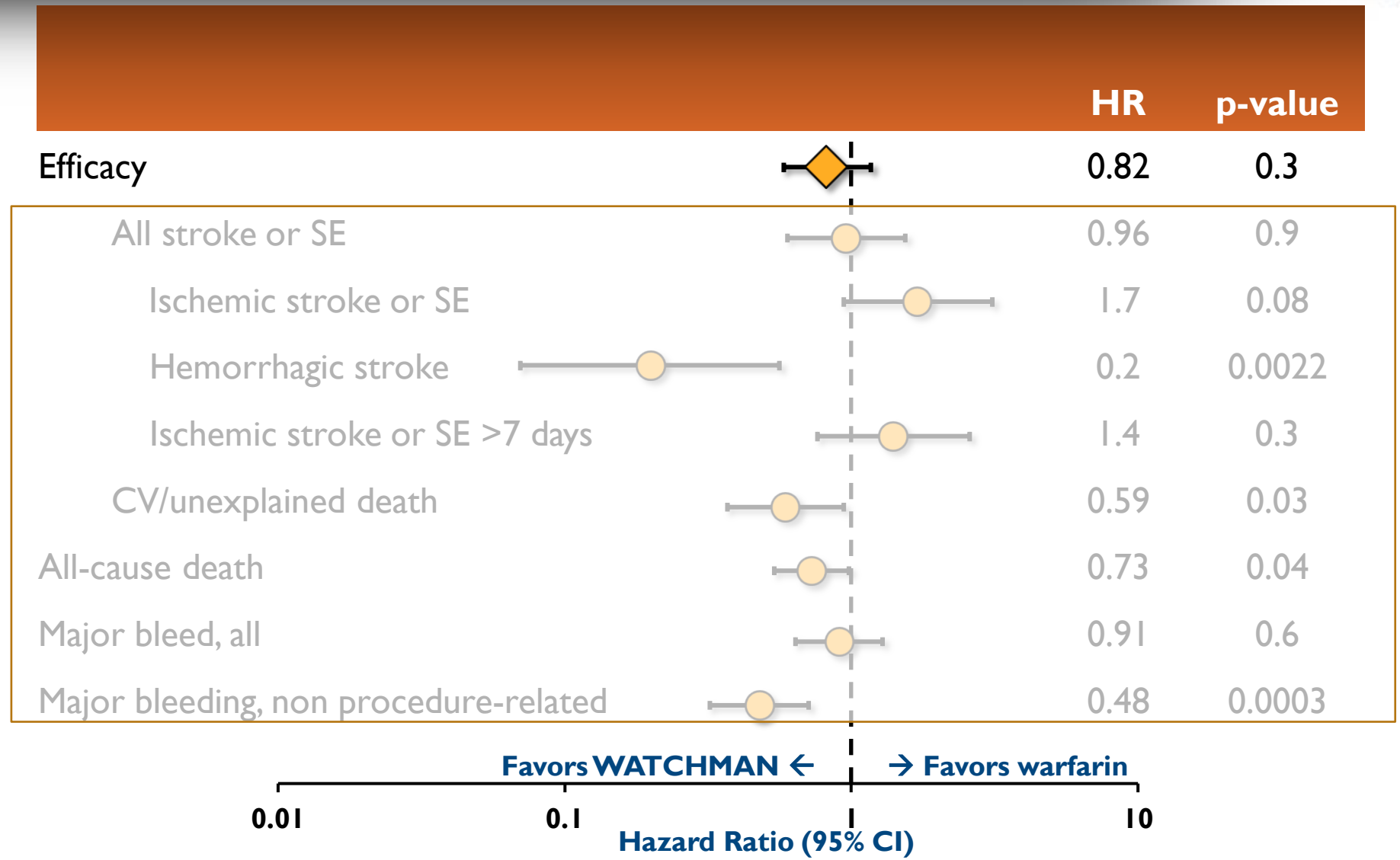
Implant success defined as deployment and release of the device into the LAA; no leak ≥ 5 mm

* The EWOLUTION Registry is a European prospective registry which reflects CE Mark indications for use which differ from the FDA indications for use.

1 Boersma, L.et al. *EHJ* 2016;37(31): 2465.; 2 Reddy VY, Holmes DR, et al. JACC 2016; 69(3): 253-261.

PROTECT AF/PREVAIL META-ANALYSIS (5 YEARS): WATCHMAN EFFICACY COMPARABLE TO WARFARIN

WATCHMAN™
LEFT ATRIAL APPENDAGE
CLOSURE DEVICE



Reddy VY, Holmes, DR et al. JACC 2017 in Press.

MAJORITY OF PATIENTS ARE ABLE TO STOP LONG-TERM WARFARIN THERAPY

WATCHMAN™
LEFT ATRIAL APPENDAGE
CLOSURE DEVICE

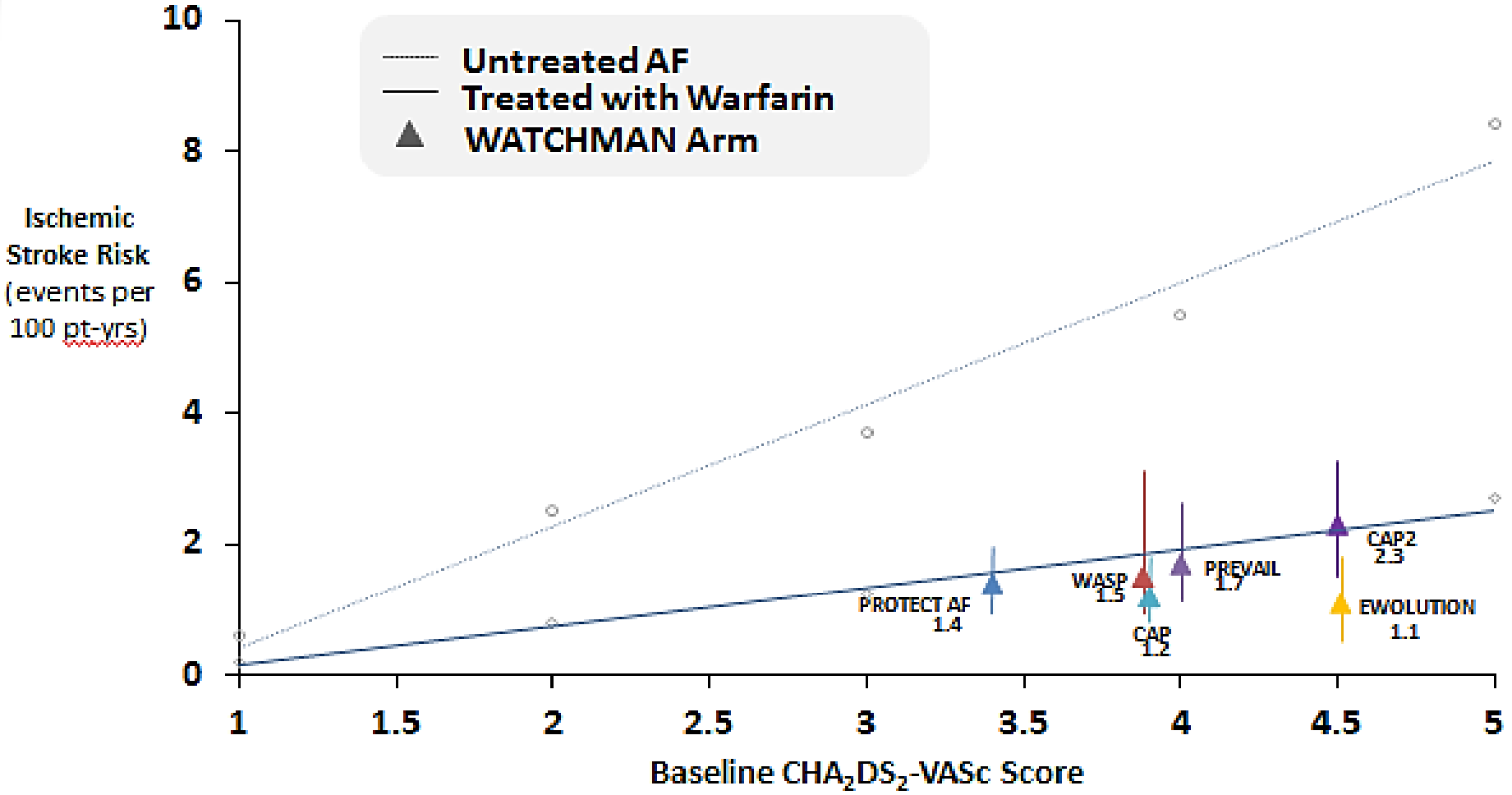
Warfarin Cessation

Study*	45-day	12-month
PROTECT AF[1]	87%	>93%
CAP[2]	96%	>96%
PREVAIL[3]	92%	>99%

*CAP2 N/R

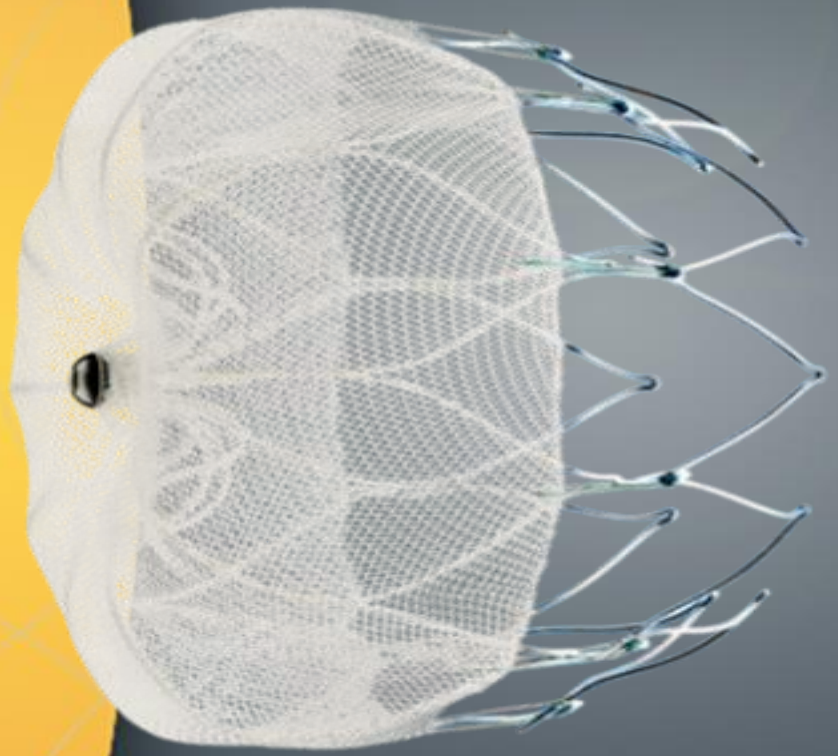
1 Reddy, VY et al. Circulation. 2011;123:417-424; 2 Kar S et al. TCT 2017 (Abstract);; 3 Holmes, DR et al. *JACC* 2014; 64(1):1-12.

WATCHMAN COMPARABLE TO WARFARIN FOR ISCHEMIC STROKE IN 2 RCT, 4 REGISTRIES



Source: . Reddy VY, Doshi SK, Kar S, et al. 5-Year Outcomes After Left Atrial Appendage Closure: From the PREVAIL and PROTECT AF Trials. J. Am Coll Cardiol. 2017; In Press

Patient Selection



WATCHMAN™ THERAPY CANDIDATES

WATCHMAN™
LEFT ATRIAL APPENDAGE
CLOSURE DEVICE

What type of LAAC candidates are you referring today?

Contra-indicated
(Cannot take any OAC)

Bleeder
(Previous bleed but on OAC)

Future Bleeder
(No prior bleeds but high-risk / include fall risk)

Non-Compliant
(tolerant but not taking OAC)

Lifestyle
(Patient prefers device over OAC)

PATIENT EXAMPLE #1: HIGH BLEEDING RISK

WATCHMAN™
LEFT ATRIAL APPENDAGE
CLOSURE DEVICE

- Age: 80; Involved Grandfather; NVAF, Congestive Heart Failure, Hypertension, Diabetes
- CHA_2DS_2-VASc score: 5; HAS-BLED score: 2
- Although patient is suitable for warfarin, he is currently taking 15 mg rivaroxaban daily
- Has a history of recurrent falls, resulting in both a broken hip and cerebral contusion after falling on separate occasions. His physician believes his medical condition places him at high risk of major bleeding secondary to trauma

Is he a candidate for WATCHMAN?

Case description for educational purposes; Not a real patient case

PATIENT EXAMPLE #2: STRUGGLE WITH COMPLIANCE

WATCHMAN™
LEFT ATRIAL APPENDAGE
CLOSURE DEVICE

- Age: 68; Retired, Volunteer; NVAF, Hypertension, Vascular Disease
- CHA_2DS_2-VASc score: 4; HAS-BLED score: 3
- Currently taking 5 mg warfarin
- Unable to comply with regular INR monitoring due to her proximity to the clinic and cannot afford novel oral anticoagulant (NOAC) medication

Is she a candidate for WATCHMAN?

Case description for educational purposes; Not a real patient case

PATIENT EXAMPLE #3: DISLIKES WARFARIN

WATCHMAN™
LEFT ATRIAL APPENDAGE
CLOSURE DEVICE

- Age: 65; Retired, NVAF, Hypertension, CHF, Alcohol use (>8 drinks per week)
- CHA_2DS_2-VASc = 3; HAS-BLED = 3
- Currently taking 5 mg warfarin
- Patient dislikes taking warfarin; alcohol use effects ability to maintain INR

Is he a candidate for WATCHMAN?

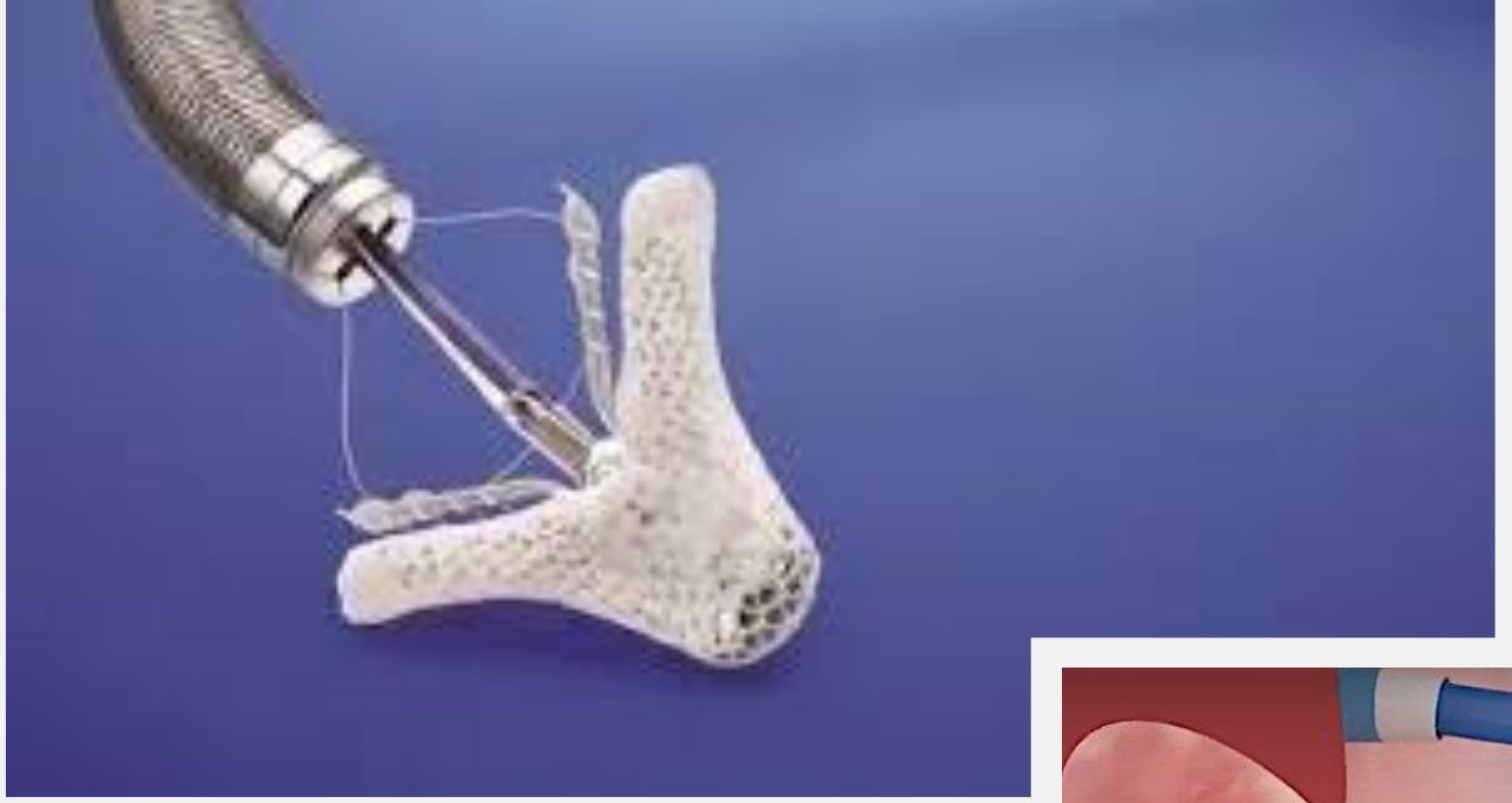
Case description for educational purposes; Not a real patient case

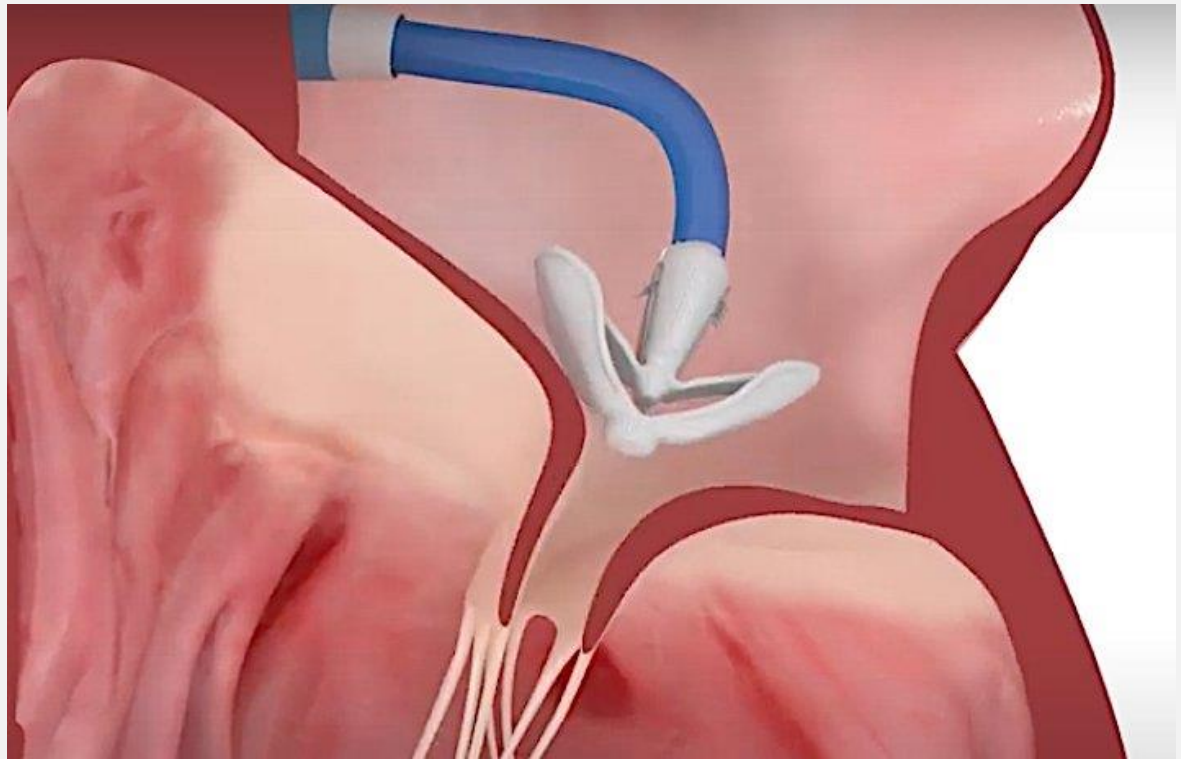
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

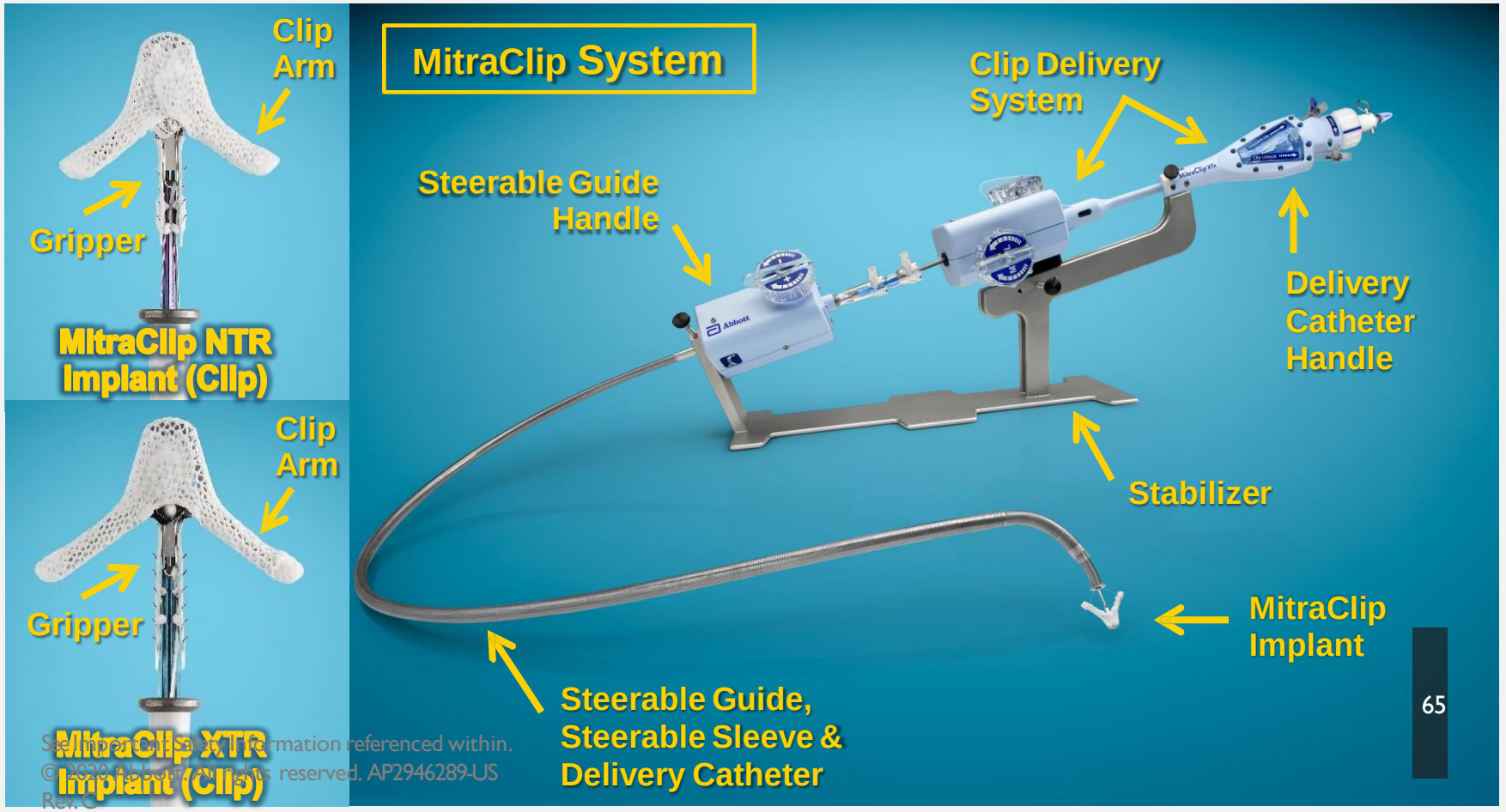
Transcatheter Mitral-Valve Repair in Patients with Heart Failure

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*





MITRACLIP™ NTR & MITRACLIP™ XTR SYSTEM



See important safety information referenced within.
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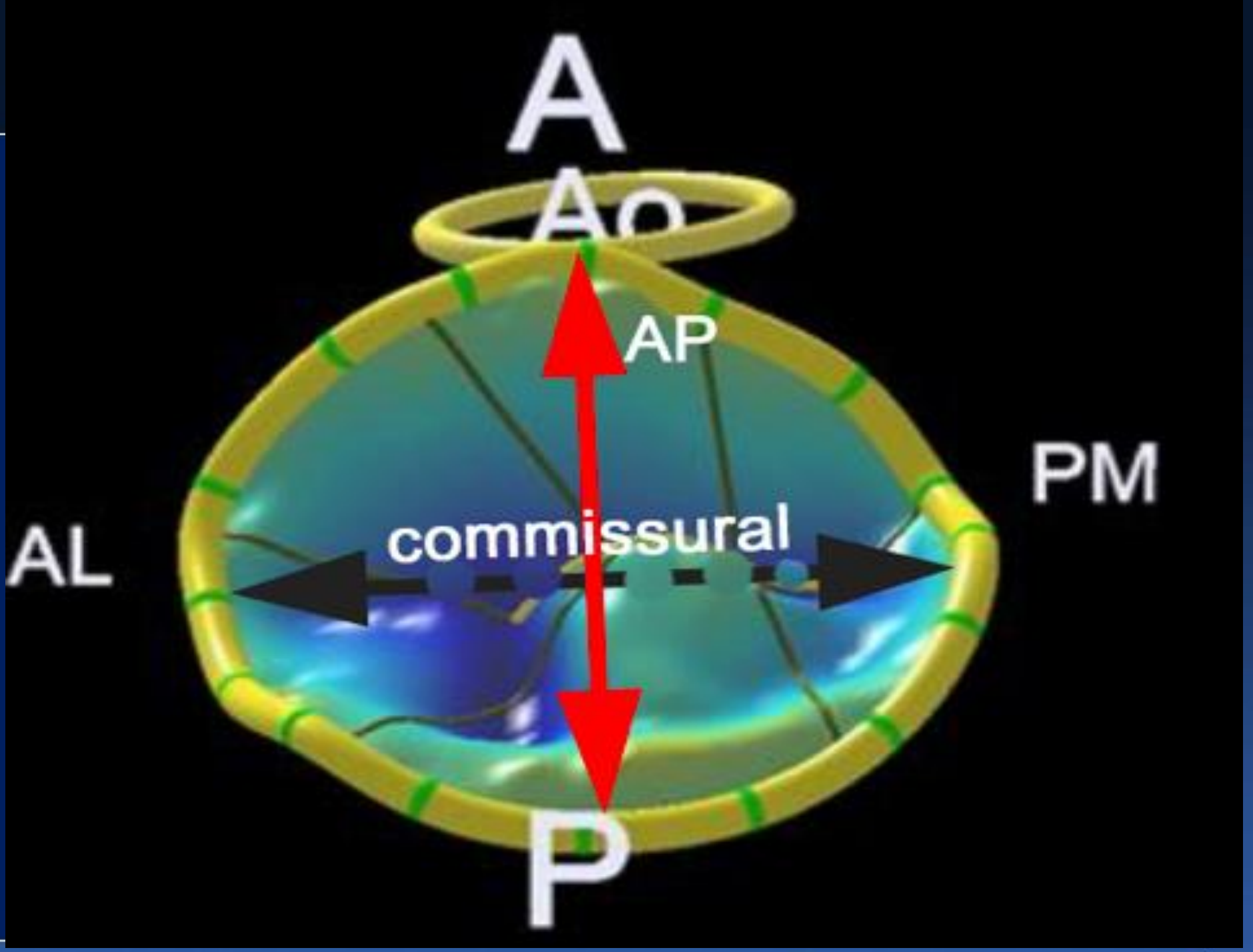
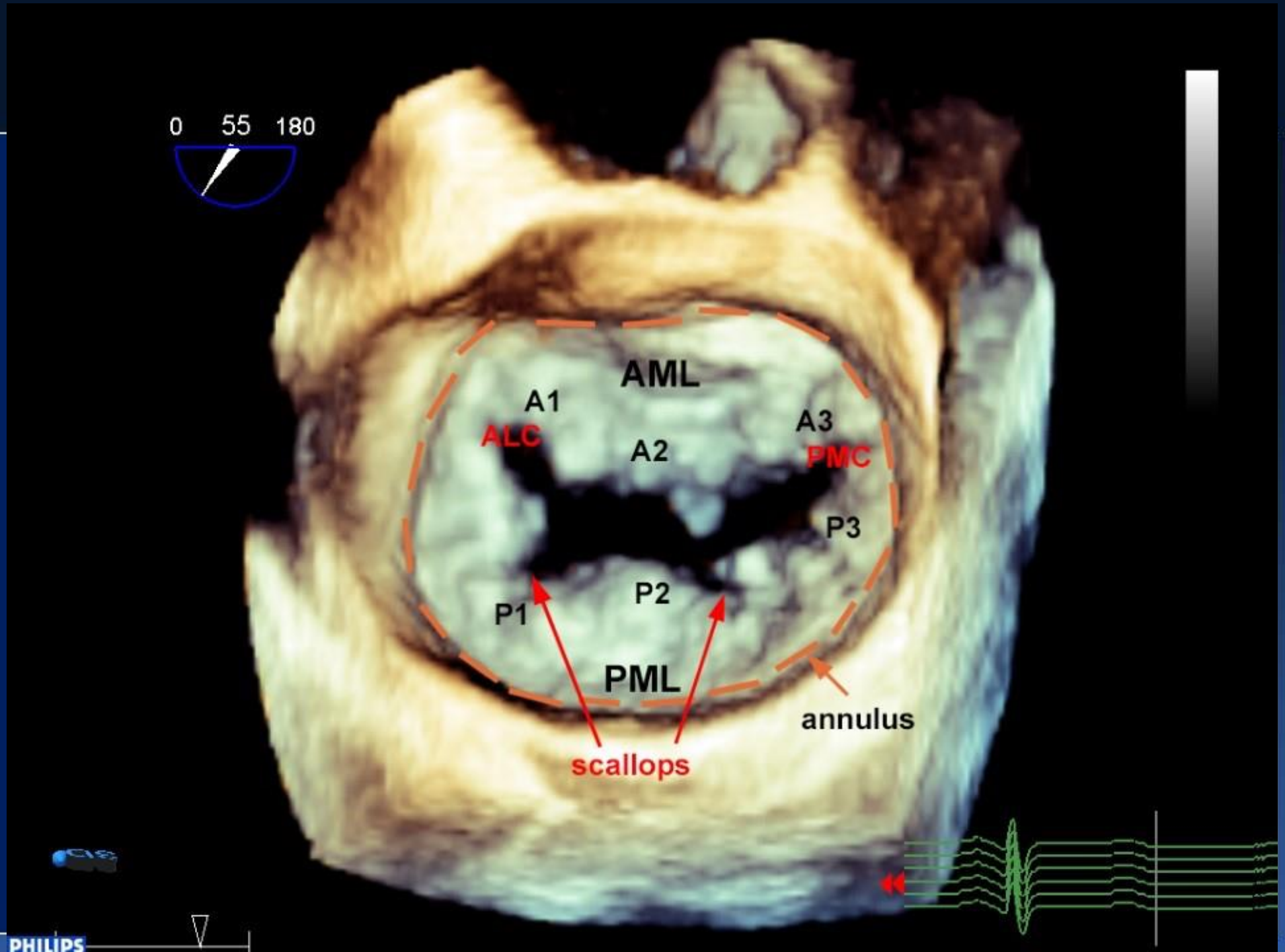
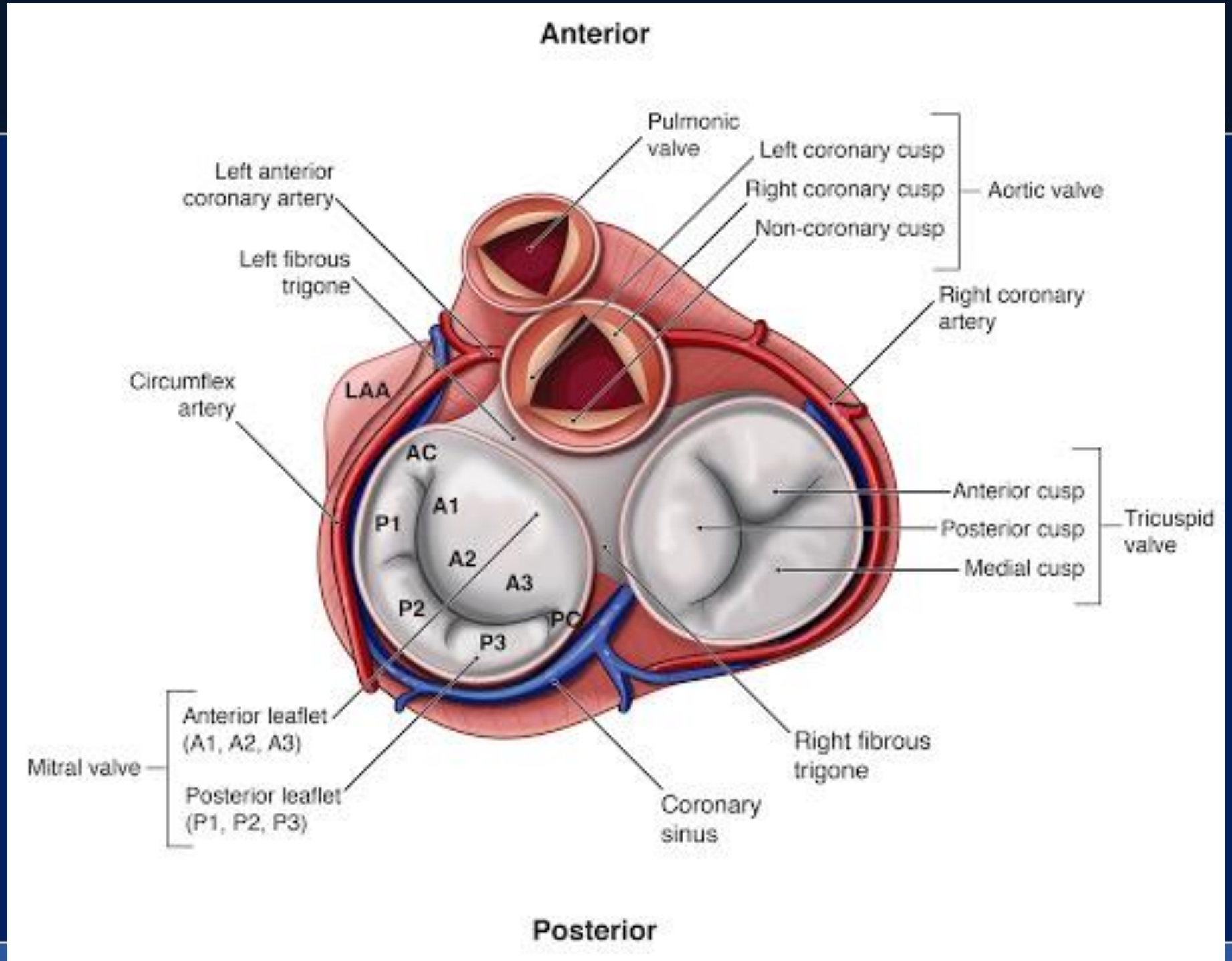
COAPT TRIAL



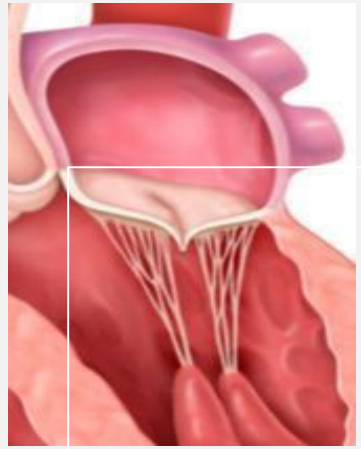
COAPT
TRIAL


0
55
180
AML
A1
ALC
A2
A3
PMC
P3
P2
P1
PML
annulus
scallops
PHILIPS

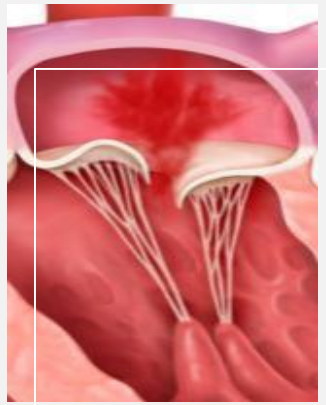

Anterior
Pulmonic valve
Left coronary cusp
Right coronary cusp
Non-coronary cusp
Aortic valve
Left anterior coronary artery
Left fibrous trigone
Right coronary artery
Circumflex artery
LAA
AC
A1
P1
A2
A3
P2
PC
P3
Anterior cusp
Posterior cusp
Medial cusp
Tricuspid valve
Mitral valve
Anterior leaflet (A1, A2, A3)
Posterior leaflet (P1, P2, P3)
Right fibrous trigone
Coronary sinus
Posterior

PRIMARY (DEGENERATIVE) MR

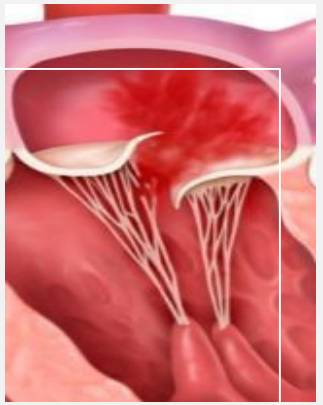
- Definition: pathology of one or more of the main components of the apparatus(leaflets, annulus, chordae, papillary muscle) causes valve incompetence leading to MR
- The mitral valve and its MR is the disease.
- MV prolapse is the most common form in developed countries.
  - Younger with myxomatous degeneration, bileaflet disease, Barlow's. (leaflet)
  - Older patients with fibroelastic deficiency disease leading to chordal rupture (chordal)
  - Less common: IE, connective tissue disease, rheumatic, cleft, radiation.
- "Correction of MR is curative as MR is the disease"



Normal Mitral Valve



Degenerative



Degenerative

JACC 2014; 63: e57 – e185 Circulation 2017; 135: e1159 – e1195

SECONDARY (FUNCTIONAL) MR

- Definition: components of the mitral apparatus are intact. Valvular incompetence is the result of severe LV dysfunction from:
  - Coronary Artery Disease (aka Ischemic MR)
  - Idiopathic Myocardial Disease (aka Non-Ischemic MR)
- Abnormal and dilated LV causes papillary muscle displacement -> papillary muscle displacement -> leaflet tethering with annular dilatation -> loss of coaptation -> MR
- The ventricle is diseased and the MR is a byproduct.
- Severity is difficult to assess and echo may be an underestimate
- “Fixing MR is not curative”

Normal Mitral Valve

MITRACLIP INDICATIONS..

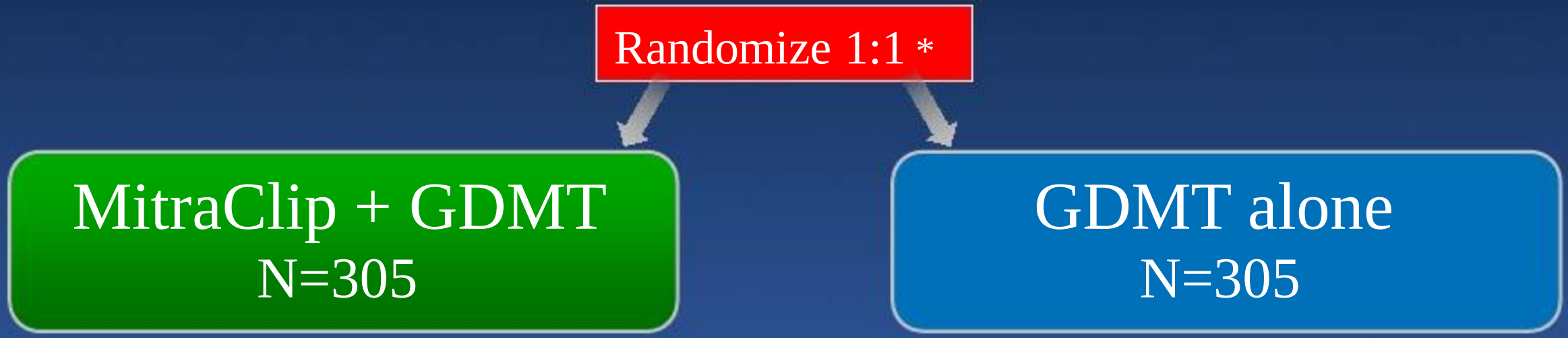
MitraClip is approved in the U.S. for patients with:

- Severe primary mitral regurgitation
- Presence of primary disease causing the regurgitation
  - "Primary disease of the mitral apparatus"
- Prohibitive risk for surgical MVr/MVR
  - As determined by MONUMENT HEALTH STRUCTURAL HEART TEAM
  - Procedure and MR reduction would not be futile
- FUNCTIONAL MITRAL REGURGITATION (COAPT TRIAL)

The COAPT Trial

C ardiovascular O utcomes A ssessment of the MitraClip P ercutaneous T herapy for Heart Failure Patients with Functional Mitral Regurgitation

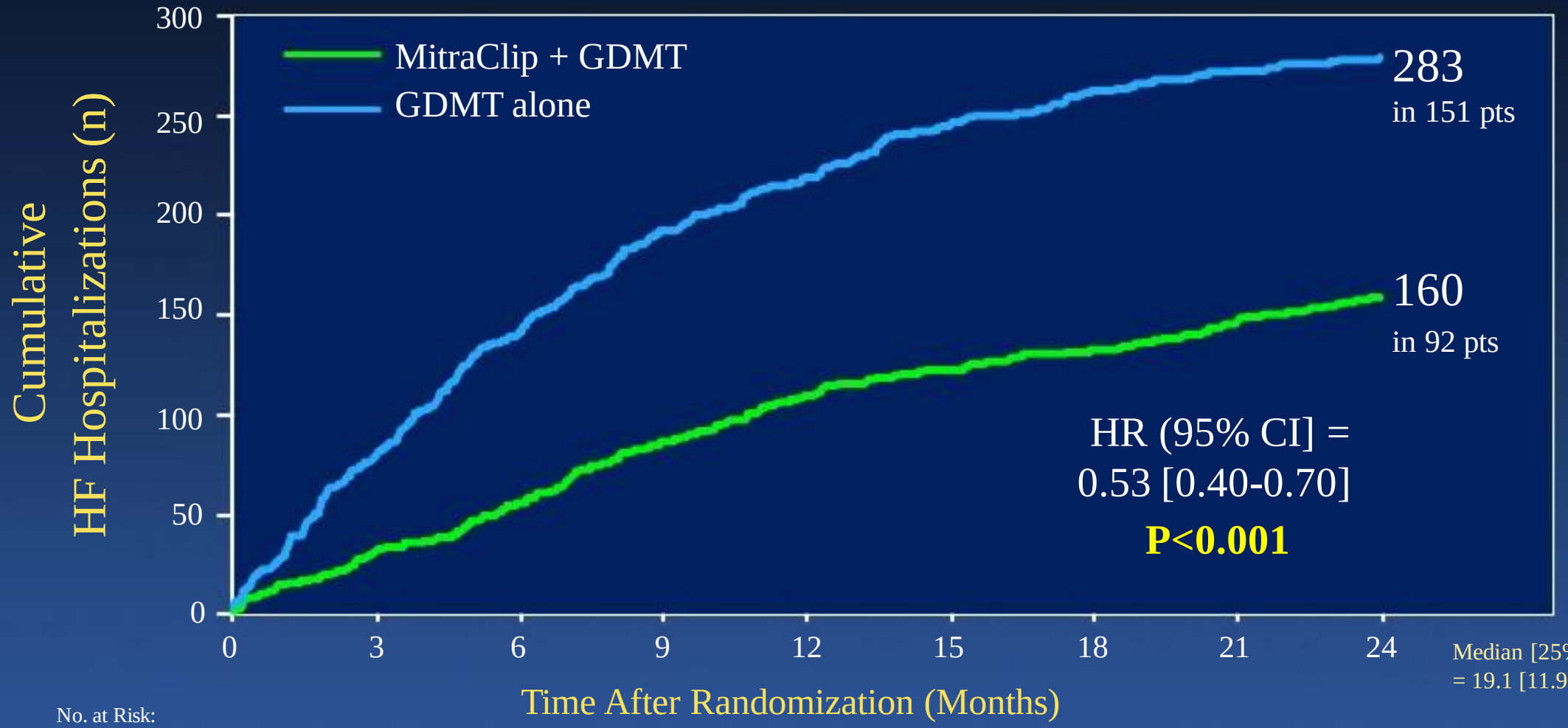
A parallel-controlled, open-label, multicenter trial in ~610 patients with heart failure and moderate-to-severe (3+) or severe (4+) secondary MR who remained symptomatic despite maximally-tolerated GDMT



*Stratified by cardiomyopathy etiology (ischemic vs. non-ischemic) and site

Primary Effectiveness Endpoint

All Hospitalizations for HF within 24 months

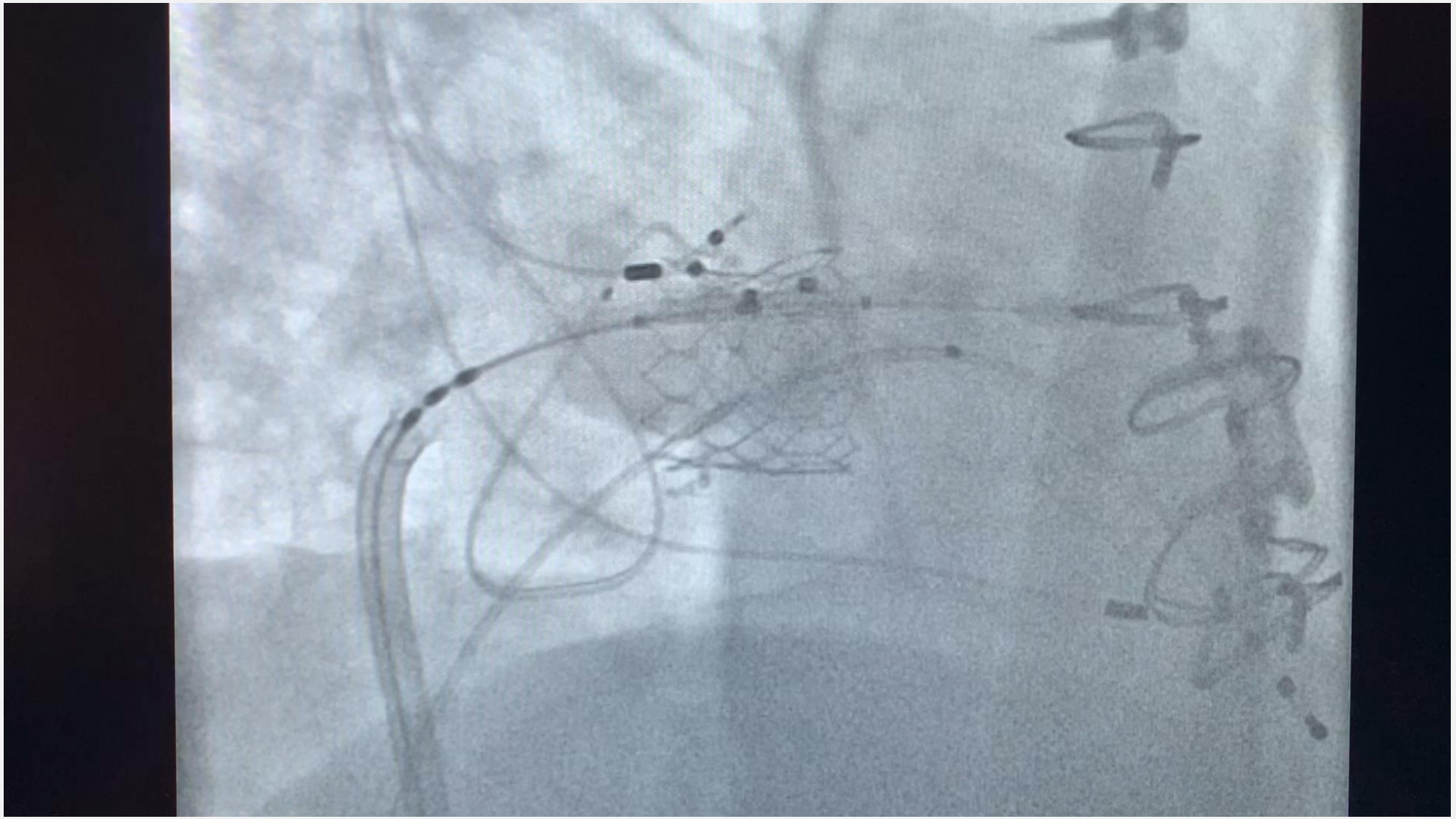


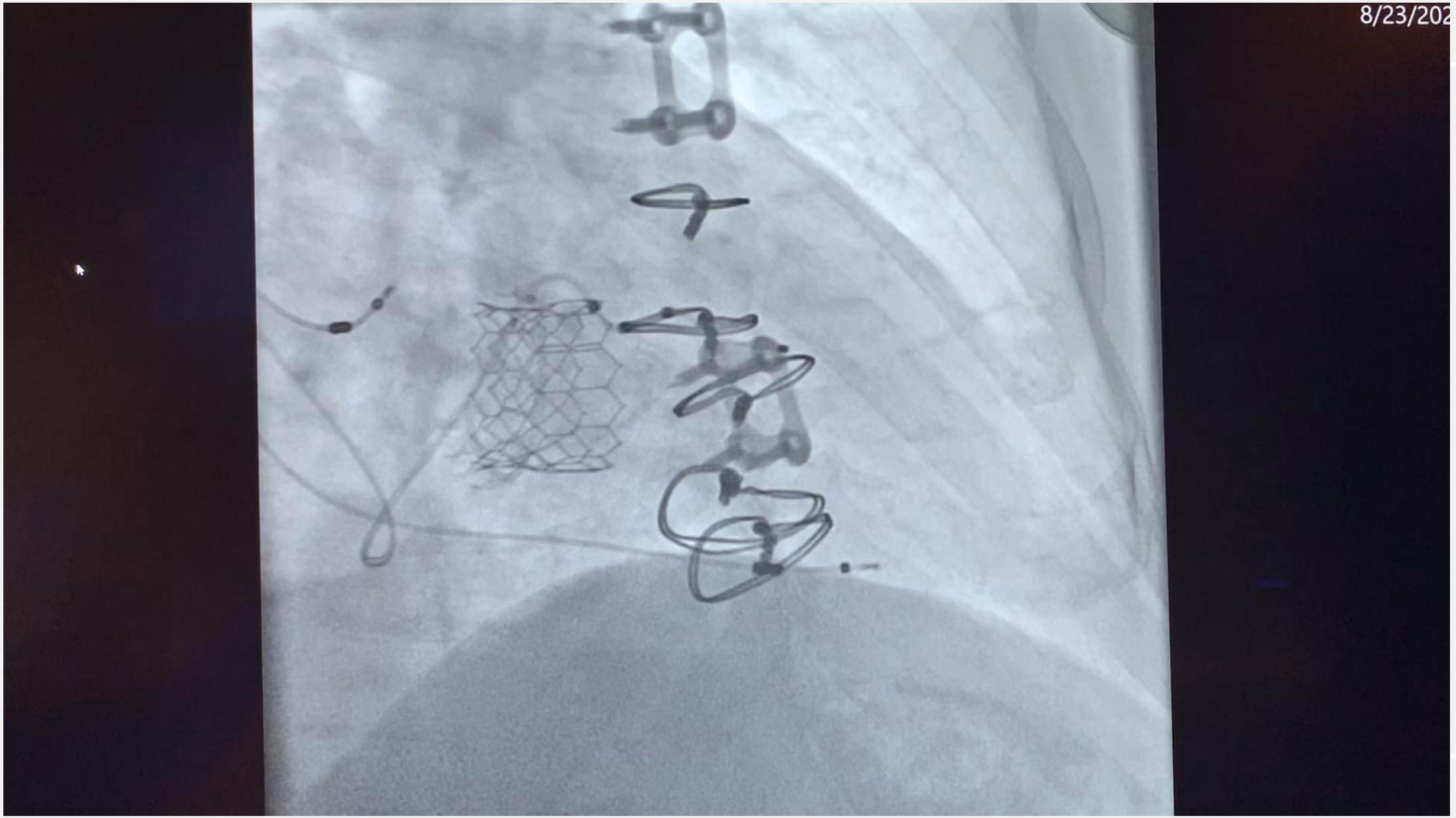
Median [25%, 75%] FU = 19.1 [11.9, 24.0] mos

No. at Risk:

MitraClip	302	286	269	253	236	191	178	161	124
GDMT	312	294	271	245	219	176	145	121	88

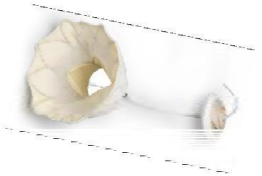
TMVR




8/23/202

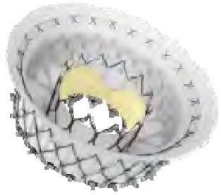
ADVANCES IN TRANSCATHETER MITRAL AND TRICUSPID VALVE REPLACEMENT

Tendyne (Abbott)



M3 (Edwards)

Intrepid (Medtronic)



Tiara (Neovasc)

Cephea (Abbott)

EVOQUE (Edwards)

Highlife

AltaValve

TRICUSPID VALVE REGURGITATION

Patients are largely undertreated with surgery

1,600,000
Number of
moderate to severe TR cases

250,000
Number of
new TR cases annually

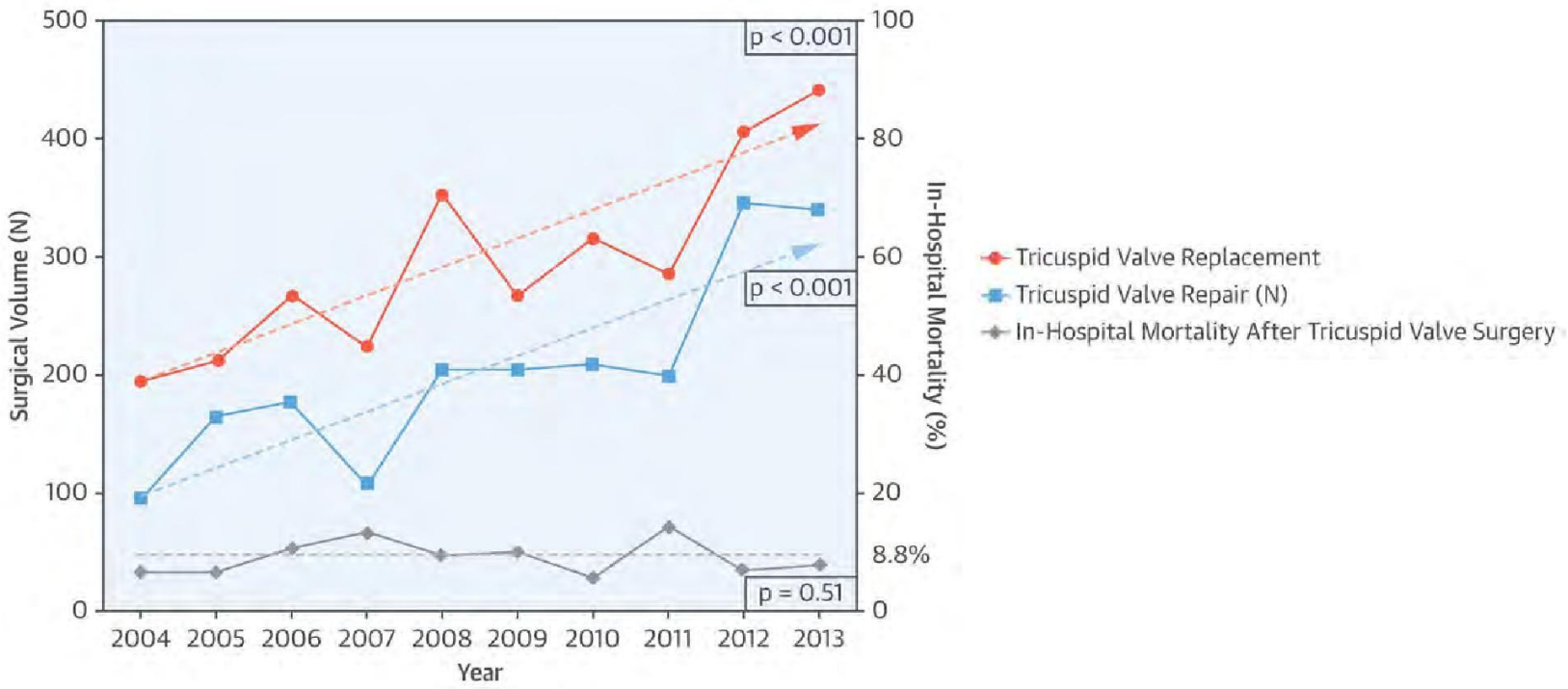
<8,000
Number of
TR surgeries

<0.5%
of TR cases treated surgically

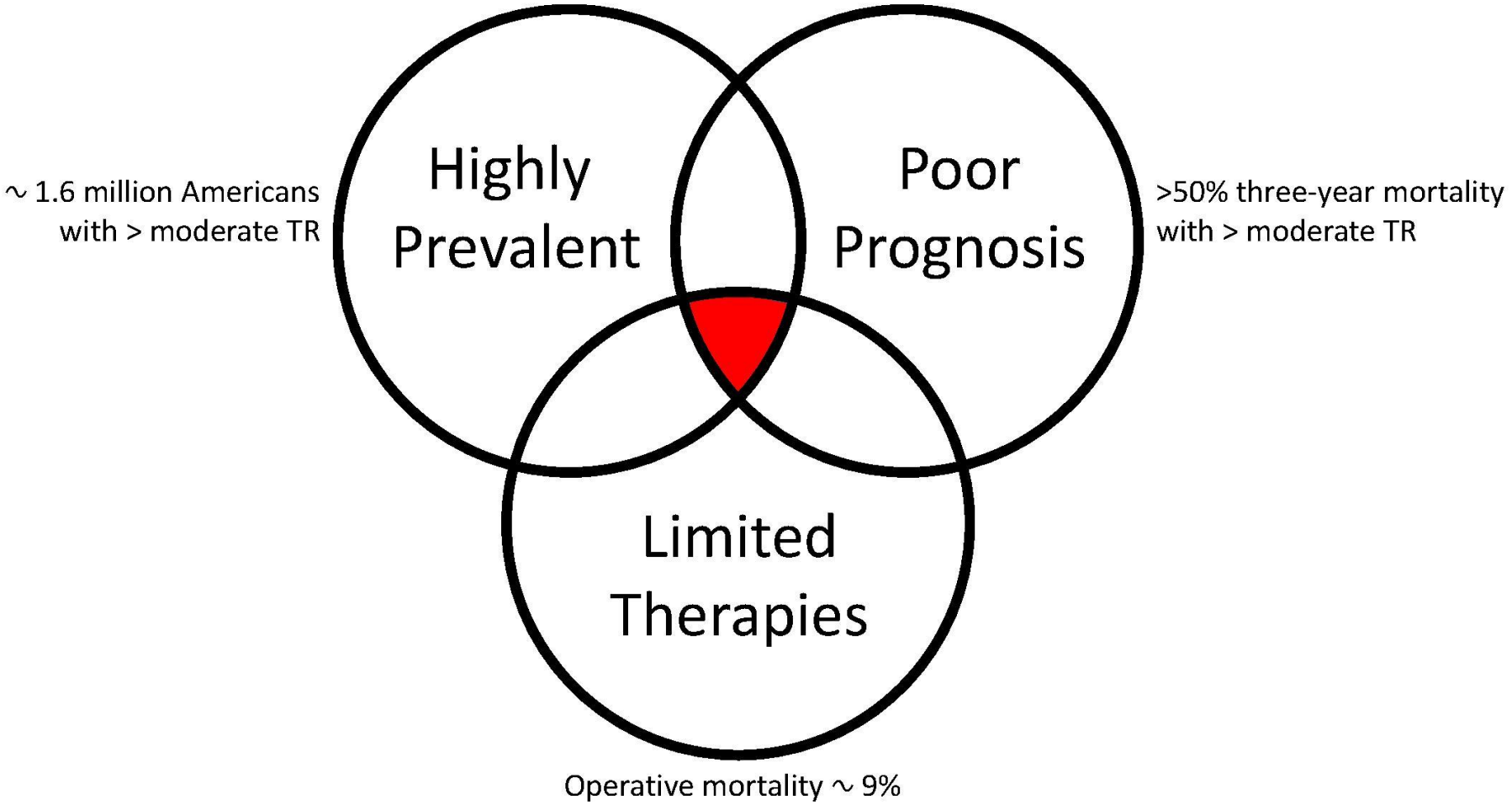
90%
are repair

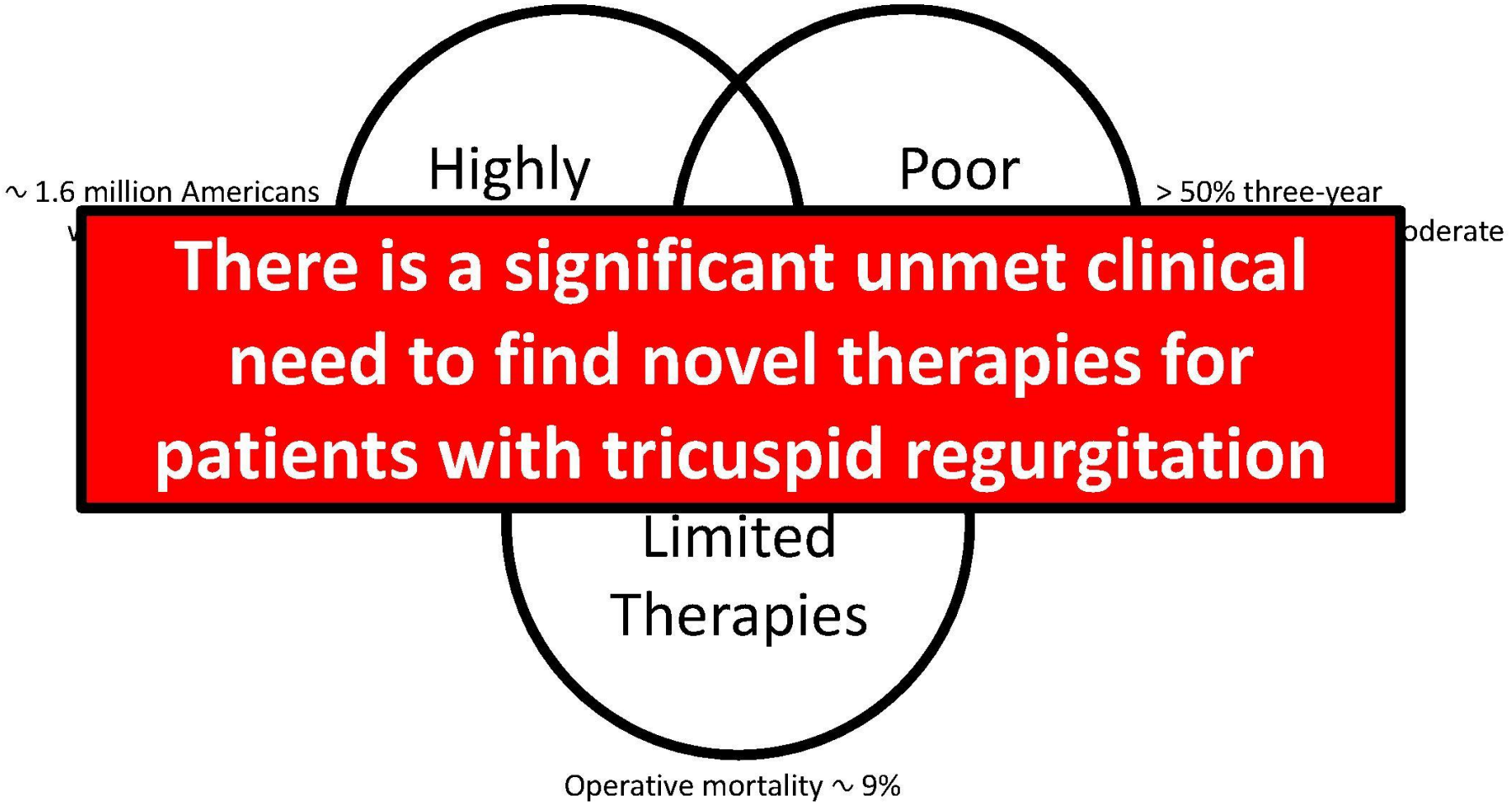
Agarwal et al. Interventional Cardiology Perspective on fTR
Circ Cardiovascular Intervention 2009; 565-573

Operative Mortality for TR remains high



C.J. Zack, E.A. Fender, P. Chandrashekar, et al. National trends and outcomes in isolated tricuspid valve surgery
J Am Coll Cardiol, 70 (2017), pp. 2953-2960


~ 1.6 million Americans with > moderate TR
Highly Prevalent
Poor Prognosis
>50% three-year mortality with > moderate TR
Limited Therapies
Operative mortality ~ 9%

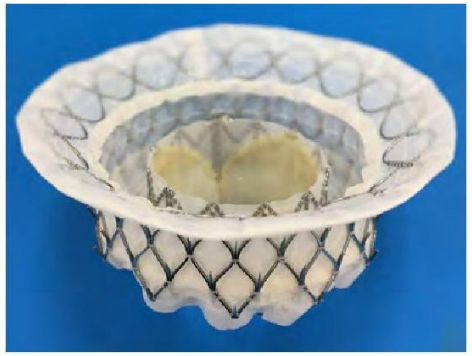

~ 1.6 million Americans
Highly
Poor
> 50% three-year
oderate
There is a significant unmet clinical need to find novel therapies for patients with tricuspid regurgitation
Limited
Therapies
Operative mortality ~ 9%

Transcatheter Tricuspid Valve Replacement

Devices with FIM experience

Navigate

Lux



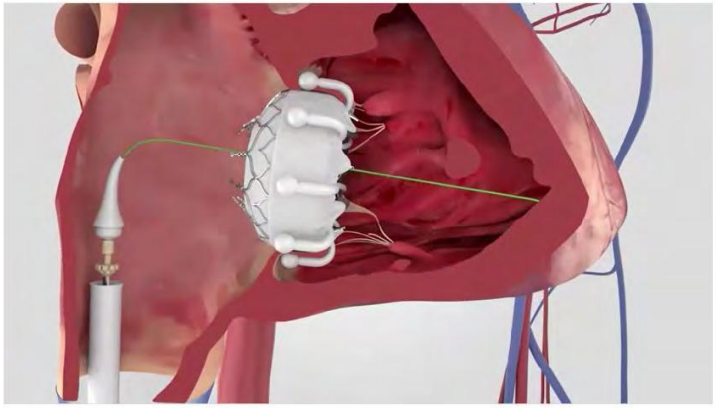
Intrepid

Evoque

TriClip

EVOQUE Tricuspid Valve Replacement

Unique valve design engages leaflets, chords, and annulus to achieve secure placement



Atraumatic anchors compatible with pre-existing leads and respect the native anatomy

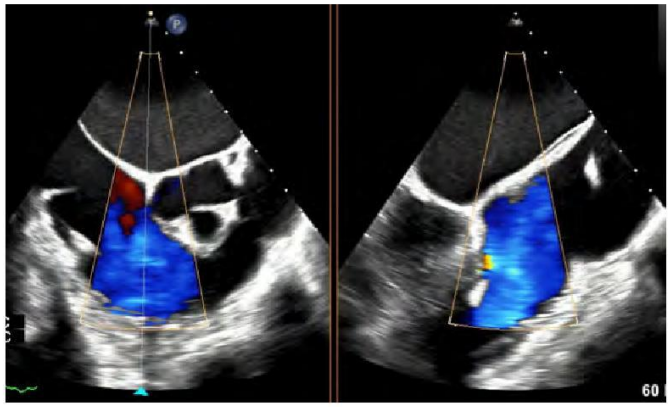
Conforming frame designed to achieve optimal retention force

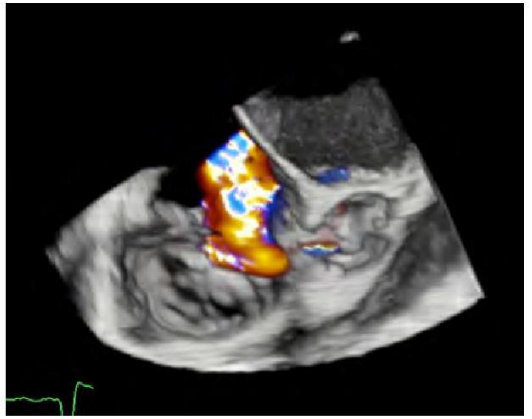
Multiple sizes offer treatment for a broad range of tricuspid pathologies and anatomies **(44, 48, 52 mm)**

28F transfemoral delivery system **compatible with all valve sizes**

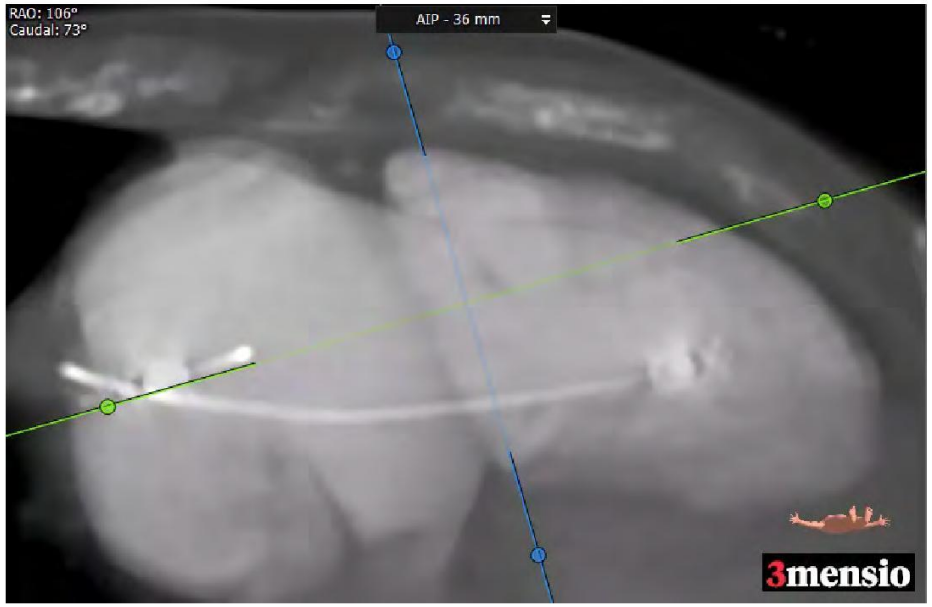
Transcatheter Tricuspid Valve Replacement

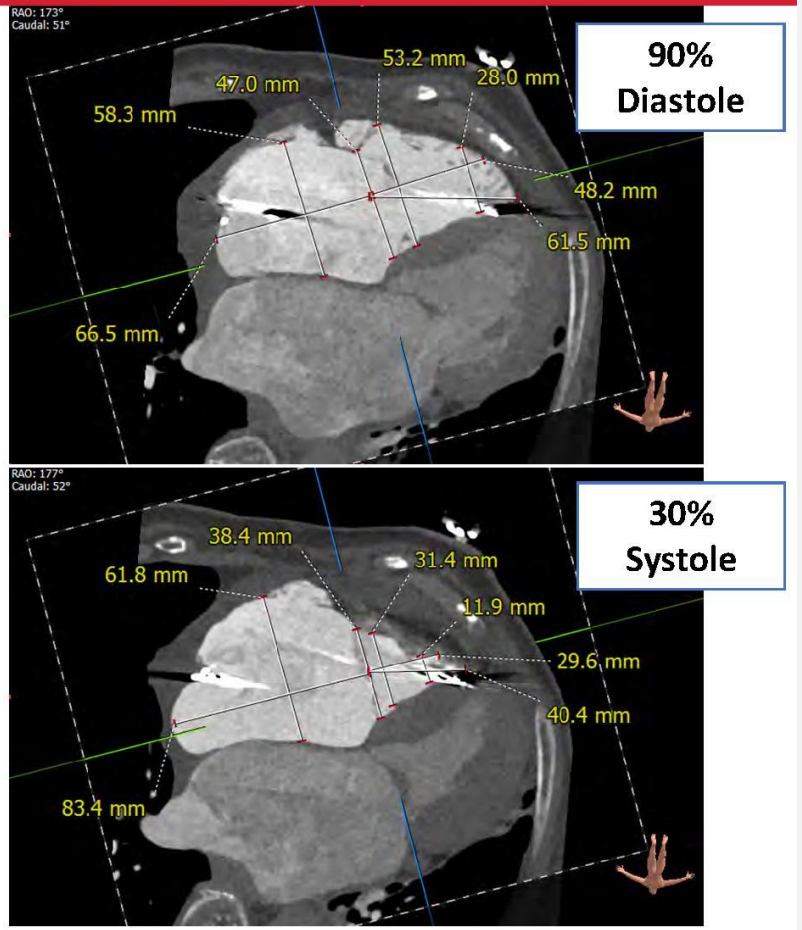
- 74-year-old female with worsening peripheral oedema and shortness of breath.
- History of atrial fibrillation, permanent pacemaker insertion, and previous TIA.
- Two hospital admissions with right sided heart failure
  - Echo demonstrated severe TR
  - Referred for consideration of transcatheter therapy



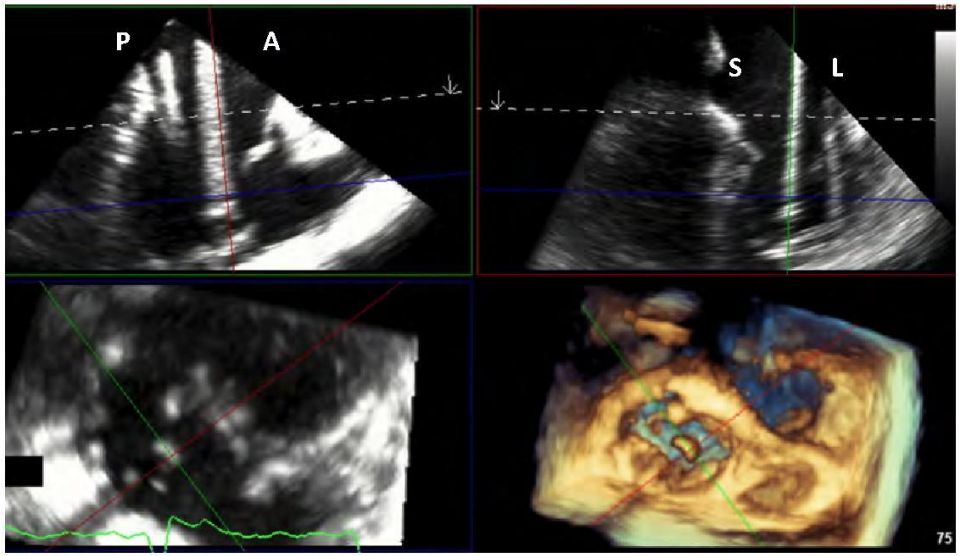


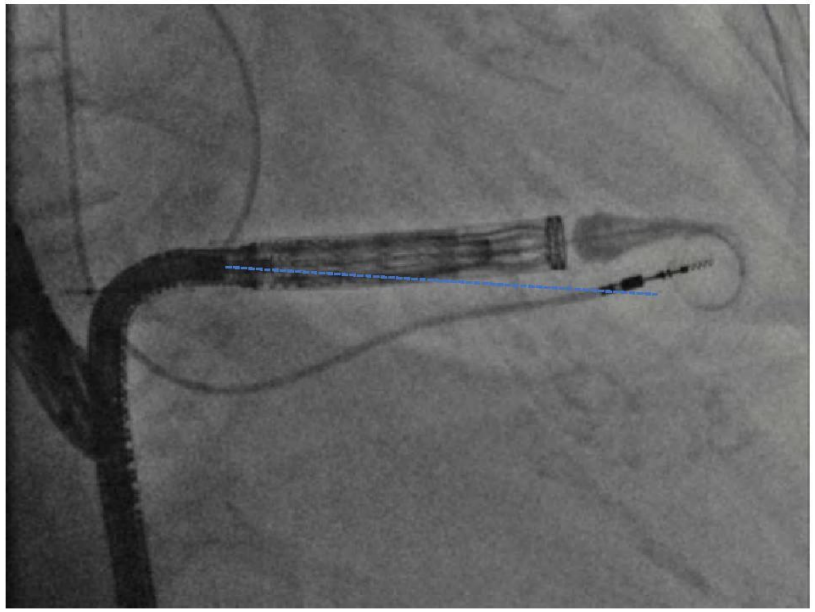
CT Screening to assess RV & TV anatomy





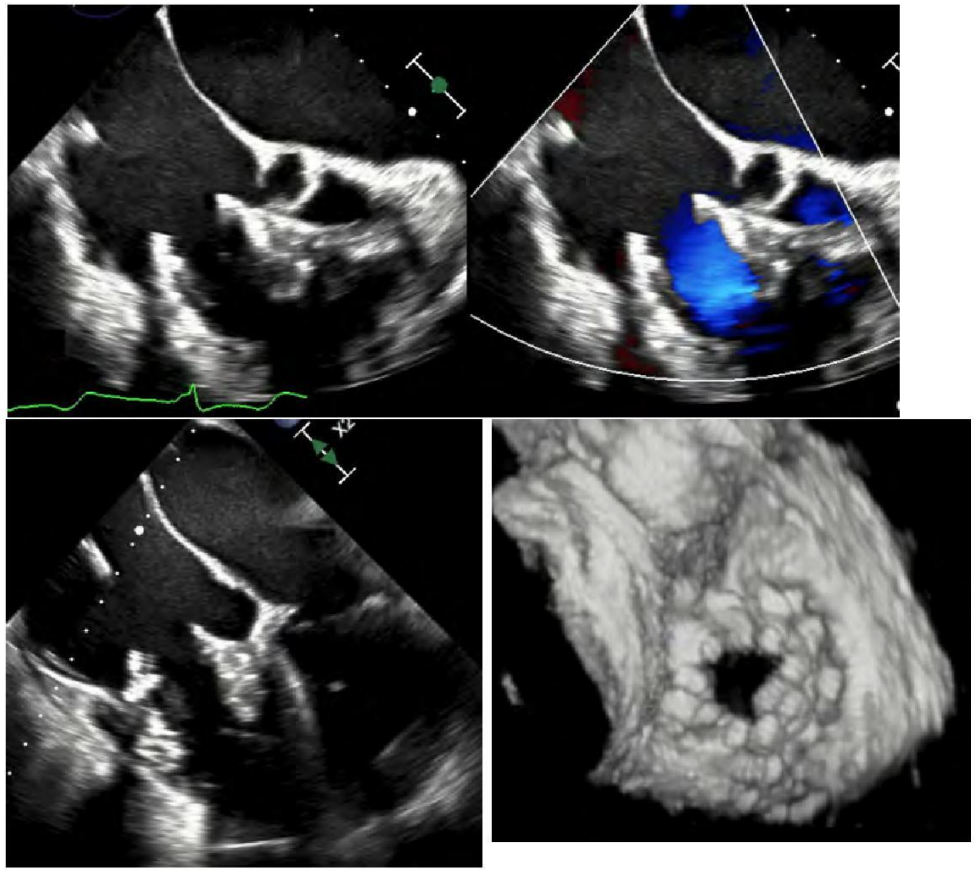
Procedure: Establish depth, position & trajectory

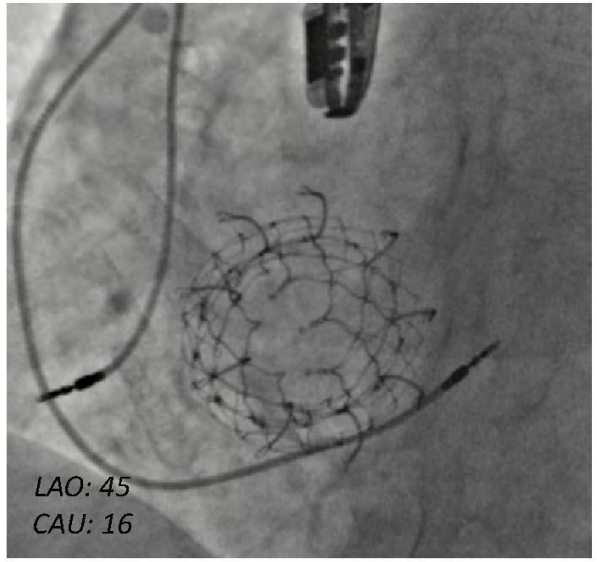




Interaction of the tapered tip with the RV was preventing the capsule from getting coaxial to the TV in A-P.

Procedure: Final Result





***TR reduction**: Severe to None*

Mean PG 1mmHg

On-going: TRISCEND Pivotal Study

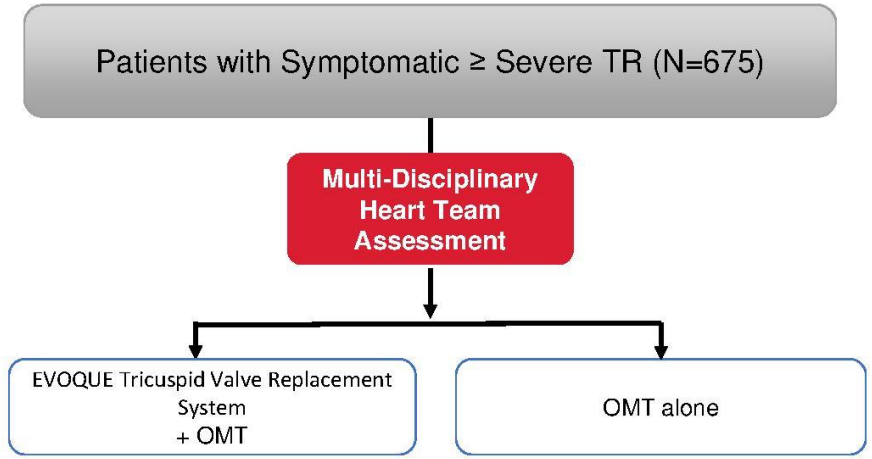
Edwards EVOQUE Transcatheter **T**ricuspid Valve **R**eplacement: Pivotal Clinical **I**nvestigation of **S**afety and **C**linical **E**fficacy Using a **N**ovel **D**evice

Prospective, multicenter, randomized, controlled pivotal trial

Inclusion Criteria:

- Age ≥ 18 years
- Symptomatic TR despite optimal medical therapy
- TR graded as ≥ severe
- Patient appropriate for transcatheter tricuspid valve replacement per the local heart team

THE TRISCEND II PIVOTAL TRIAL



Follow-up: discharge, 30 days, 3 months, 6 months, 1 year, and annually through 5 years

Primary Endpoints:

- MAE rate at 30 days
- TR grade reduction to ≤ moderate along with hierarchical composite endpoint including KCCQ, NYHA, and 6MWD improvement at 6 months
- Hierarchical composite endpoint including all-cause mortality, RVAD implantation or heart transplant, tricuspid valve intervention, heart failure hospitalizations, and improvements in KCCQ, NYHA, and 6MWD at 1 year

Clinicaltrials.gov NCT04482062

Transcatheter Tricuspid Valve Therapy

- There is renewed interest and focus on the tricuspid valve in the era of transcatheter valve technologies
- There are a number of concepts that have been shown to be feasible with early acceptable safety and efficacy results
- Early experience with dedicated devices to treat TR with valve replacement have encouraging results.
- On-going pivotal studies randomizing against medical therapy are essential to determining efficacy and safety.

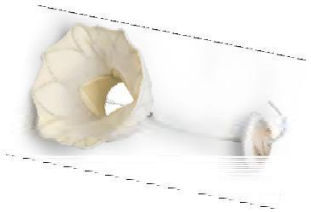
Key question: TR is associated with adverse outcomes but does transcatheter correction of TR result in improved clinical outcomes

Transcatheter mitral replacement vs repair?

- **More durable reduction in MR**
  - Residual MR following therapy affects survival
  - Residual MR in MitraFR: 17% had ≥3+ MR at 12 mos
  - Residual MR in COAPT: 31% had ≥2+ MR at 12 mos
- **Fewer anatomic and clinical exclusions**
  - Able to treat small valves, MAC, multiple jets and perforations
  - Some devices able to treat mitral stenosis
  - Exclusions of those considered for COAPT = 58%
- **Reproducible procedural success**
  - Encouraging data with regards to feasibility and safety with a variety of devices

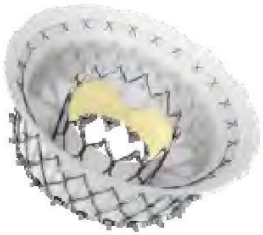
TMVR Devices

Tendyne (Abbott)



M3 (Edwards)

Intrepid (Medtronic)



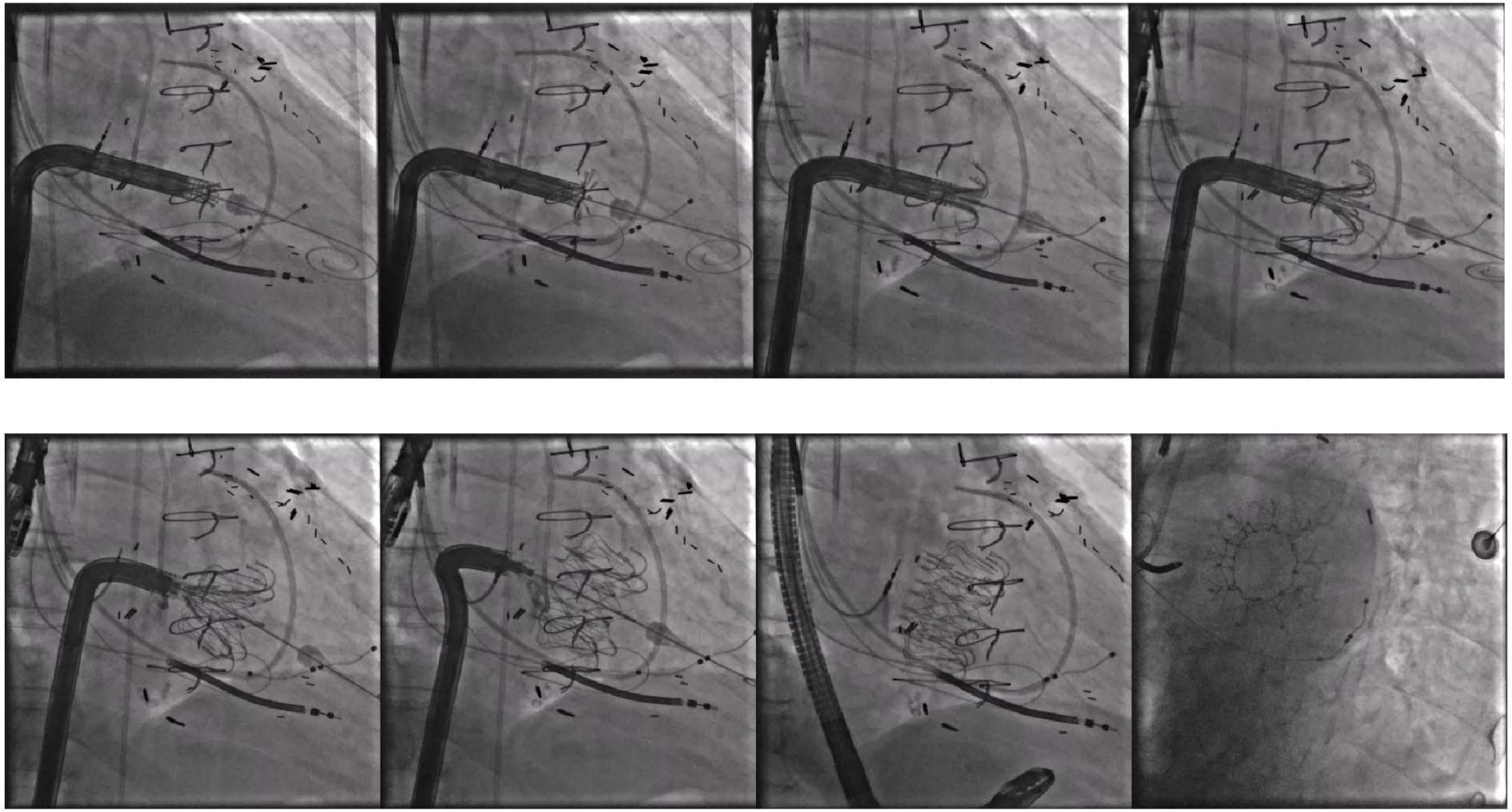
Tiara (Neovasc)

Cephea (Abbott)

EVOQUE (Edwards)

Highlife

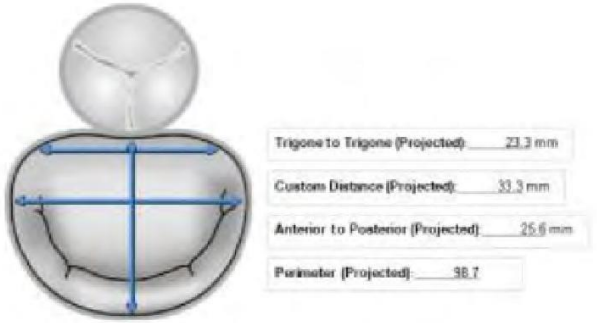
AltaValve

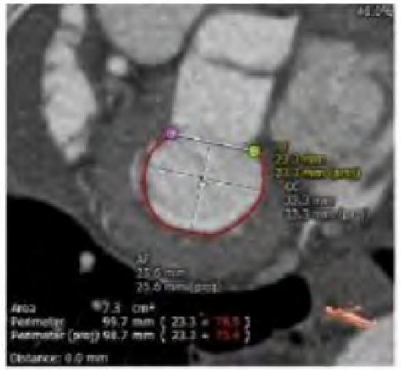


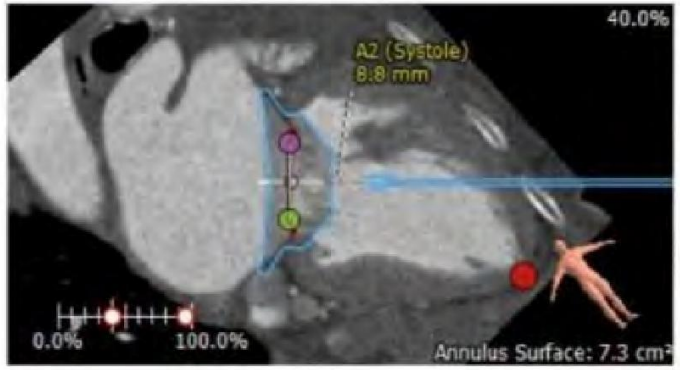
Tendyne: Case Example

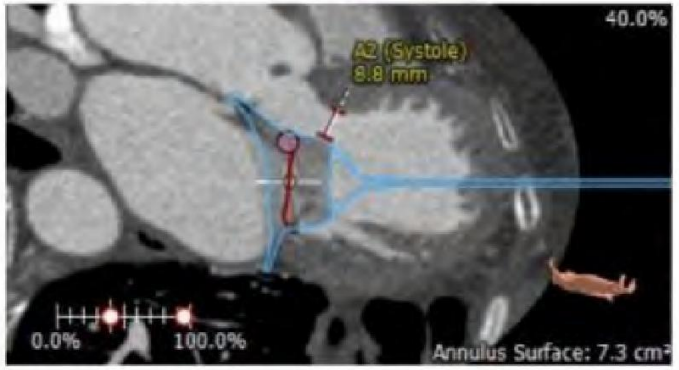
Cedars Sinai
Smidt Heart Institute

76-year-old female with severe MR with a history of chest wall radiation. She referred for percutaneous treatment of mitral regurgitation



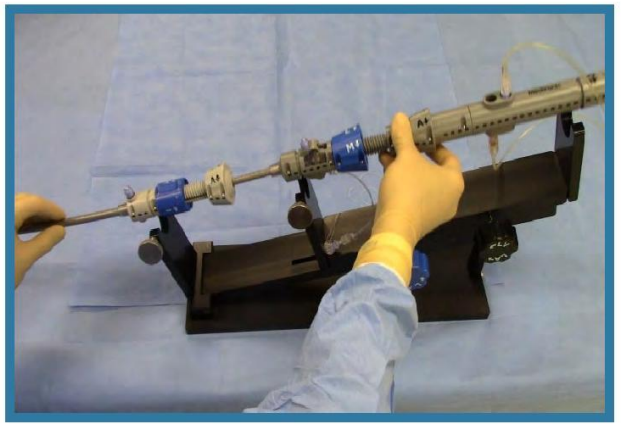


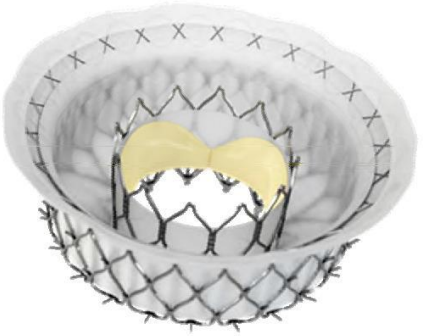




Intrepid TMVR

Cedars Sinai
Smidt Heart Institute



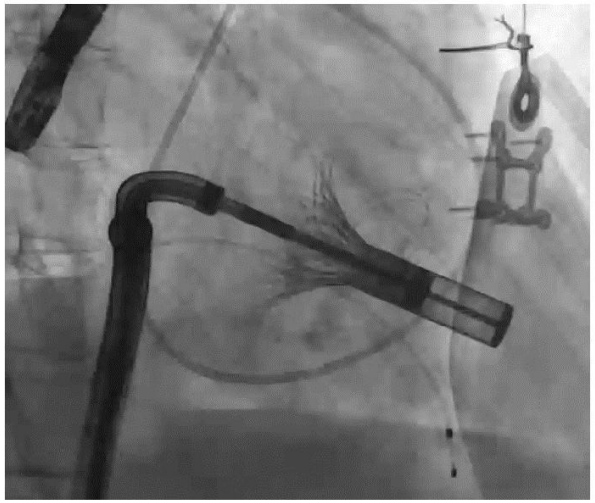


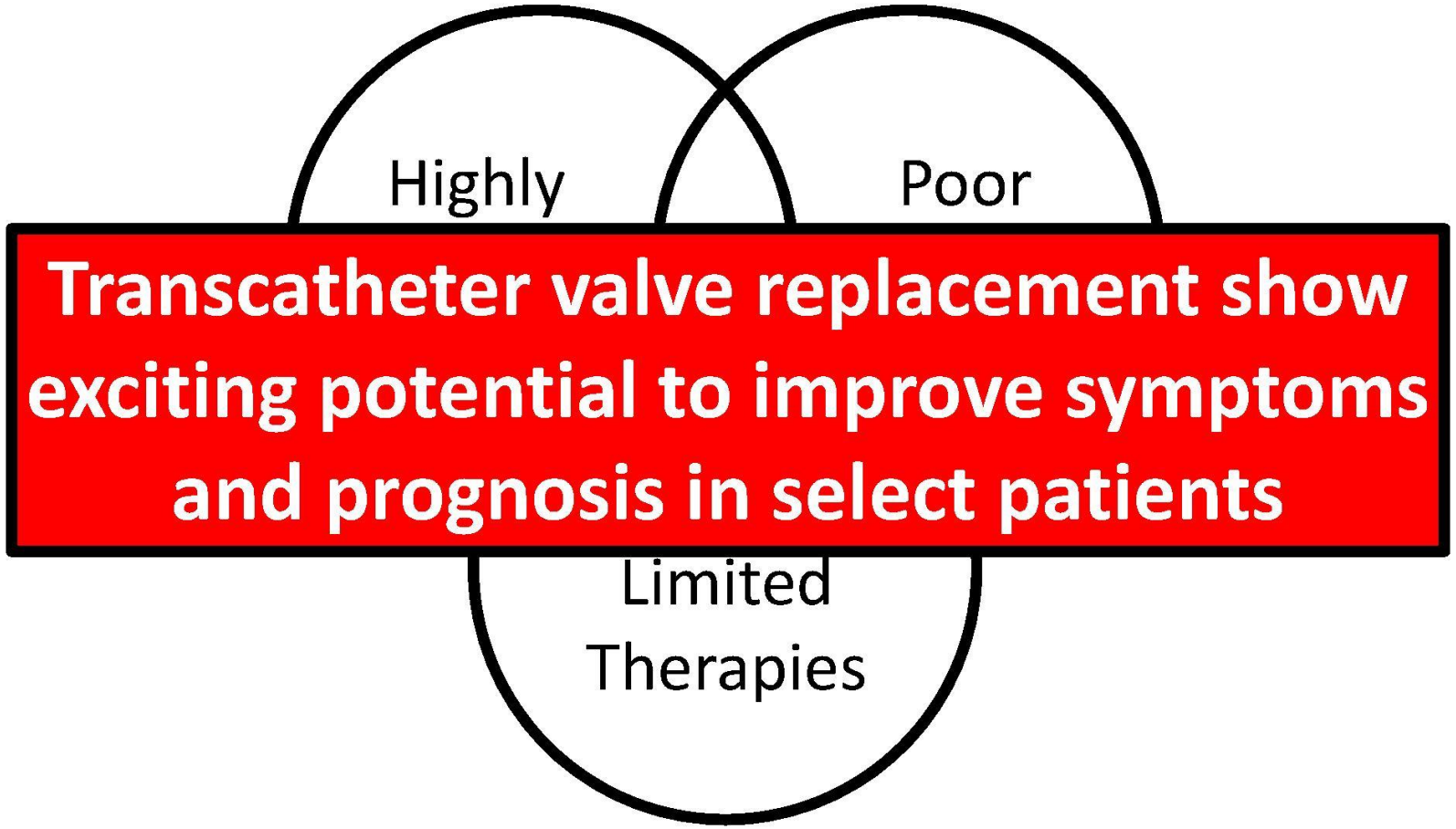
- Conformable Outer Stent engages the annulus and leaflets providing fixation & sealing while isolating the inner stent from the dynamic anatomy
- Circular Inner Stent houses a 27mm tricuspid bovine pericardium valve
- Flexible Brim aids imaging during implantation & subsequent tissue in-growth

Intrepid™ TMVR Transeptal System

Intrepid™ TMVR Delivery System

- Transfemoral access with dilator and 35-Fr sheath
- Cradle and delivery catheter with familiar transeptal MV maneuvers




Highly
Poor
Transcatheter valve replacement show exciting potential to improve symptoms and prognosis in select patients
Limited
Therapies

MONUMENT HEALTH STRUCTURAL HEART TEAM

MONUMENT HEALTH