



Echo for TAVR

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DISCLOSURE

Relevant Financial Relationship(s)

None

Off Label Usage

None

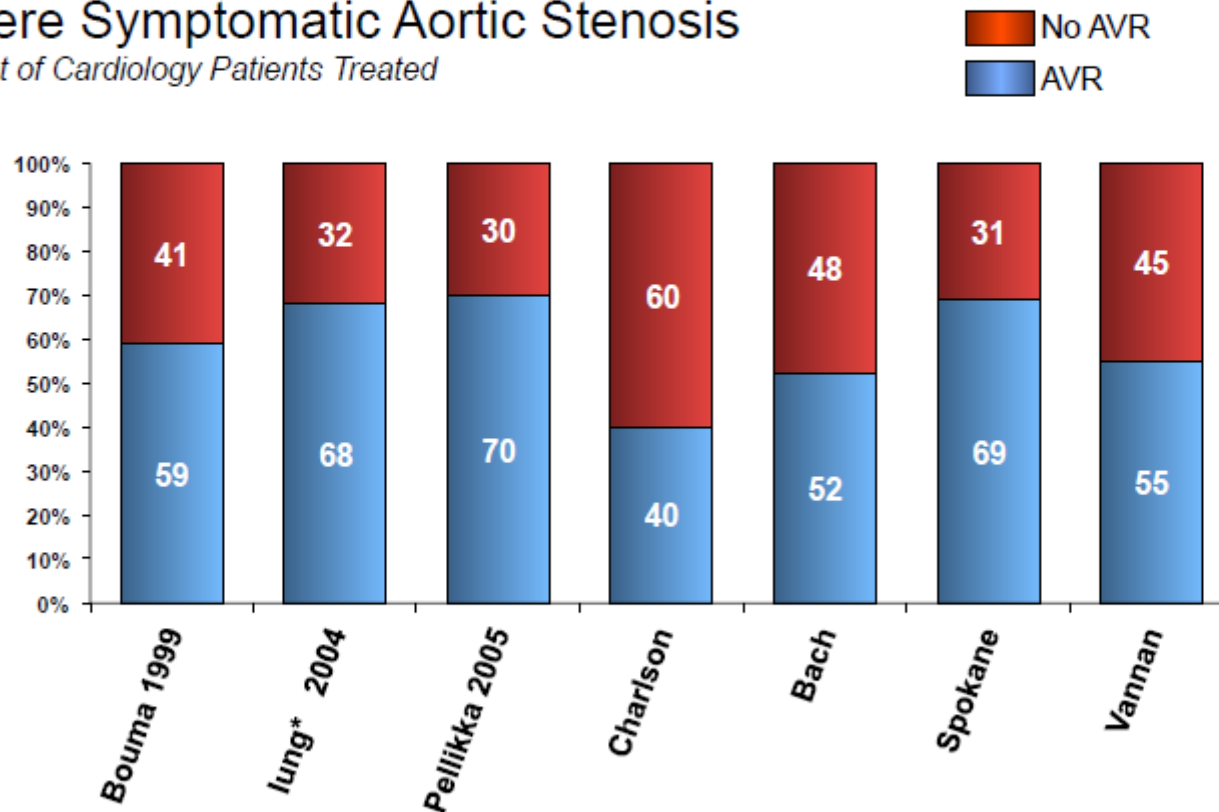
Overview

- TAVR Background/Outcomes
- Pre-procedural imaging
- Peri-procedural imaging
- Follow-up imaging

At Least 30% of Patients with Severe Symptomatic AS are “Untreated”!

Severe Symptomatic Aortic Stenosis

Percent of Cardiology Patients Treated



Under-treatment especially prevalent among patients managed by *Primary Care* physicians

1. Bouma B J et al. To operate or not on elderly patients with aortic stenosis: the decision and its consequences. *Heart* 1999;82:143-148
2. lung B et al. A prospective survey of patients with valvular heart disease in Europe: The Euro Heart Survey on Valvular Heart Disease. *European Heart Journal* 2003;24:1231-1243 (*includes both Aortic Stenosis and Mitral Regurgitation patients)
- Pellikka, Sarano et al. Outcome of 622 Adults with Asymptomatic, Hemodynamically Significant Aortic Stenosis During Prolonged Follow-Up. *Circulation* 2005
- Charlson E et al. Decision-making and outcomes in severe symptomatic aortic stenosis. *J Heart Valve Dis* 2006;15:312-321

87 Year Old Man with NYHA Class IV Dyspnea

• Physical Exam

- BP 96/67 HR 60
- JVP: elevated
- Carotids: tardus and parvus
- Heart: Single component S2, 3/6 late-peaking SEM, 2/6 HSM at apex
- Lungs: bibasilar crackles
- Ext: 2+ edema

• Past Medical History

- CABG: age 69
- Redo CABG: age 81
- Atrial Fibrillation
- HTN
- Hyperlipidemia
- OSA
- CKD (baseline Cr 2.5)
- Remote tobacco use
- Mild cognitive impairment

87 Year Old Man with NYHA Class IV Dyspnea

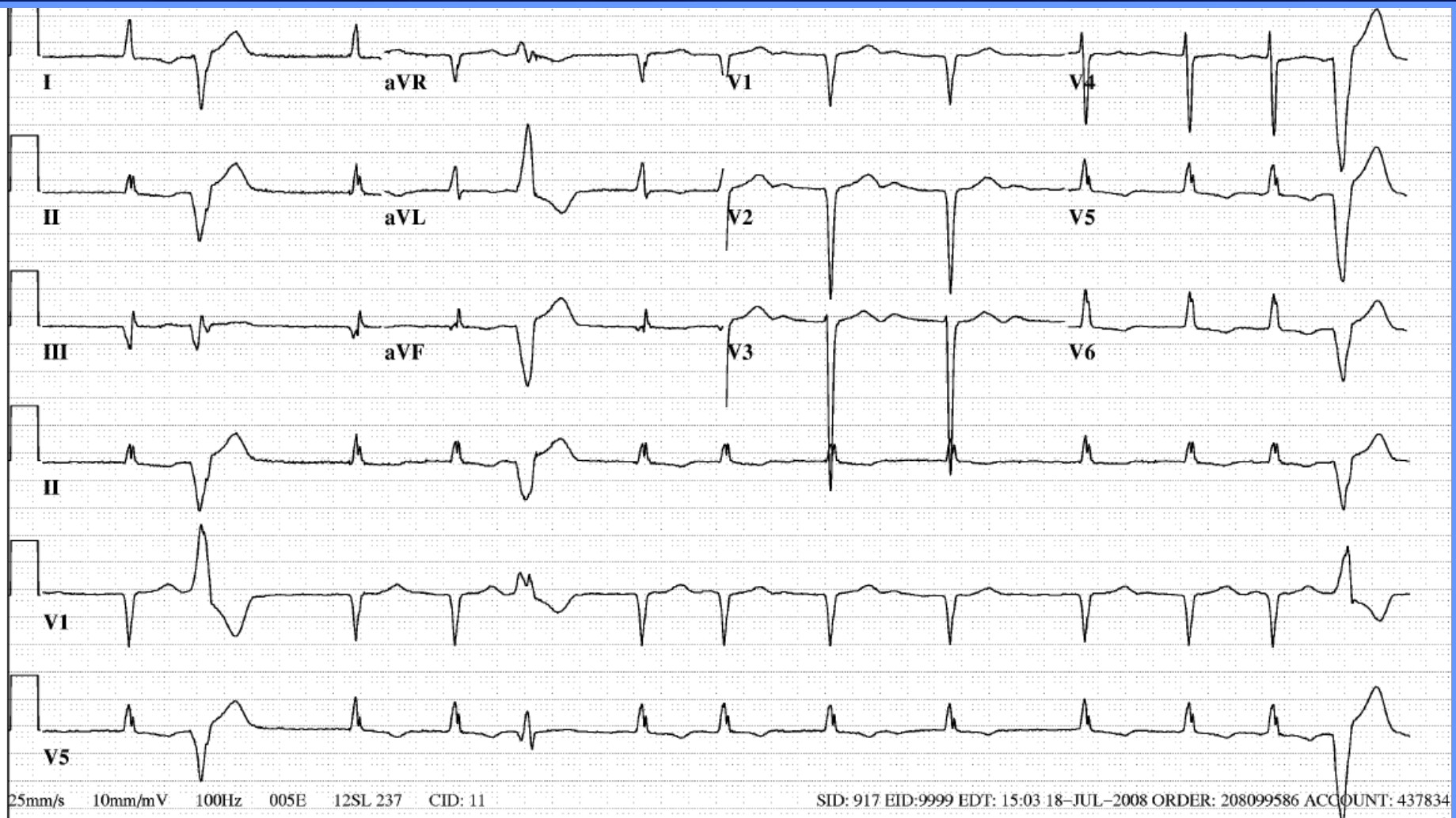
- **Meds:**

- Statin
- ACE-I
- Beta Blocker
- Diuretic
- Nitrate
- Coumadin
- PPI

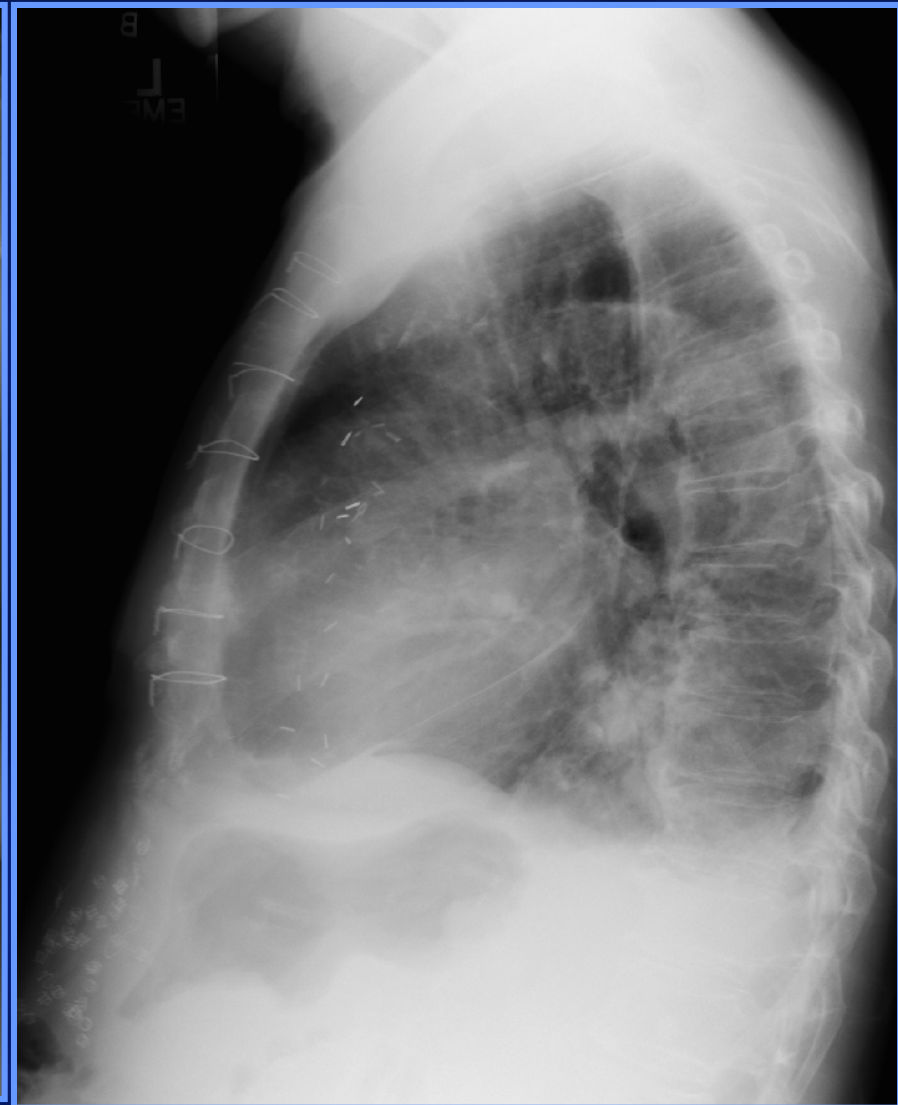
- **Abnormal Labs:**

- Hgb: 11.3 g/dl
- Cr: 2.6 mg/dl
- INR: 2.5
- BNP 1655 pg/ml

EKG

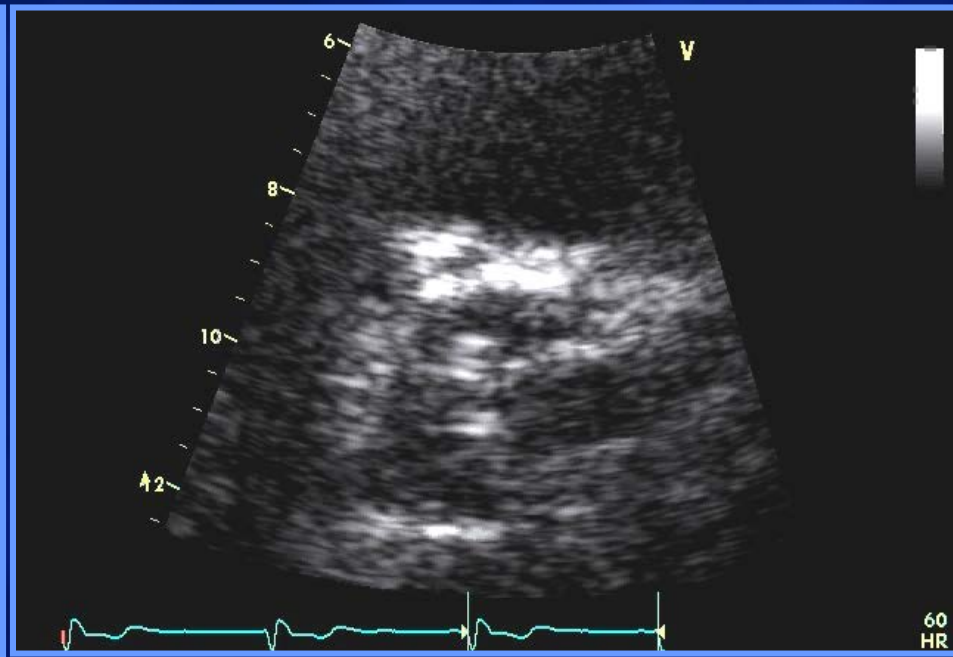
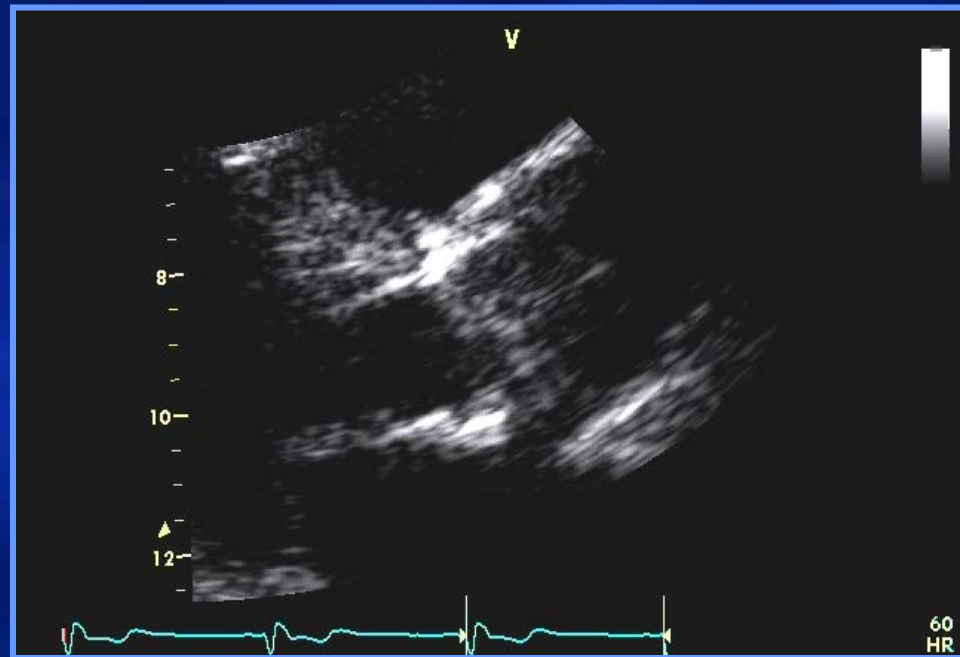


CXR



Echocardiogram

- LV Ejection Fraction = 20-25%
- Aortic valve area = 0.58 cm²
- Mean aortic valve gradient = 65 mmHg
- Moderate to Severe MR
- Moderate TR



Cardiac Catheterization

- LIMA – LAD patent
- SVG – R-PDA patent
- 100% occluded LAD, LCX, and RCA
- **Nothing to revascularize**

Summary

- 87 year old man
- Severe AS with Class IV symptoms, LV dysfunction, and multiple comorbidities
 - 2 prior CABG operations
 - Creatinine = 2.6 mg/dl
- Options?
- What is the risk of surgery?

Online STS Risk Calculator

STS Risk Calculator - Windows Internet Explorer

http://66.89.112.110/STSWebRiskCalc261/de.aspx

File View Favorites Tools Help

Online STS Risk Calculator

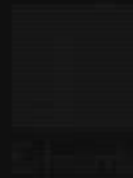
Risk of Mortality = 20.1%
Risk of Morbidity or Mortality = 68.9%
Risk of Long Length of Stay = 39.4%
Risk of Permanent Stroke = 8.1%
Risk of Renal Failure = 31.3%

- Replacement
- Repair/Reconstruction
- Root Reconstruction with Valve Conduit
- Replacement + aortic graft conduit (not a valve conduit)
- Root Reconstruction with Valve Sparing
- Resuspension Aortic Valve with replacement of ascending Aorta
- Resuspension Aortic Valve without replacement of ascending Aorta
- Resection Sub-Aortic Stenosis

Prolonged Ventilation	31.1%
DSW Infection	0.3%
Renal Failure	31.3%
Reoperation	24.2%

The Edwards SAPIEN Transcatheter Heart Valve

Transfemoral Procedure Using the
RetroFlex Delivery System

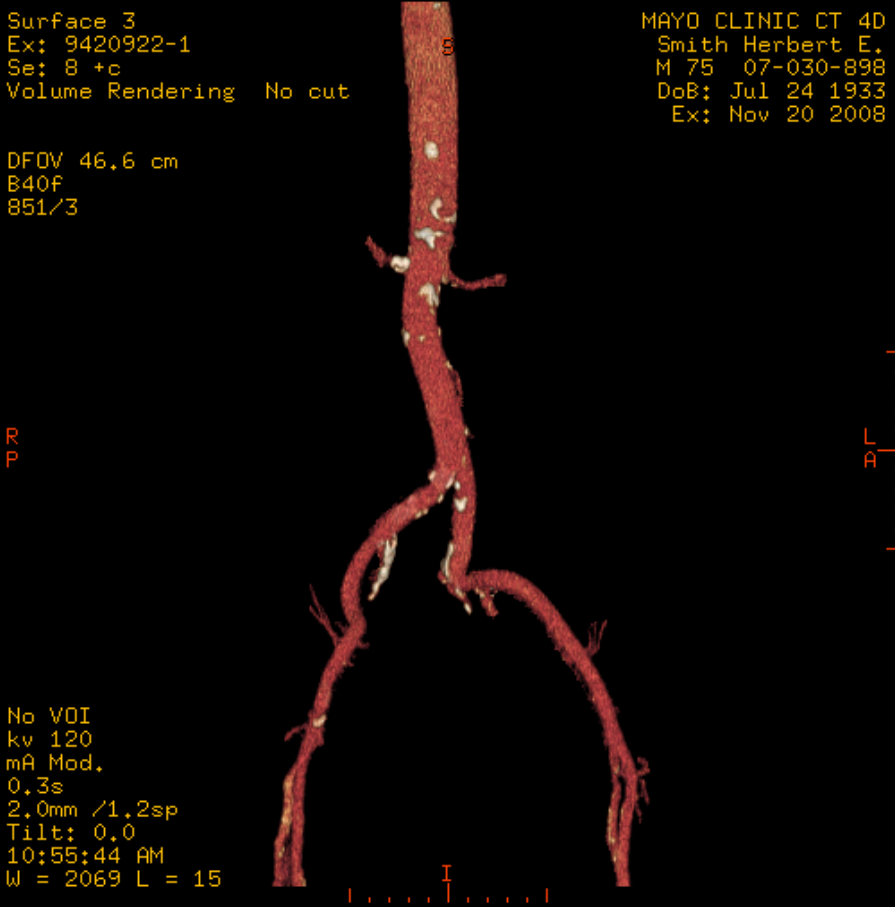


Screening For Vascular Access

Surface 3
Ex: 9420922-1
Se: 8 +c
Volume Rendering No cut

MAYO CLINIC CT 4D
Smith Herbert E.
M 75 07-030-898
DoB: Jul 24 1933
Ex: Nov 20 2008

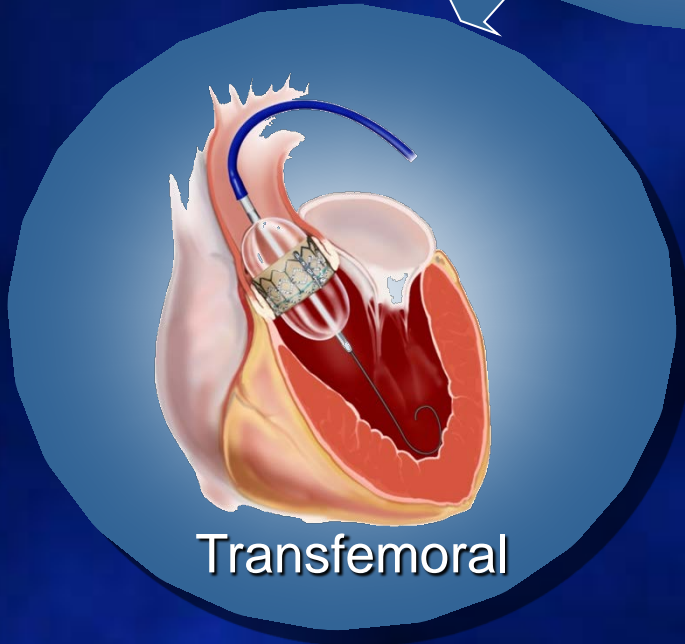
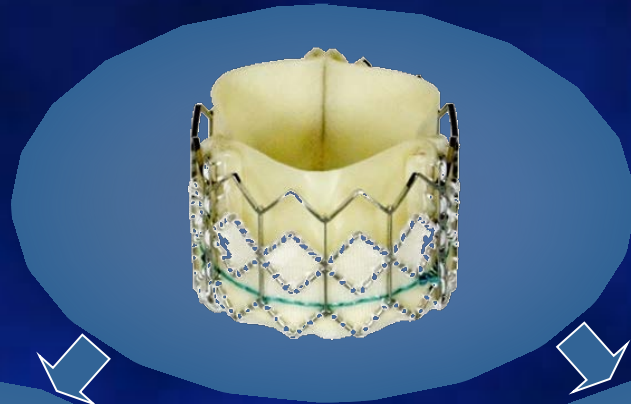
DFOV 46.6 cm
B40F
851/3



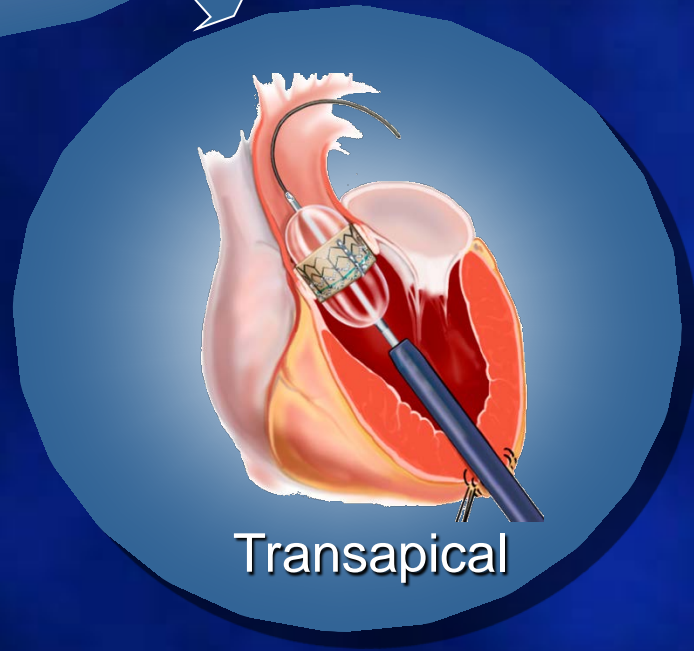
No VOI
kv 120
mA Mod.
0.3s
2.0mm /1.2sp
Tilt: 0.0
10:55:44 AM
W = 2069 L = 15



Transfemoral and Transapical



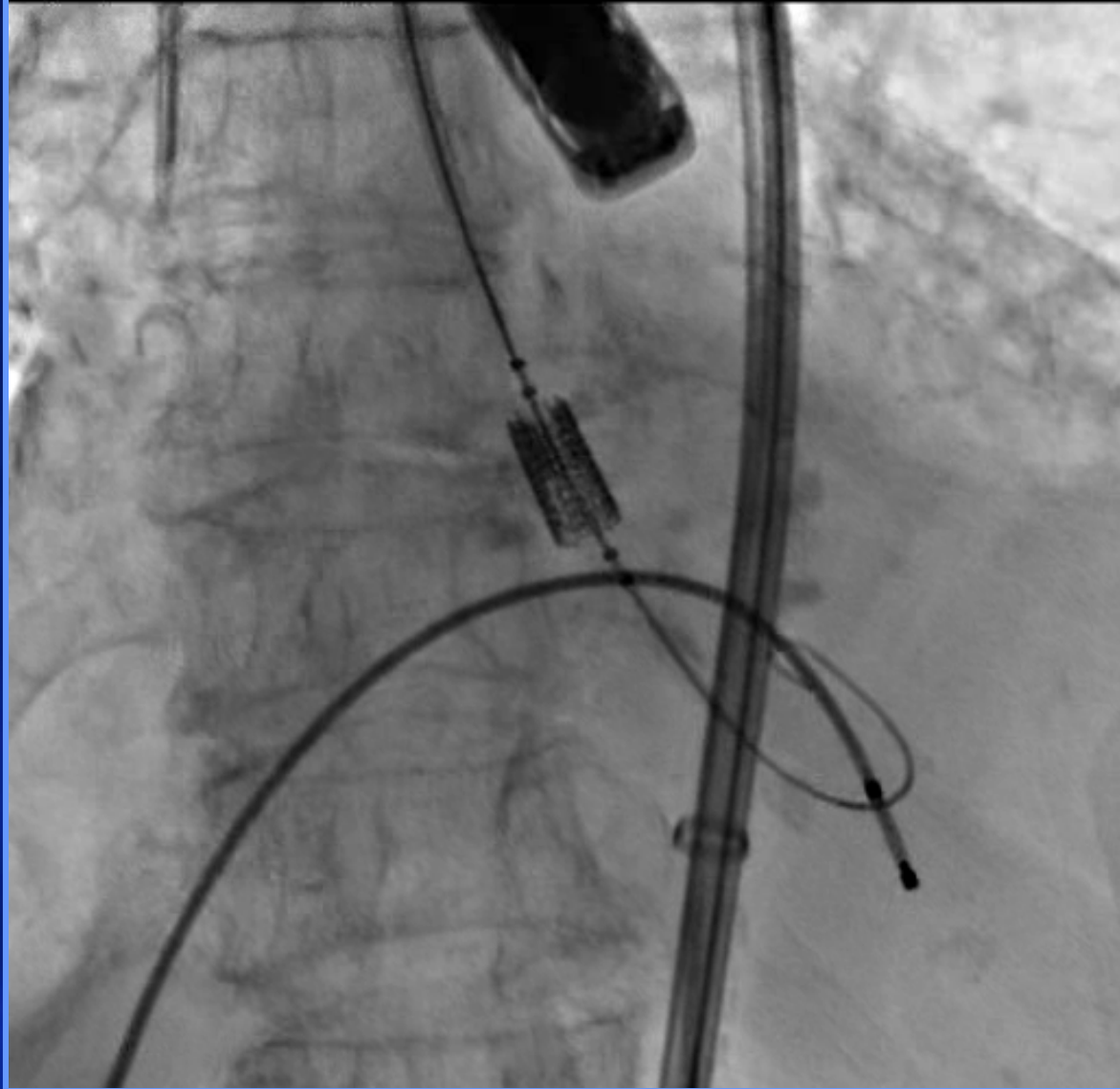
Transfemoral



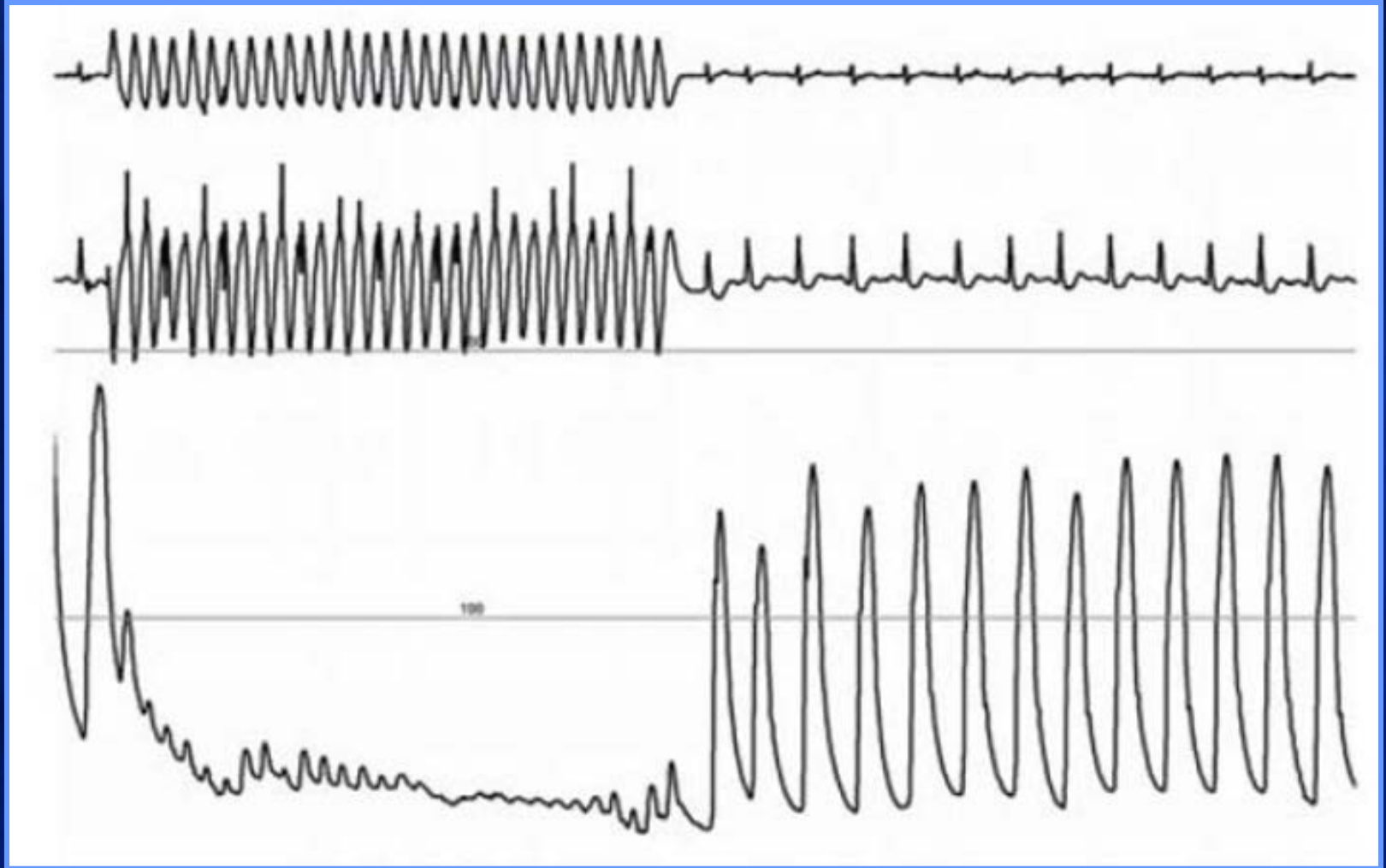
Transapical

Deploying the Valve

Lousy compression - not intended for diagnosis



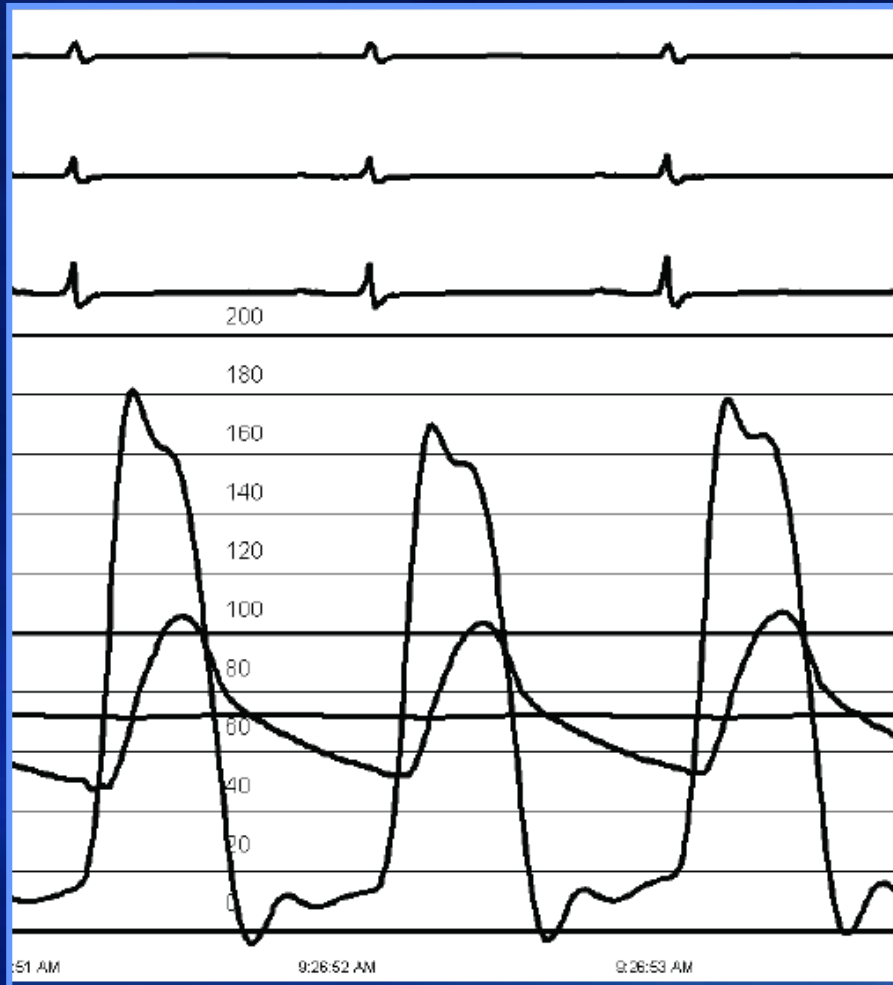
Rapid Ventricular Pacing



Our Patient

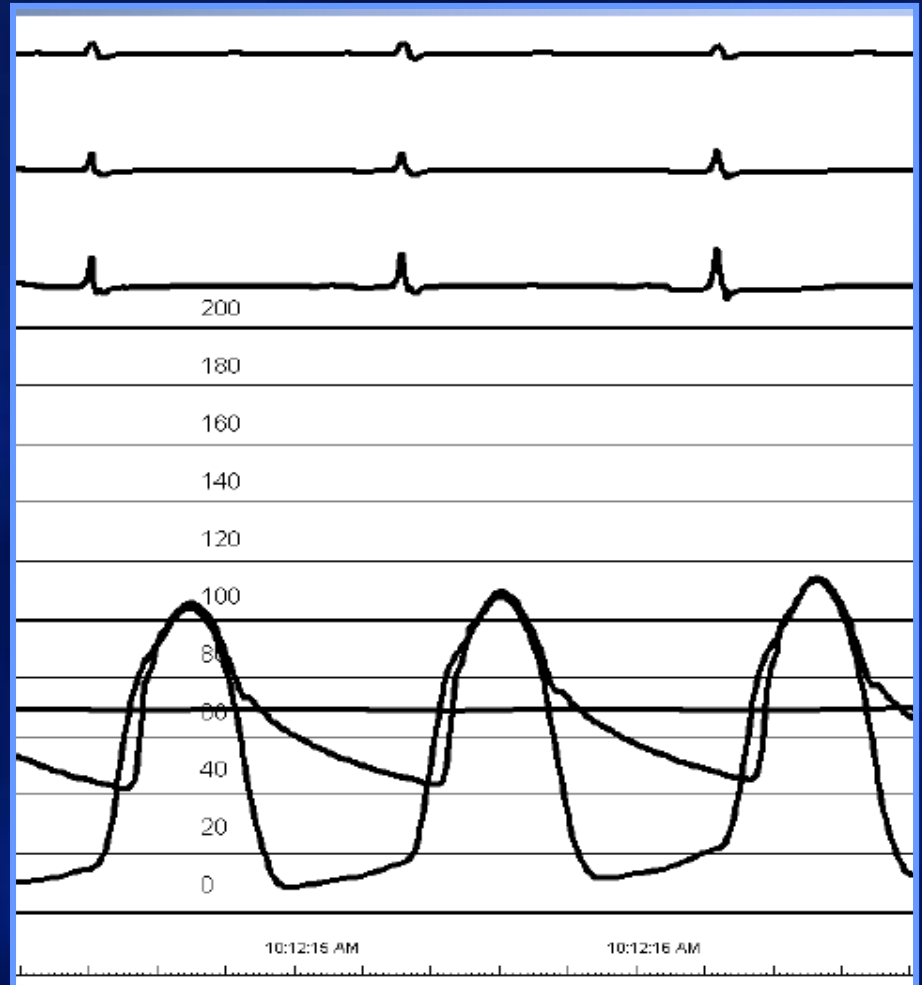
Pre-AVR

MG=65 mmHg, AVA=0.5cm²



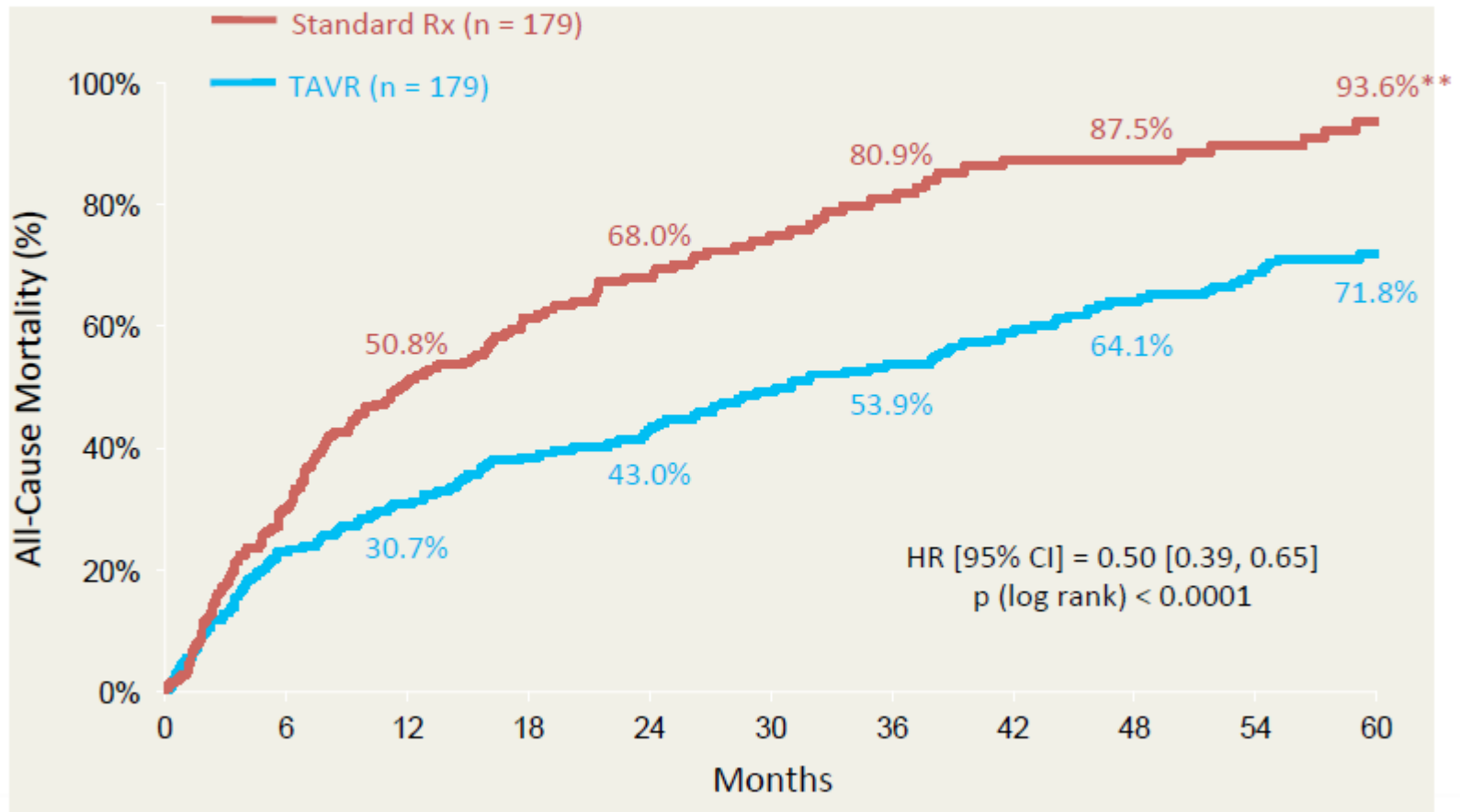
Post-AVR

MG=9mmHg, AVA=2.1cm²



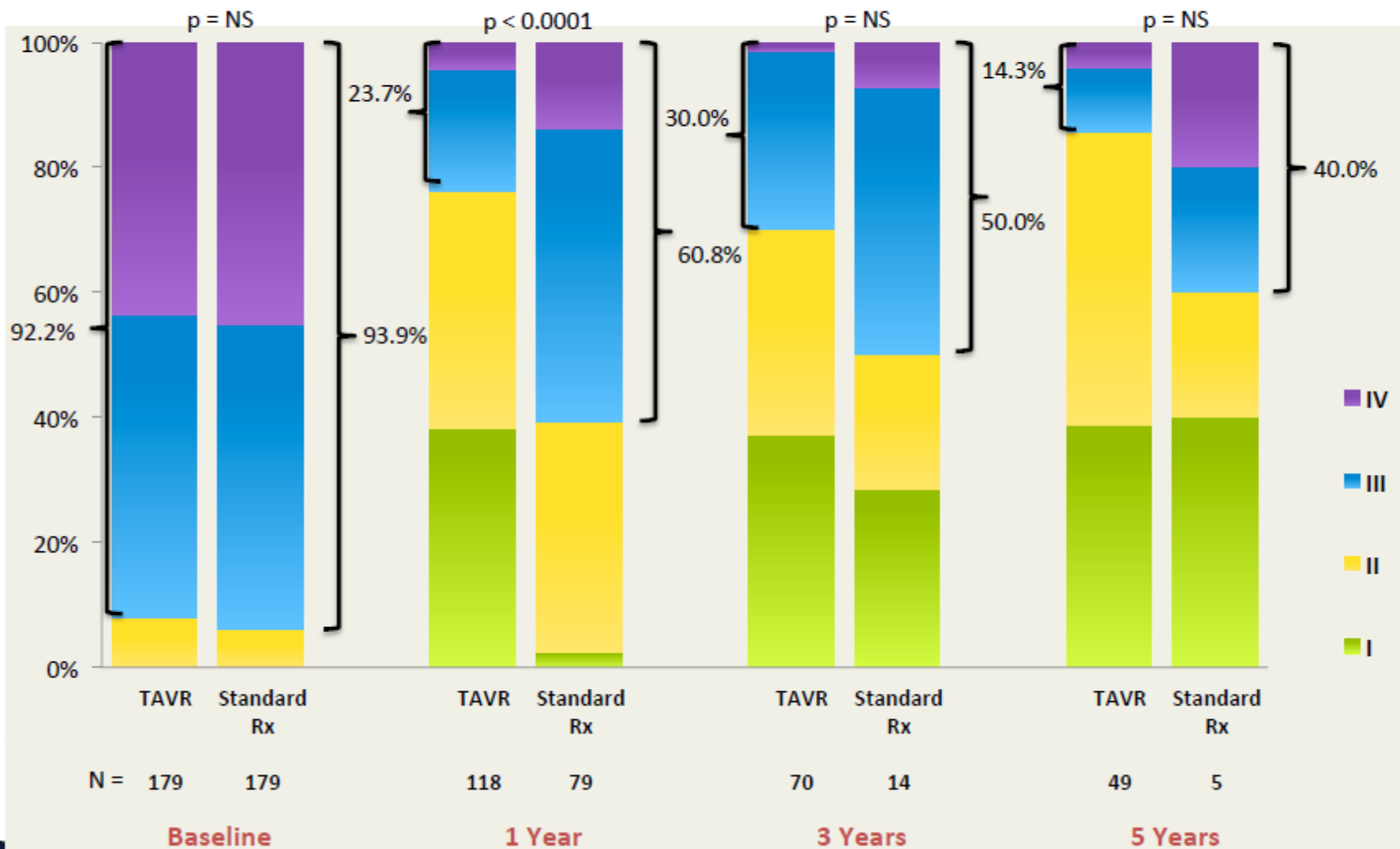
TAVR Improves Survival

PARTNER Cohort B (TAVR vs Standard Therapy)



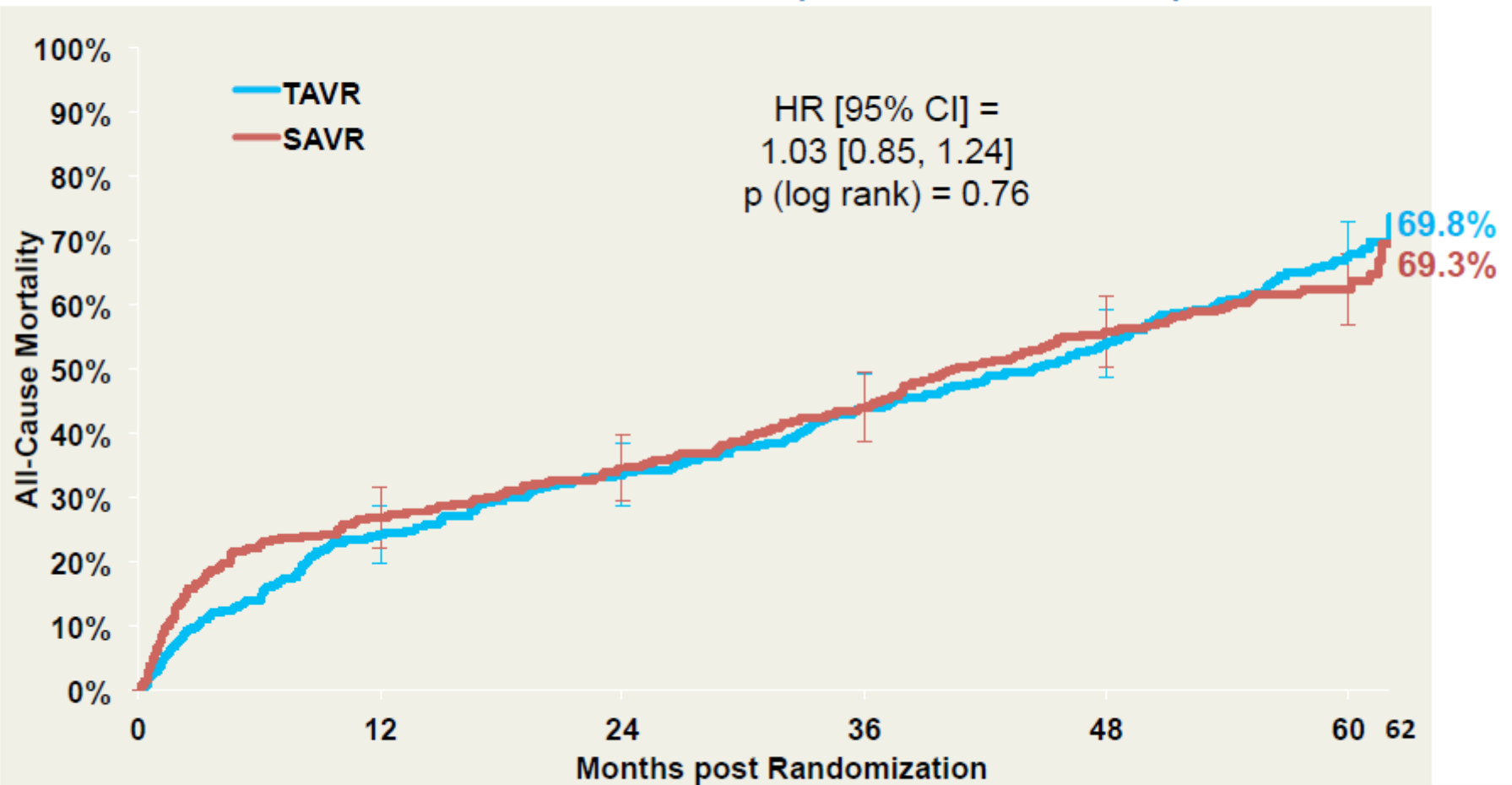
** Only 1 standard Rx patient was alive at 5 years who didn't crossover to TAVR or had SAVR (out of protocol)

TAVR Improves Quality of Life



TAVR is Equivalent to Surgery

PARTNER Cohort A (TAVR vs. SAVR)



TAVR	348	262	228	191	154	61	8
SAVR	351	236	210	174	131	64	8

Neurologic Events

Outcome	30 Days			1 Year		
	TAVR (N = 348)	AVR (N = 351)	P	TAVR (N = 348)	AVR (N = 351)	P
All Stroke or TIA – no. (%)	19 (5.5)	8 (2.4)	0.04	27 (8.3)	13 (4.3)	0.04
TIA – no. (%)	3 (0.9)	1 (0.3)	0.33	7 (2.3)	4 (1.5)	0.47
All Stroke – no. (%)	16 (4.6)	8 (2.4)	0.12	20 (6.0)	10 (3.2)	0.08
Major Stroke – no. (%)	13 (3.8)	7 (2.1)	0.20	17 (5.1)	8 (2.4)	0.07
Minor Stroke – no. (%)	3 (0.9)	1 (0.3)	0.34	3 (0.9)	2 (0.7)	0.84
Death/maj stroke – no. (%)	24 (6.9)	28 (8.2)	0.52	92 (26.5)	93 (28.0)	0.68

Sapien Valve



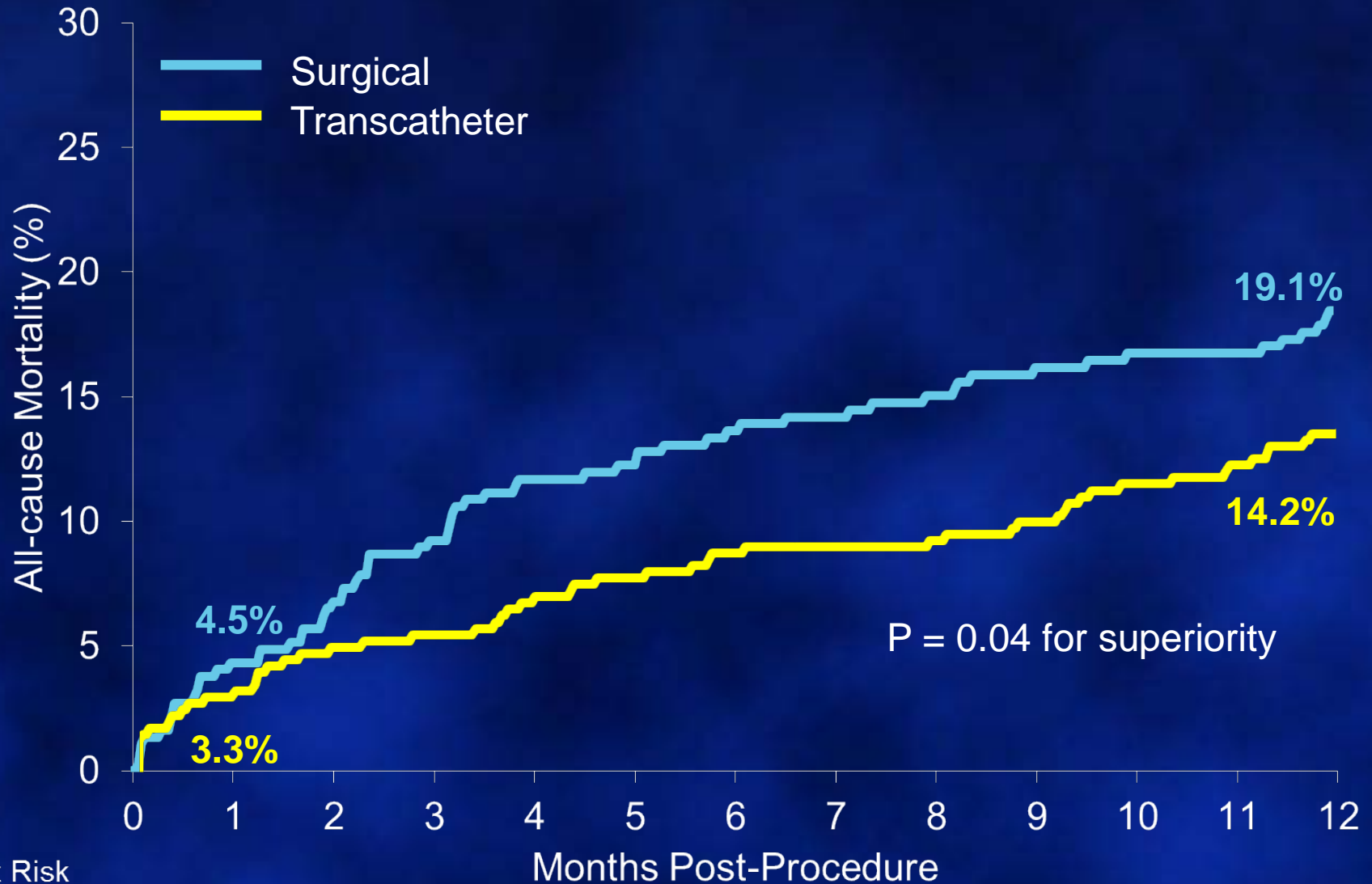
Balloon Expandable

CoreValve



Self Expandable

Primary Endpoint: 1 Year All-cause Mortality



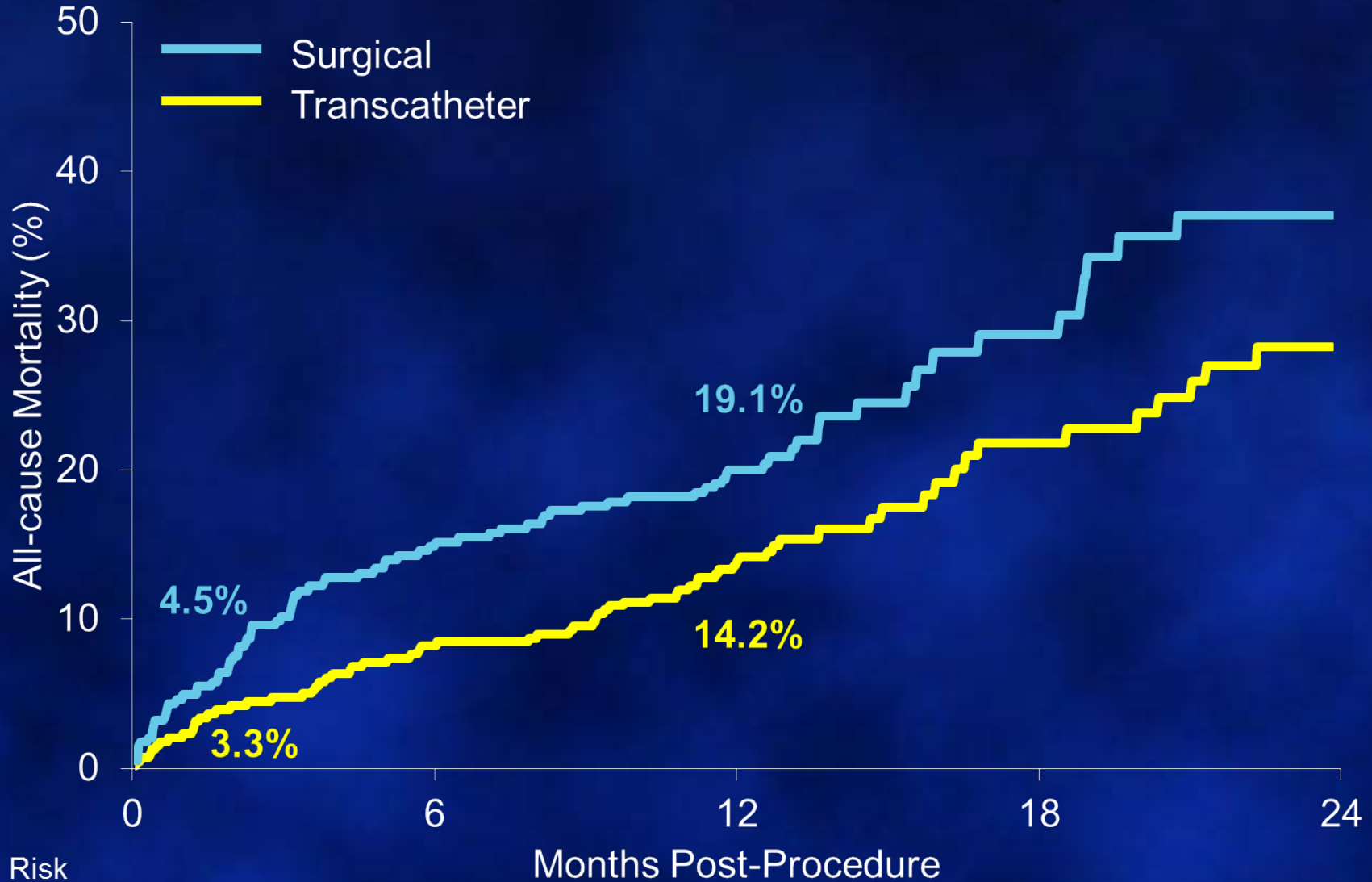
P = 0.04 for superiority

No. at Risk

Months Post-Procedure

Surgical	357	341	297	274
Transcatheter	390	377	353	329

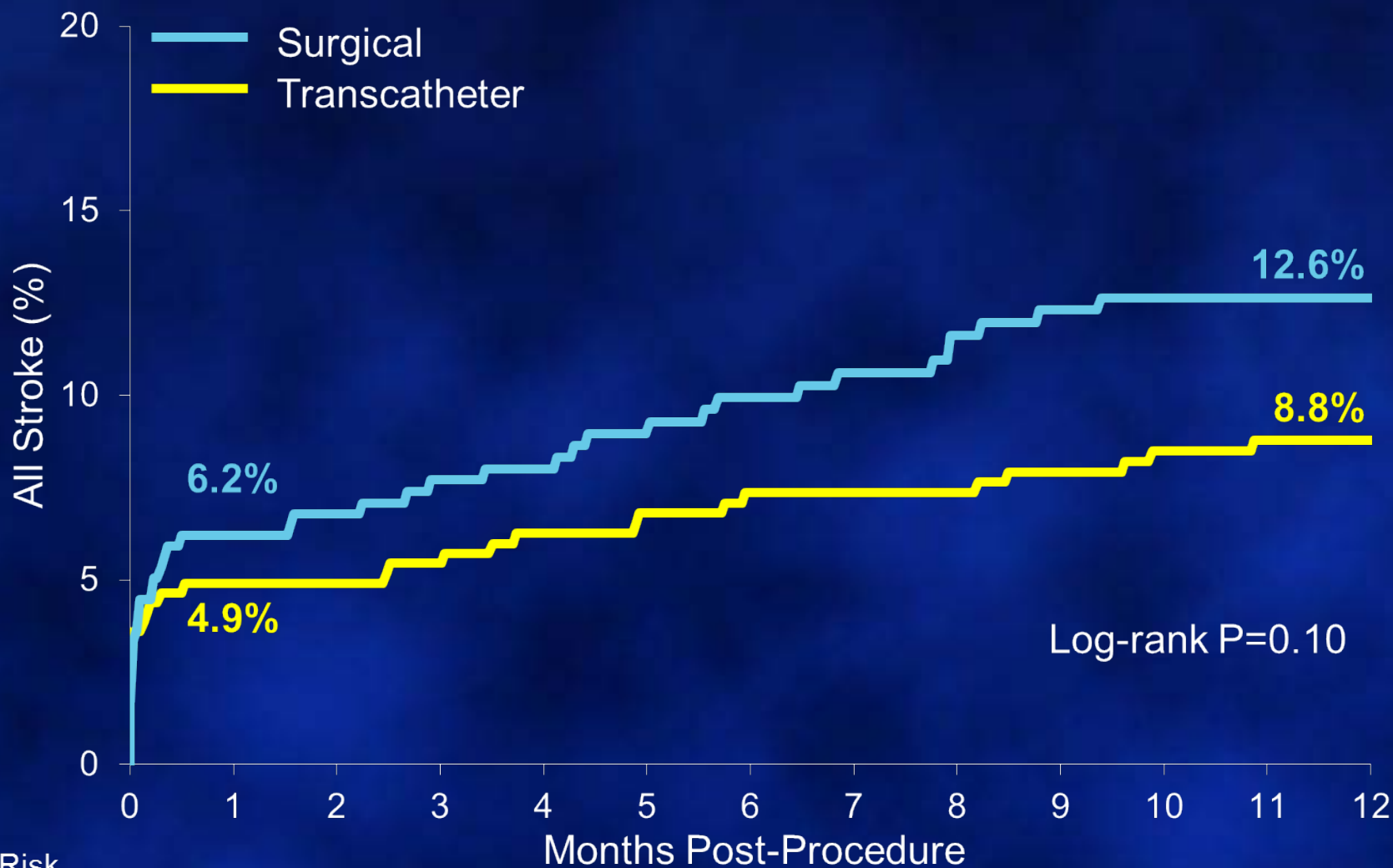
2-Year All-cause Mortality



No. at Risk

Surgical	357	341	274	28
Transcatheter	390	377	329	38

All Stroke



No. at Risk

Surgical	357	322	274	249
Transcatheter	390	363	334	314

Pre-Procedural Planning

Echo Check List

- **Confirm trileaflet AV morphology**
- **Presence/degree of AR, MR, TR**
- **LV/RV function**
- **Presence of basal septal hypertrophy/LVOT obstruction**
- **Presence of pericardial effusion**
- **Exclude LA or LV thrombus**

Intra/post Procedural Objectives

- **Ensure proper prosthesis placement**
- **Assess prosthesis position & function after deployment**
- **Assess ventricular function**
- **Identify immediate post deployment complications**

Echo for TAVR

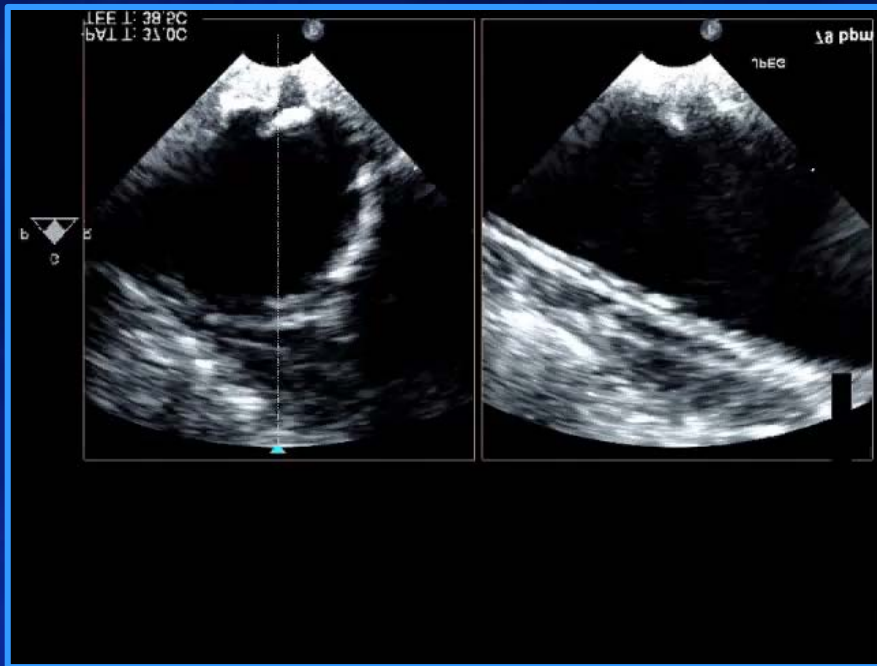
Objectives

- **Assess atherosclerosis**
- **Select device size**
- **Assess landing zone site for suitability of valve deployment/potential complications**
- **Guide valve deployment & monitor/assess periprocedural complications**

Echo for TAVR

- **Assess atherosclerosis**
- **Select device size**
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Atherosclerosis in the Thoracic Aorta



Echo for TAVR

Objectives

- Assess atherosclerosis
- **Select device size**
- Assess landing zone site for suitability of valve deployment/potential complications
- Guide valve deployment & monitor/assess periprocedural complications

Measurement of Annulus Diameter

- **Undersized prostheses**→
 - Periprosthetic AR
 - Device migration
 - Prosthesis-patient mismatch
- **Oversized prostheses**→
 - Underexpansion with central regurgitation
 - Annular rupture
 - Coronary ostial obstruction

Sizing of Aortic Annulus Pre-TAVR

Question: How do you do it?

1. 2D TEE

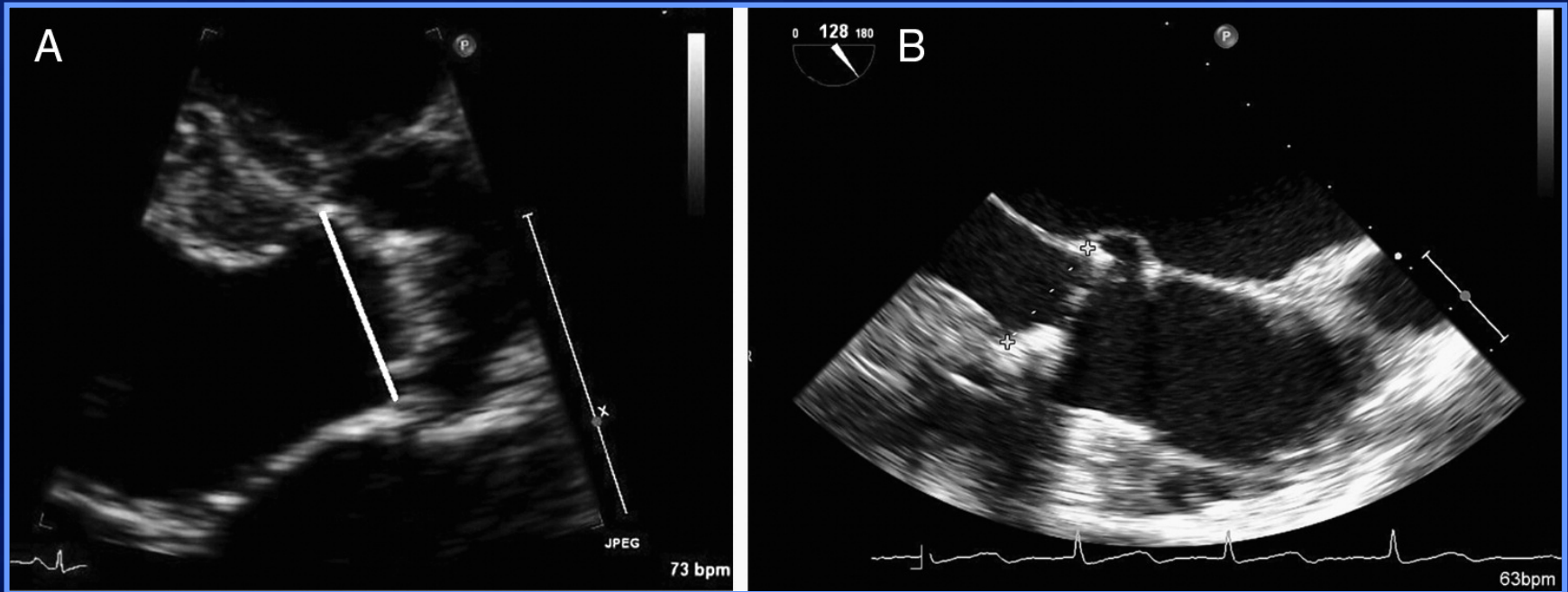
2. 3D TEE

3. CT

4. Both

5. Other

Early TAVR Method: 2D Echo



Journal of the American Society of Echocardiography 2011; 24:937-965

CLINICAL RESEARCH

Interventional Cardiology

Multimodal Assessment of the Aortic Annulus Diameter

Implications for Transcatheter Aortic Valve Implantation

David Messika-Zeitoun, MD, PHD,*‡ Jean-Michel Serfaty, MD, PHD,† Eric Brochet, MD,‡
Gregory Ducrocq, MD,‡ Laurent Lepage, MD,‡ Delphine Detaint, MD,‡ Fabien Hyafil, MD,‡
Dominique Himbert, MD,‡ Nicoletta Pasi, MD,† Jean-Pierre Laissy, MD, PHD,† Bernard Iung, MD,‡
Alec Vahanian, MD‡

Paris, France

Objectives

We sought to compare 3 methods of measurements of the aortic annulus, transthoracic echocardiography (TTE),

Conclusions: In patients referred for TAVI, measurements of the aortic annulus using TTE, TEE, and MSCT were close but not identical, and the method used has important potential clinical implications on TAVI strategy. In the absence of a gold standard, a strategy based on TEE measurements provided good clinical results.

Conclusions

In patients referred for TAVI, measurements of the aortic annulus using TTE, TEE, and MSCT were close but not identical, and the method used has important potential clinical implications on TAVI strategy. In the absence of a gold standard, a strategy based on TEE measurements provided good clinical results. (J Am Coll Cardiol 2010;55:186-94) © 2010 by the American College of Cardiology Foundation

Preoperative Assessment of Aortic Annulus Dimensions: Comparison of Noninvasive and Intraoperative Measurement

Alexey Dashkevich, MD,* Philipp Blanke, MD,* Matthias Siepe, MD, PhD, Gregor Pache, MD, Mathias Langer, MD, Christian Schlensak, MD, PhD, and Friedhelm Beyersdorf, MD, PhD

Departments of Cardiovascular Surgery and Diagnostic Radiology, University Medical Centre Freiburg, Freiburg, Germany

Background. Preoperative assessment of aortic annulus diameter is crucial for valve sizing in patients scheduled for

Results. Calculated average diameter by CT correlated significantly with intraoperative measurements ($r = 0.923$,

Conclusions: The CT-measured aortic annulus diameter, assessed as the calculated average diameter of planimetric annulus area, seems to provide adequate dimensions similar to operative measurements...

attachments of the leaflets by means of planimetry. Operative measurements were performed with a Hegar dilator. A Pearson analysis was applied to test for degree of correlation.

(Ann Thorac Surg 2011;91:709–15)
© 2011 by The Society of Thoracic Surgeons

CLINICAL RESEARCH

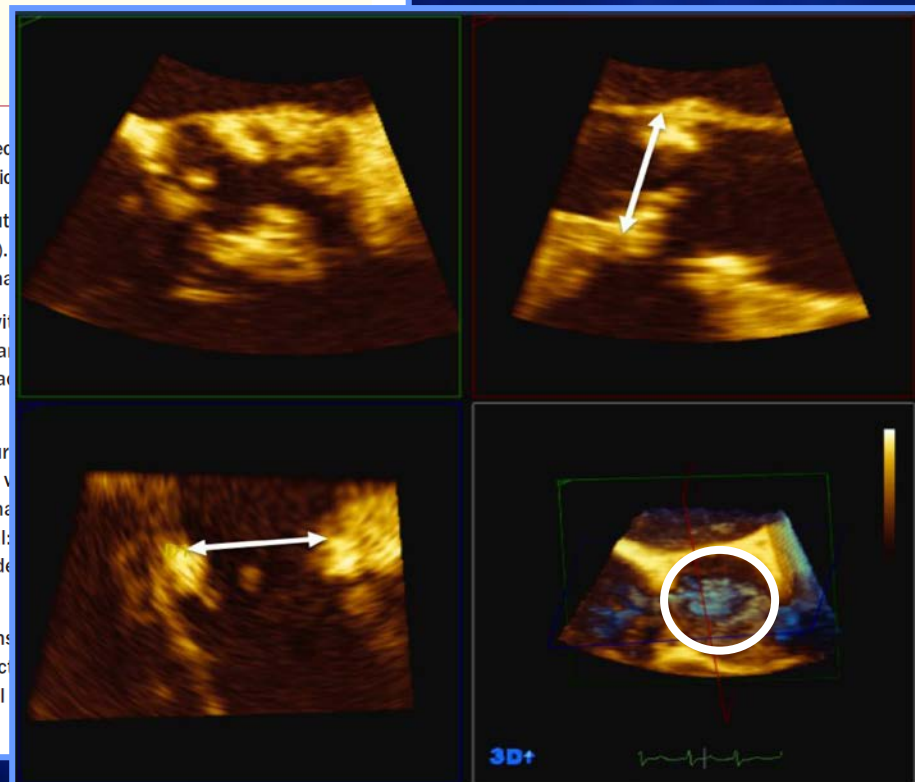
Interventional Cardiology

Aortic Annular Sizing for Transcatheter Aortic Valve Replacement Using Cross-Sectional 3-Dimensional Transesophageal Echocardiography

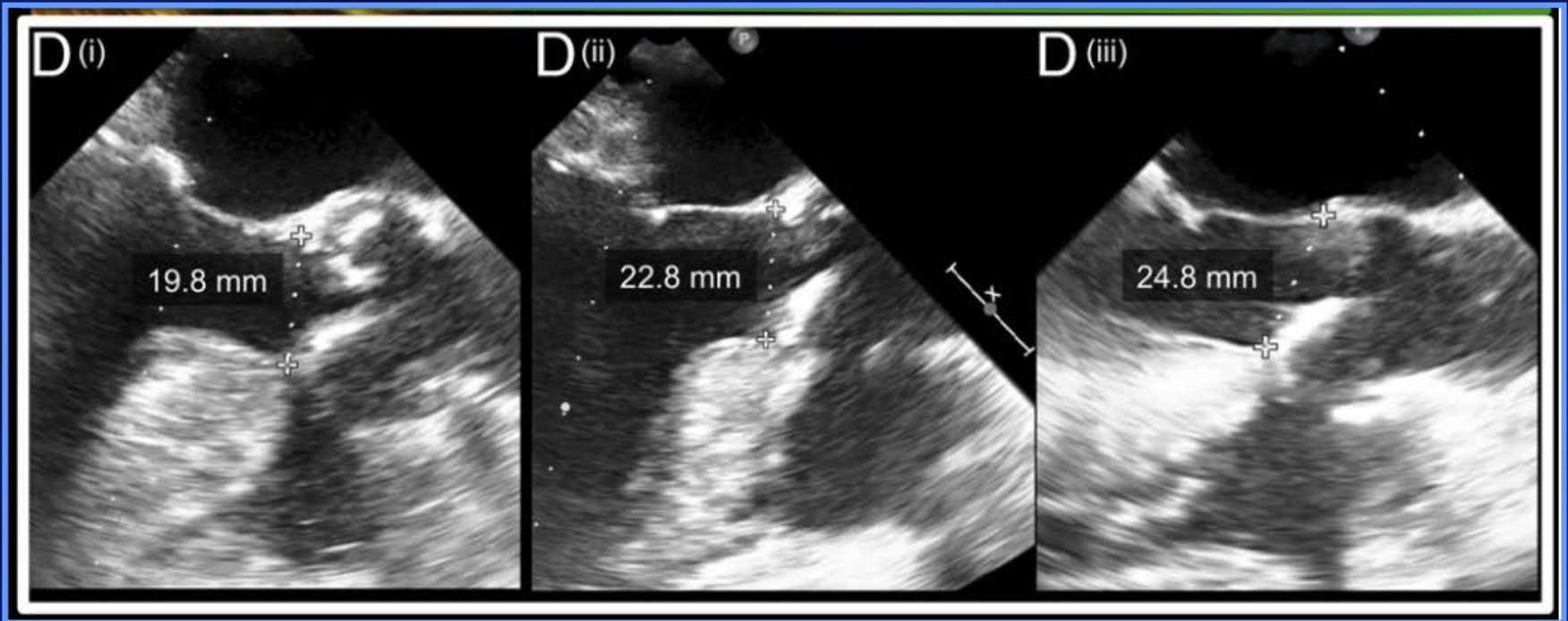
Hasan Jilaihawi, MD, Niraj Doctor, MBBS, Mohammad Kashif, MD, Tarun Chakravarty, MD, Asim Rafique, MD, Moody Makar, MD, Azusa Furugen, MD, PhD, Mamoo Nakamura, MD, James Mirocha, MS, Mitch Gheorghiu, MD, Jasminka Stegic, MS, ANP-BC, CCRN, ACNP, Kazuaki Okuyama, MD, Daniel J. Sullivan, MD, Robert Siegel, MD, James K. Min, MD, Swaminatha V. Gurudevan, MD, Gregory P. Fontana, MD, Wen Cheng, MD, Gerald Friede, BS, MS, Takahiro Shiota, MD, Raj R. Makkar, MD

Los Angeles, California

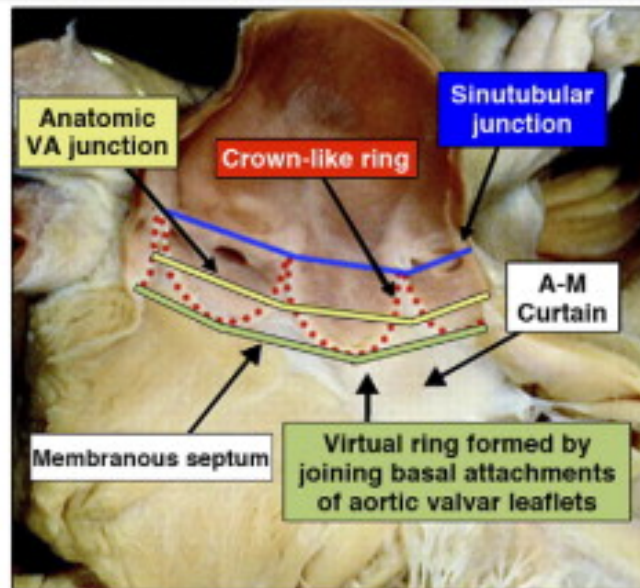
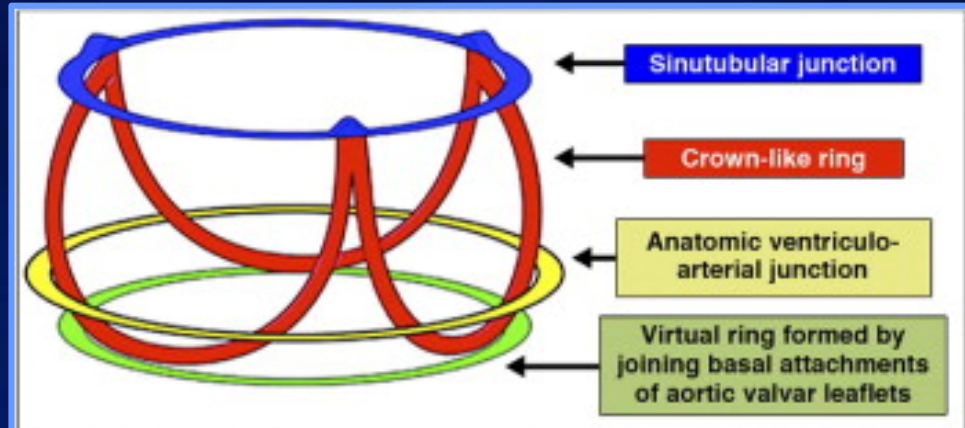
- Objectives** This study compared cross-sectional three-dimensional (3D) transesophageal echocardiography (TEE) as methods for predicting aortic regurgitation after transcatheter aortic valve replacement (TAVR).
- Background** Data have shown that TAVR sizing using cross-sectional contrast computed tomography (CT) is superior to 2D-TEE for the prediction of paravalvular aortic regurgitation (AR). Cross-sectional assessment of the aortic annulus by 3D-TEE is superior to 2D-TEE for TAVR sizing but its role for TAVR sizing has not been defined.
- Methods** All patients had severe symptomatic aortic stenosis and were treated with TAVR at our center. Patients studied had both 2D-TEE and 3D imaging (contrast CT at baseline). Receiver-operating characteristic curves were generated for each modality to predict TAVR paravalvular AR moderate or greater as the state variable.
- Results** For the 256 patients studied, paravalvular AR moderate or greater occurred in 15%. Prospectively recorded 2D-TEE measurements had a low discriminatory value (area under the curve = 0.40, 95% confidence interval: 0.40 to 0.63, $p = 0.75$). Average cross-sectional diameter of the aortic annulus by 2D-TEE was of intermediate value (area under the curve = 0.54, 95% confidence interval: 0.54 to 0.81, $p = 0.036$). Average cross-sectional diameter of discrimination (area under the curve = 0.82, 95% confidence interval: 0.75 to 0.89, $p < 0.001$). Average cross-sectional diameter by 3D-TEE was of intermediate value (area under the curve = 0.54, 95% confidence interval: 0.54 to 0.81, $p = 0.036$).
- Conclusions** Cross-sectional 3D echocardiographic sizing of the aortic annulus dimensions is superior to 2D-TEE for the prediction of paravalvular AR that is significantly superior to that of 2D-TEE. Cross-sectional 3D-TEE if good CT data are unavailable for TAVR sizing. (J Am Coll Cardiol. 2013;61:1097-1105. DOI: 10.1016/j.jacc.2012.11.055.)



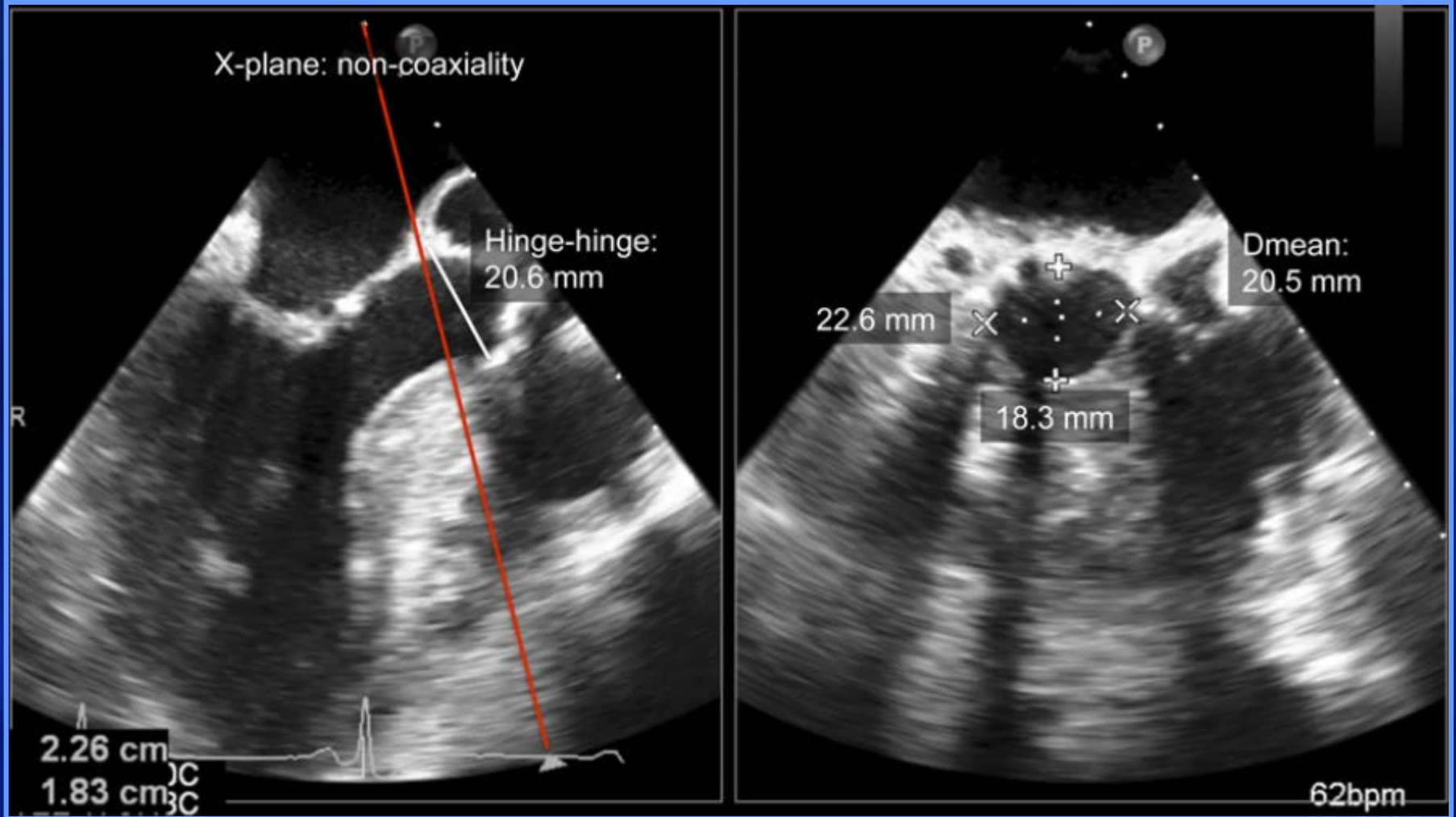
Variability of 2D TEE



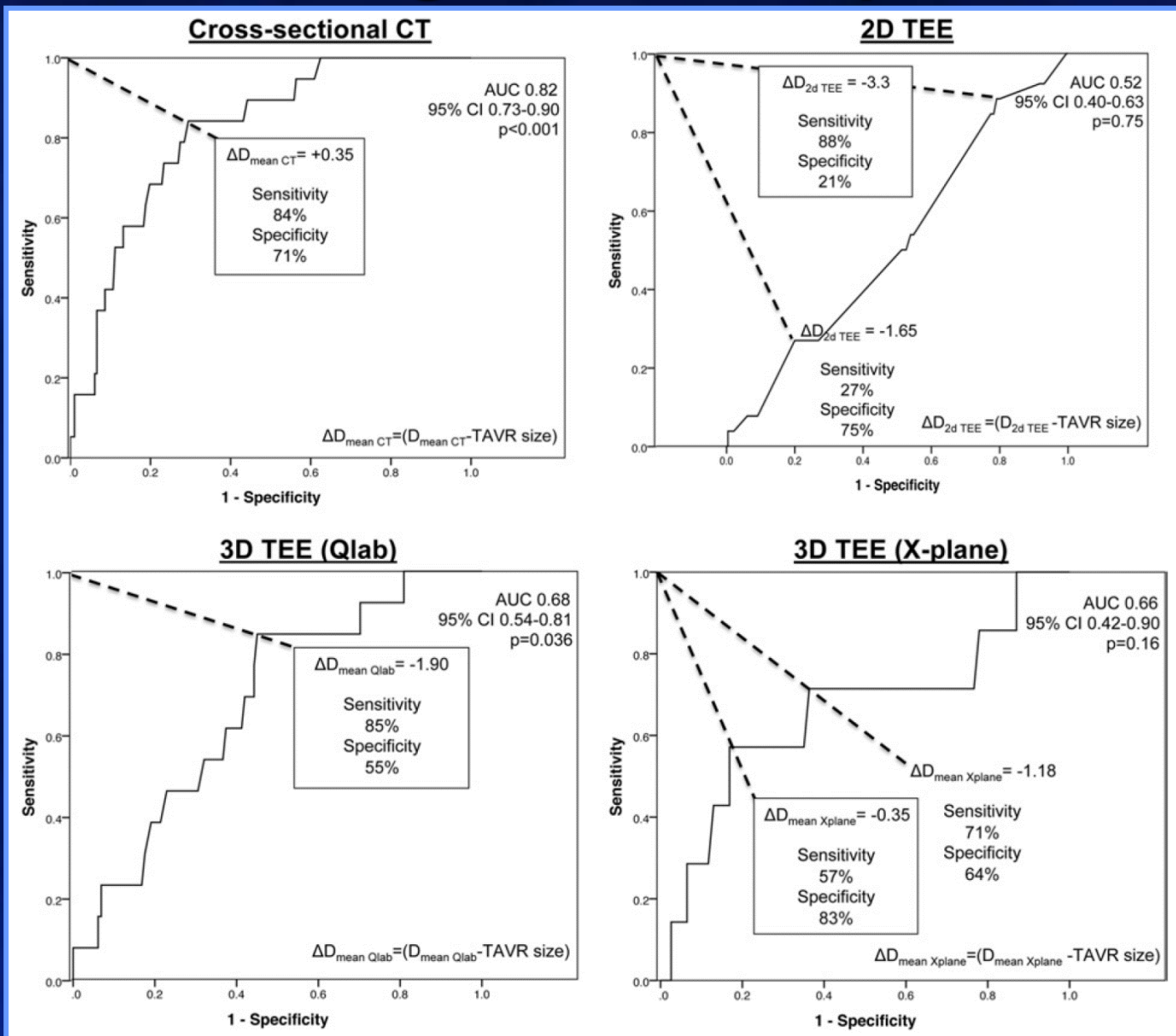
“Virtual Ring”



Limitations of X-plane TEE

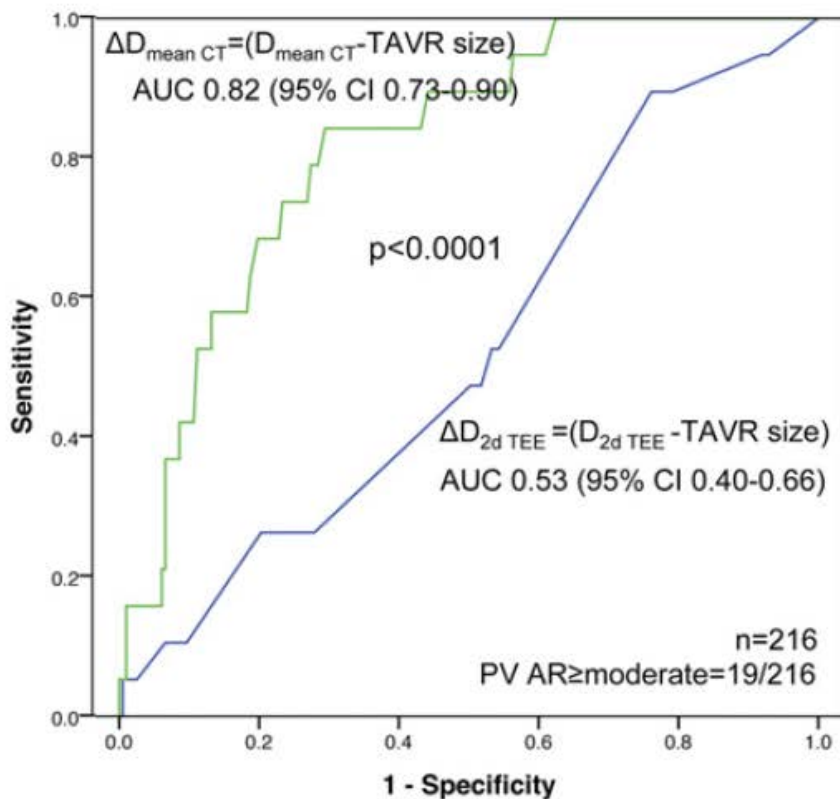


Prediction of Significant Periprosthetic AR

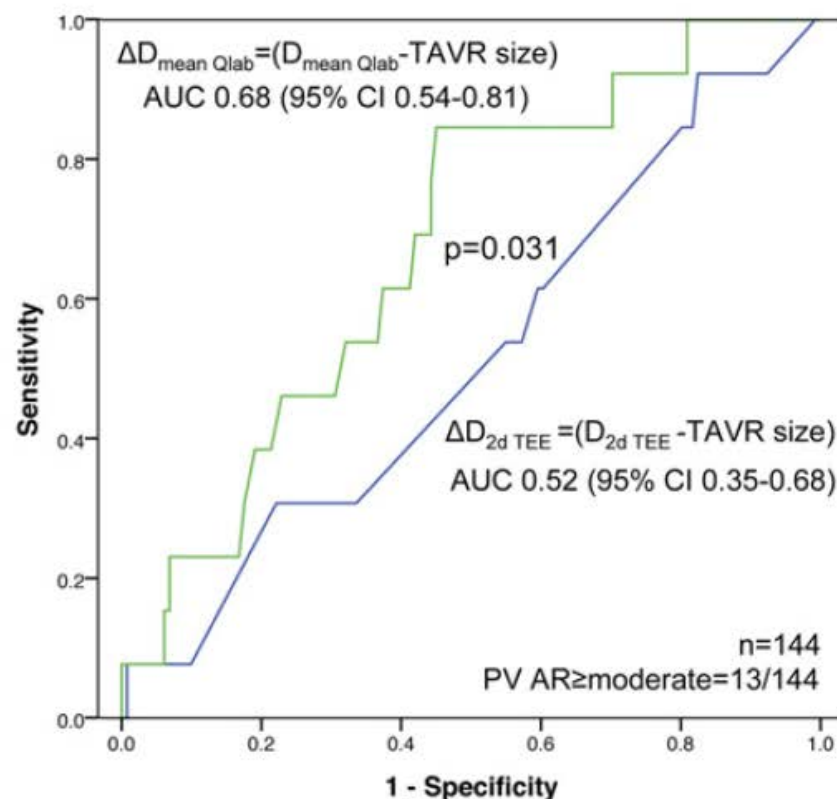


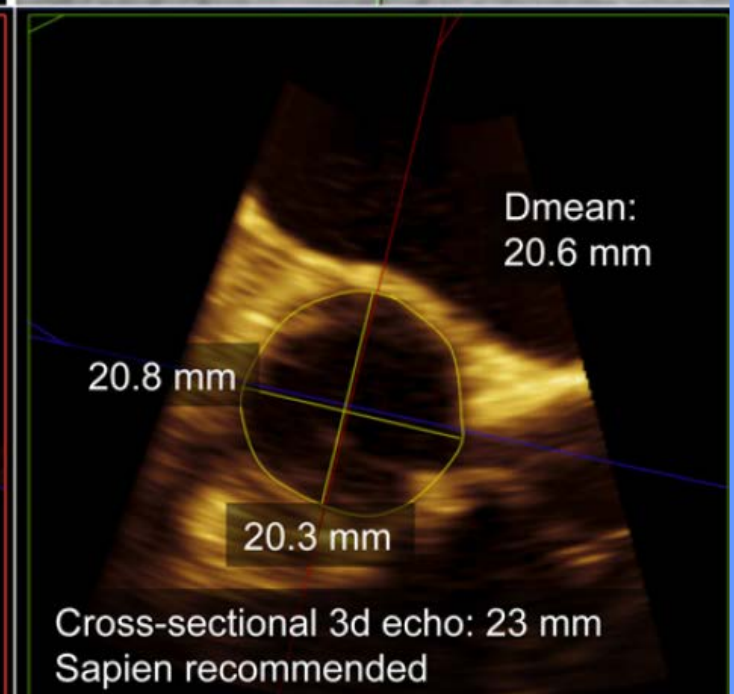
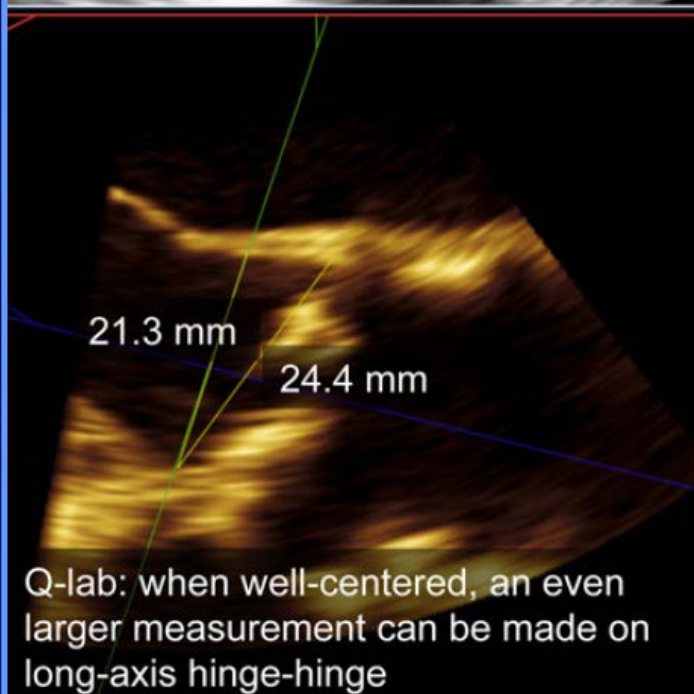
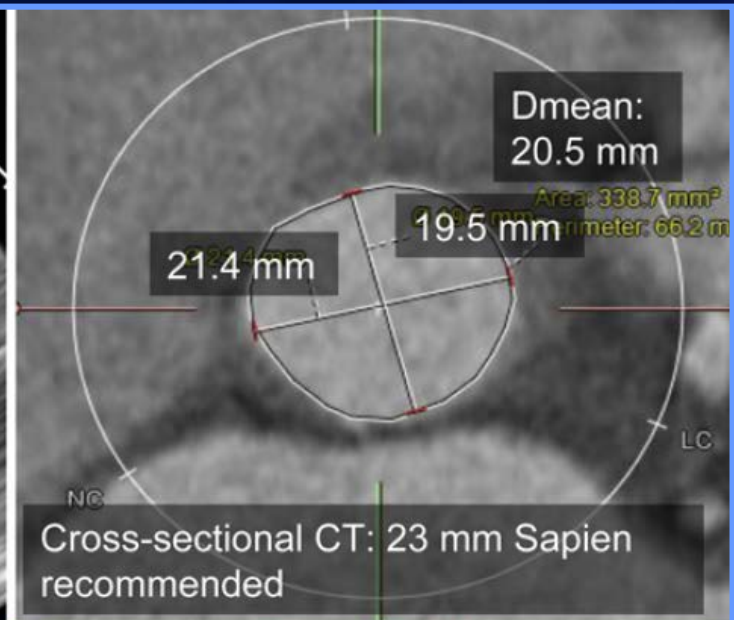
Prediction of Significant Periprosthetic AR

Cross-sectional CT vs 2D TEE

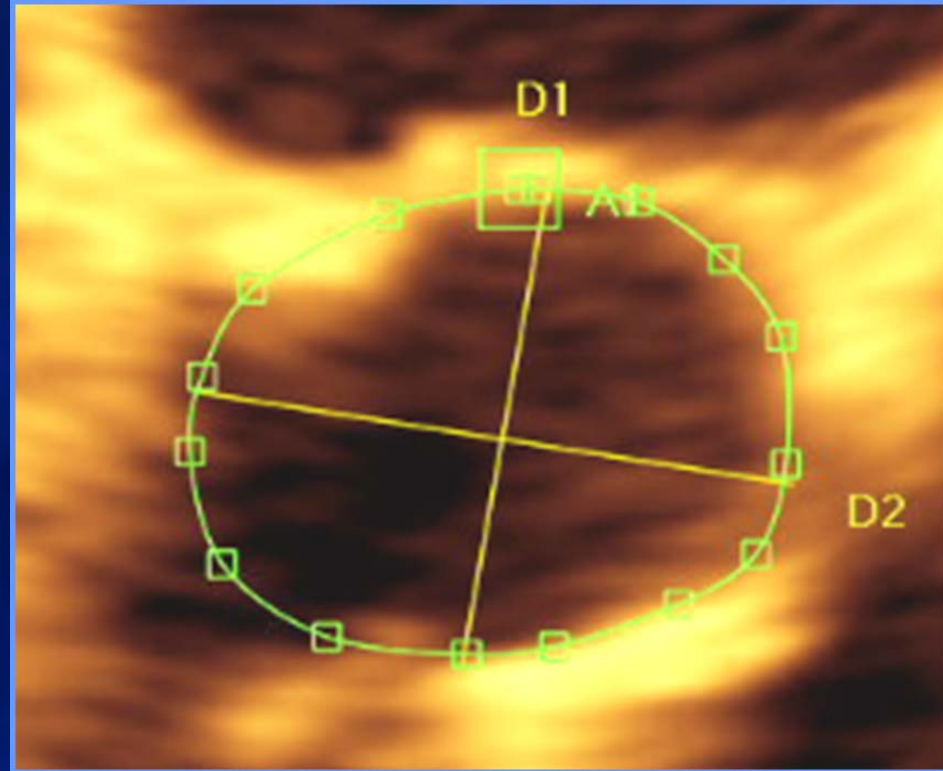
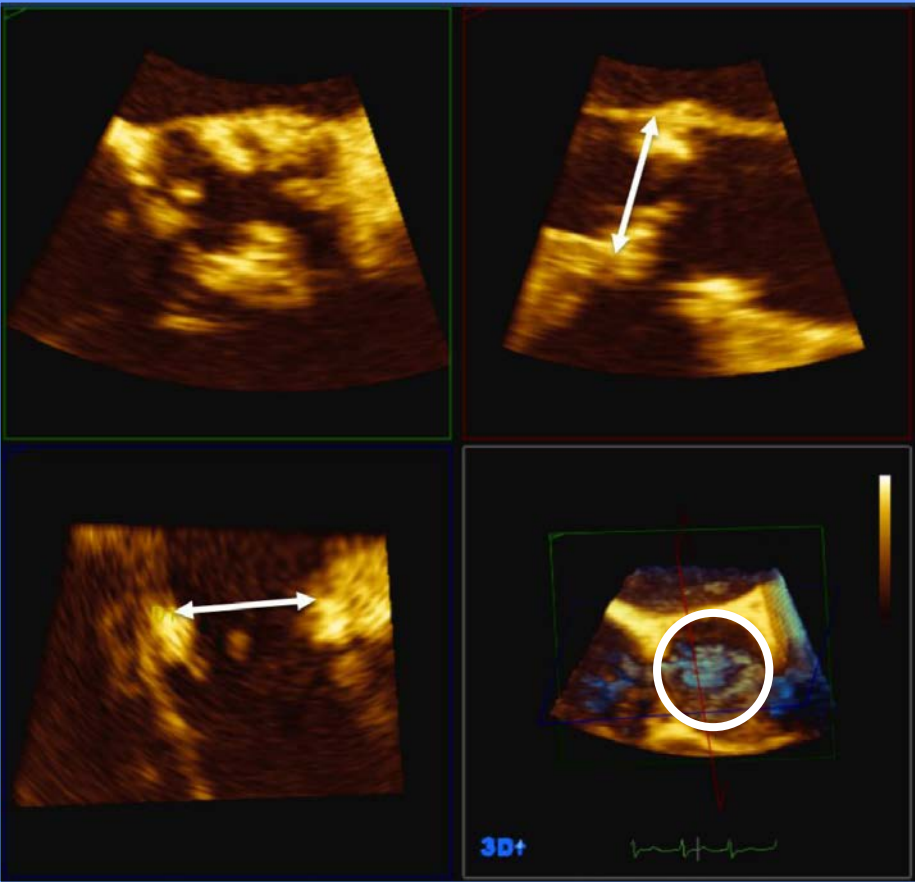


3D TEE (Qlab) vs 2D TEE





3D TEE



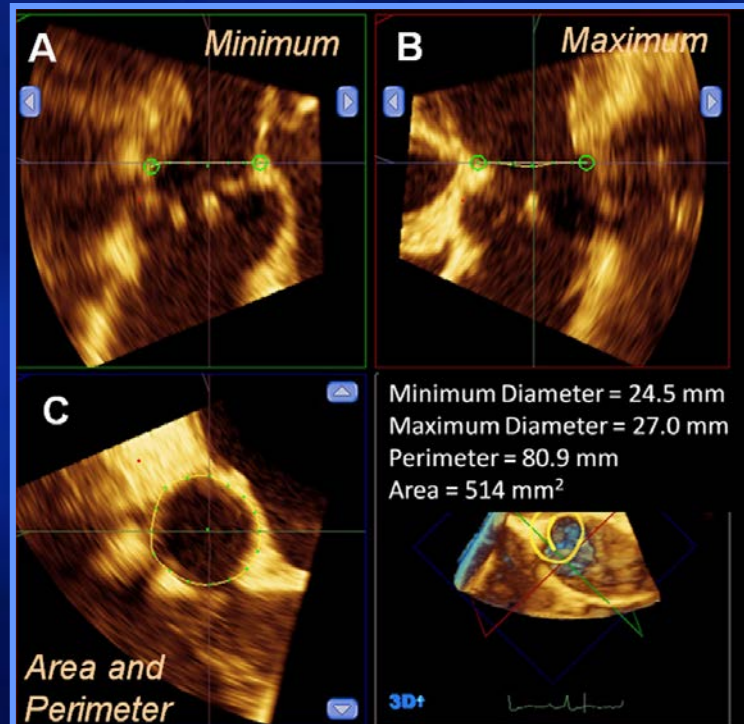
CLINICAL INVESTIGATIONS

VALVULAR HEART DISEASE

J Am Soc Echocardiogr 2013;26;1043-52

Predicting Paravalvular Regurgitation Following Transcatheter Valve Replacement: Utility of a Novel Method for Three-Dimensional Echocardiographic Measurements of the Aortic Annulus

Rebecca T. Hahn, MD, Omar Khalique, MD, Mathew R. Williams, MD, Elana Koss, MD, Jean-Michel Paradis, MD, Benoit Daneault, MD, Ajay J. Kirtane, MD, SM, Isaac George, MD, Martin B. Leon, MD, and Susheel Kodali, MD, *New York, New York*



PHILIPS QLAB IM_0139 (DICOM 3DCV, Live 3D, Frustum [IE33]) Mitral Valve Quantification 9/20/2011 10:43:14

Protocol

- Find & Tag ES
- Align MPRs & Model
- Add Ref. Pts.
- Edit Nadir & Ao. Pts.
- Edit Annulus Pts.
- Edit Comm. Pts.
- Trace Leaflet
- Edit Coapt.
- Find & Add Pap. Tips

Tools

- Add/Edit Ref. Pts.
- Add/Edit Pap. Pts.
- Clear Ref. Pts.
- Trace Leaflet

Display

- Show Min. Surface
- Show Leaflets
- Show Tenting Surface
- Show Report

View B/W Cropping MVQ MPR Setup

MPR Mode: G R B 3D Gain (31) Auto View: Off Rotation: Absolute

Auto Crop Reset Crop Magnify (100) L/R Invert U/D Invert 3D Swivel

3D Home Reset MPR SubPage 0 of 0

1/52 0.00s/4.15s (---s, --Hz, 0.000s)

Volume Slices Model

Hahn RT et al. J Am Soc Echocardiogr 2013;26;1043-52

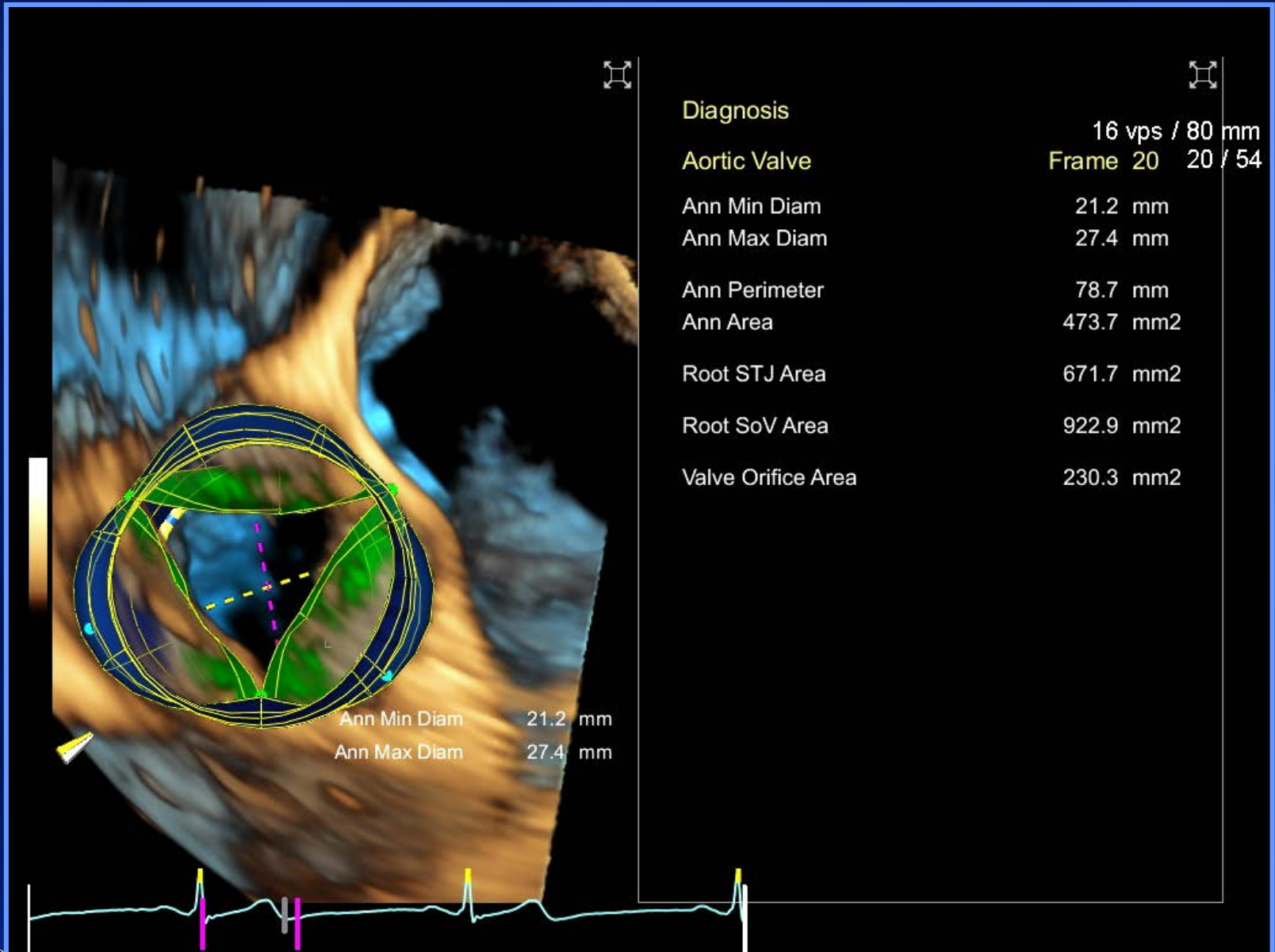
GE: 4D Auto AVQ (Aortic Valve Quantification) with 4D TEE Advanced Automation = Consistency and Reproducibility



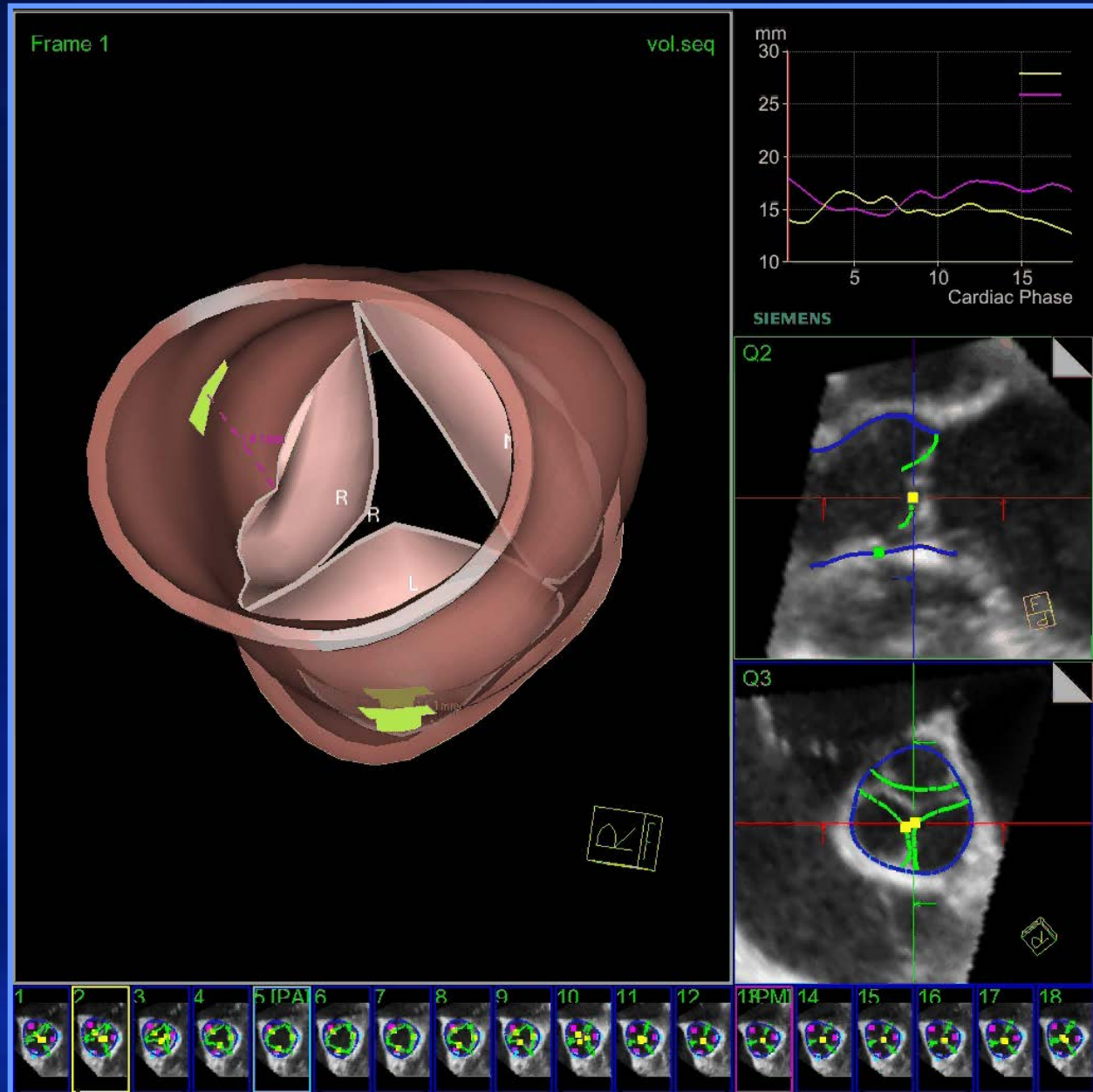
1 AA diameter	25.7 mm
AA max diameter	26.2 mm
AA min diameter	25.2 mm
AA circumference	80.9 mm
AA area	5.2 cm ²

4D Auto AVQ

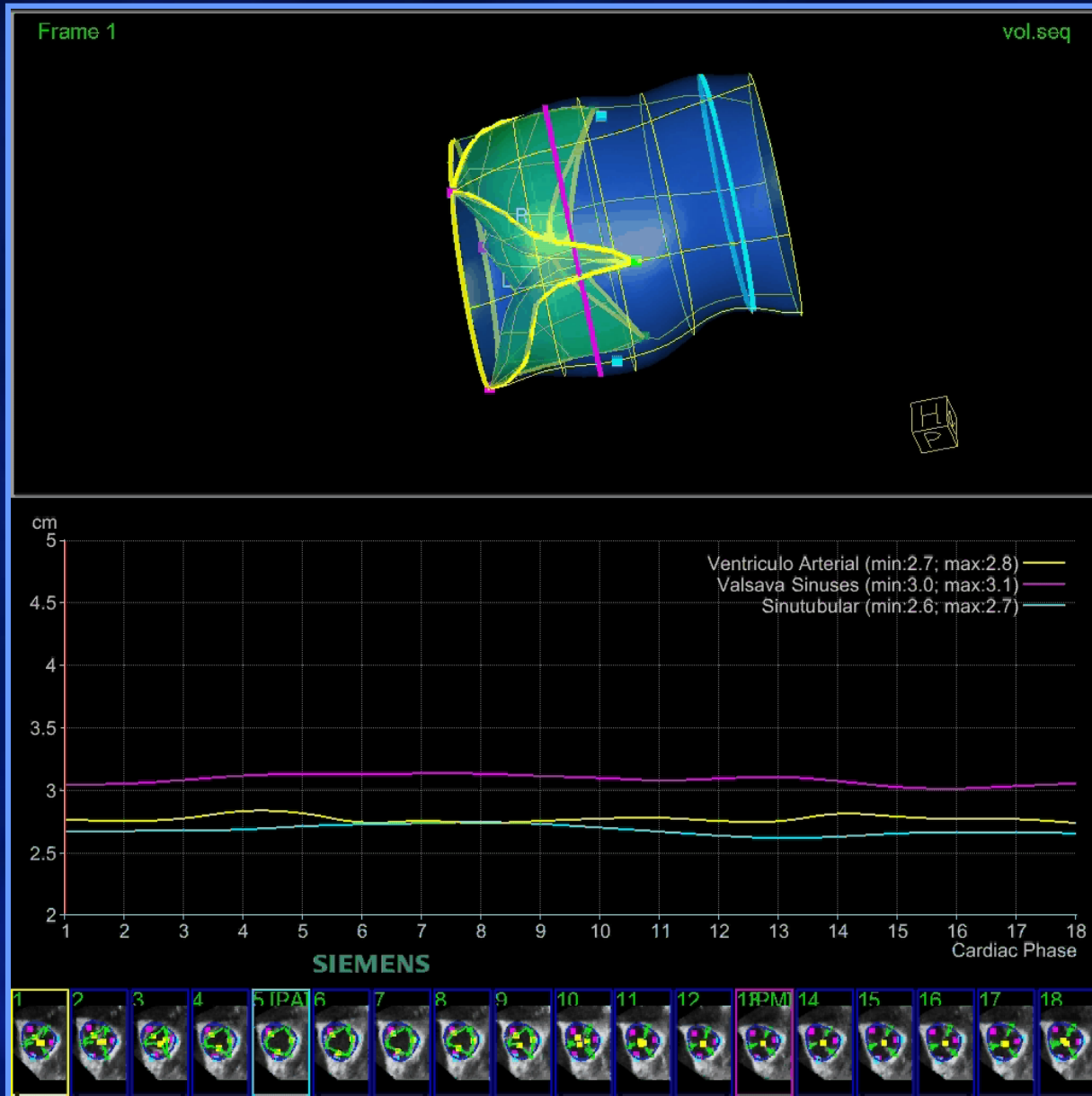
Siemens: Fully Automated Measurements



Hinge to Coronary Ostium Distance



Aortic Root



Echo for TAVR

Objectives

- Assess atherosclerosis
- Select device size
- **Assess landing zone site for suitability of valve deployment/potential complications**
- Guide valve deployment & monitor/assess periprocedural complications

It is all about the landing zone!



It is all about the landing zone!



Risk of Periprosthetic AR

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CLINICAL RESEARCH

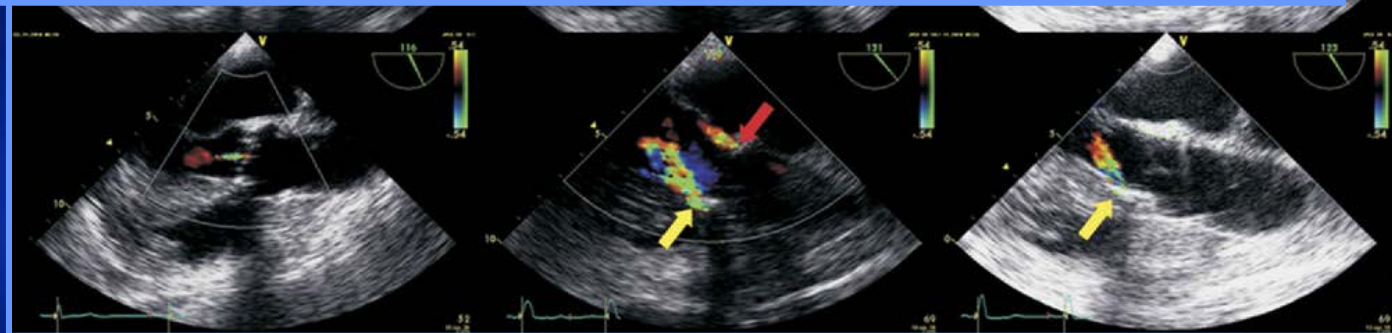
Interventional Cardiology

Transapical Aortic Valve Implantation

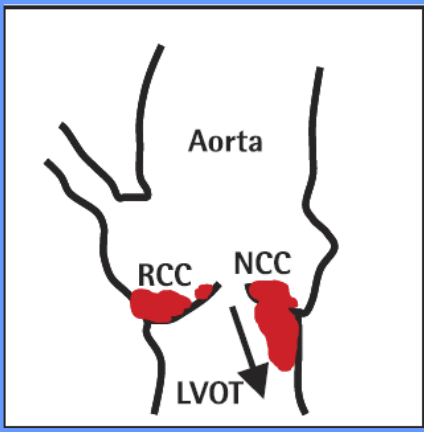
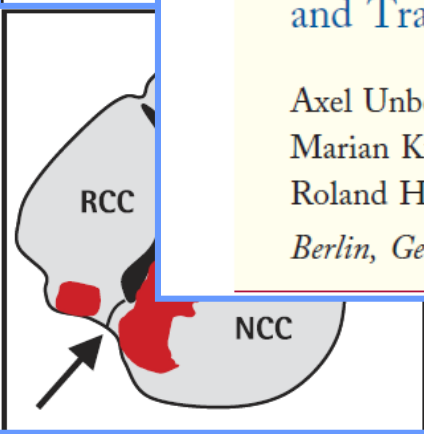
Incidence and Predictors of Paravalvular Leakage and Transvalvular Regurgitation in a Series of 358 Patients

Axel Unbehaun, MD, Miralem Pasic, MD, PhD, Stephan Dreyse, MD, Thorsten Drews, MD, Marian Kukucka, MD, Alexander Mladenow, MD, Ekaterina Ivanitskaja-Kühn, MD, Roland Hetzer, MD, PhD, Semih Buz, MD

Berlin, Germany



- Asymmetric cusp calcification
- Oval shaped annulus
- Device landing zone calcification

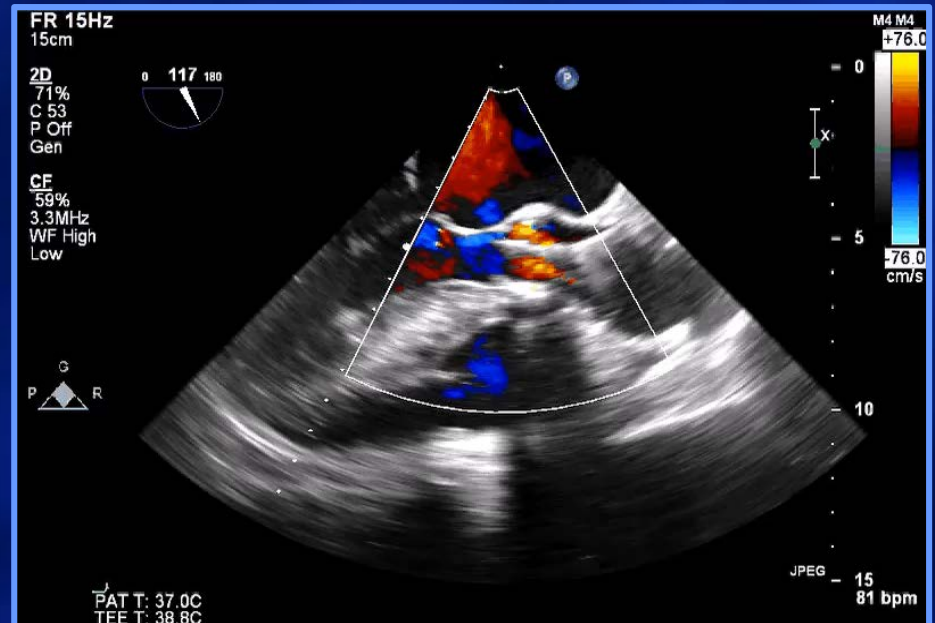
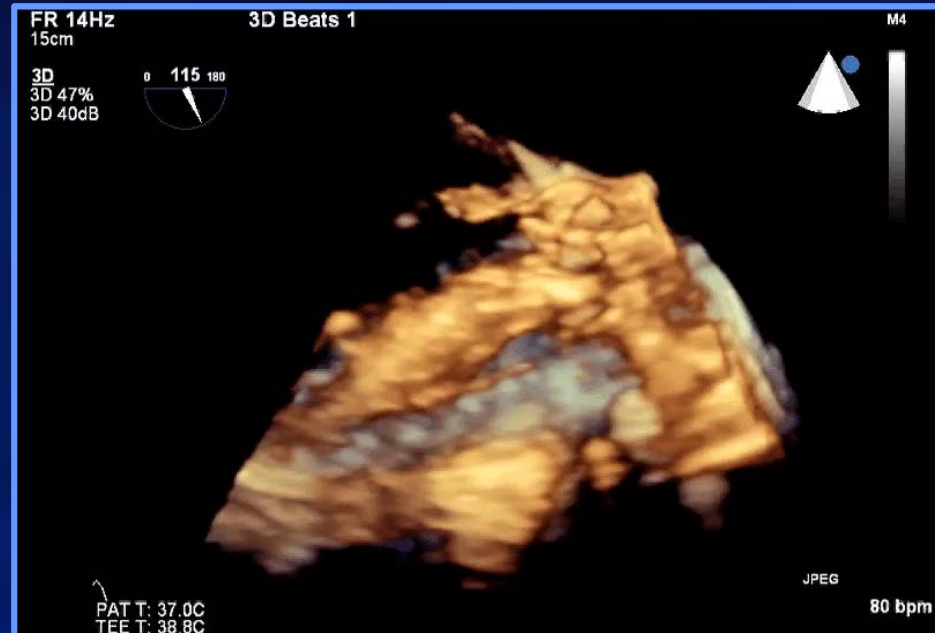


It is all about the landing zone!

Dr. Lester and the Mayo Heart Team



Posterior Calcification: CorValve

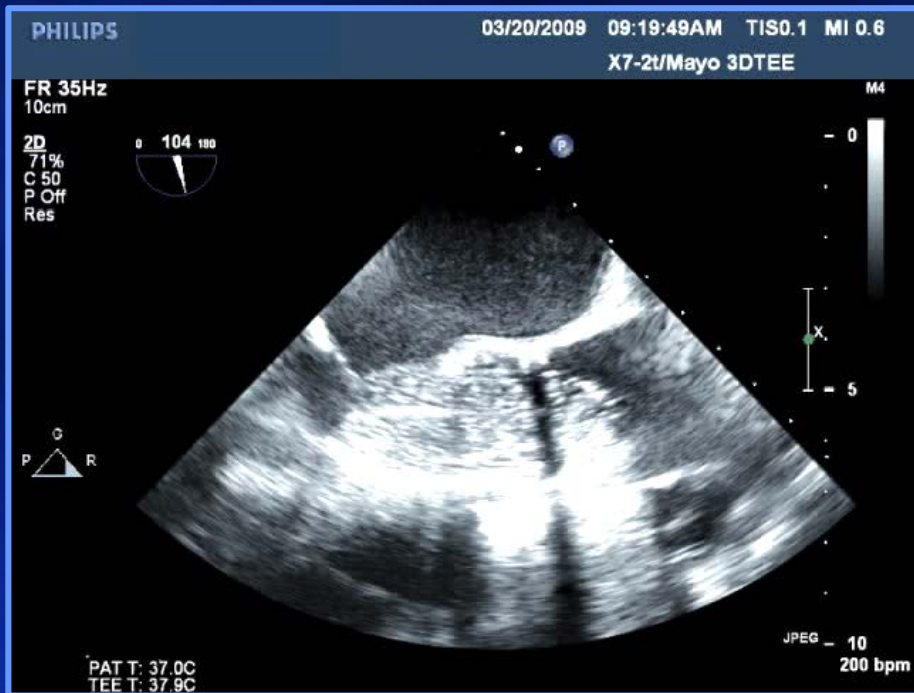


Echo for TAVR

Objectives

- Assess atherosclerosis
- Select device size
- Assess landing zone site for suitability of valve deployment/potential complications
- **Guide valve deployment & monitor/assess periprocedural complications**

TEE During TAVR Procedure



God Result

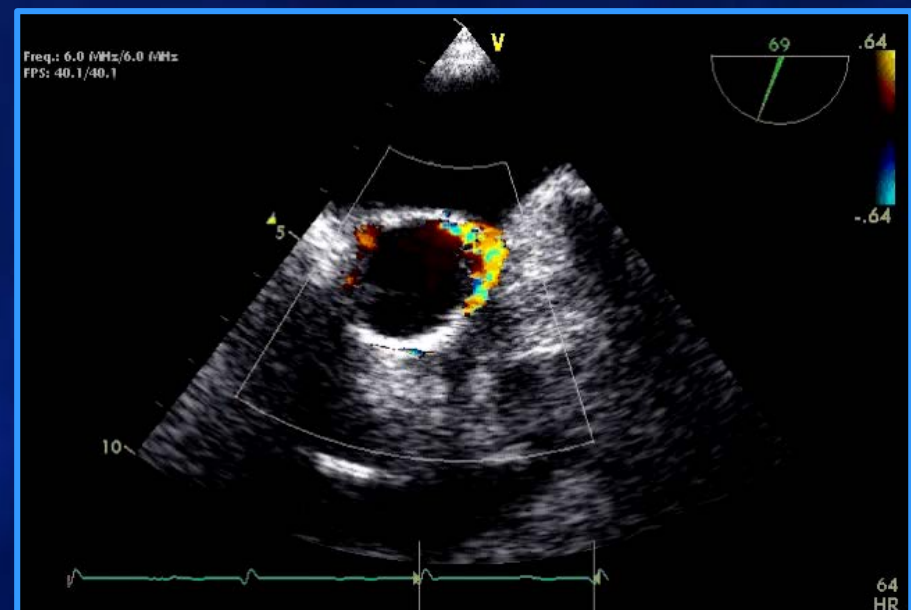


Periprosthetic AR

Associated Morphologic Risk Factors

- Large aortic annulus
- Undersized prosthesis
- Asymmetric cusp calcification
- LVOT calcification
- Prominent septal bulge
- Low valve deployment

How Much Periprosthetic Aortic Regurgitation?



1. Mild
2. Mild-moderate
3. Moderate
4. Severe

Standardized endpoint definitions for transcatheter aortic valve implantation clinical trials: a consensus report from the Valve Academic Research Consortium[†]

Martin B. Leon*, Nicolo Piazza, Eugenia Nikolsky, Eugene H. Blackstone, Donald E. Cutlip, Arie Pieter Kappetein, Mitchell W. Krucoff, Michael Mack, Roxana Mehran, Craig Miller, Marie-angèle Morel, John Petersen, Jeffrey J. Popma, Johanna J.M. Takkenberg, Alec Vahanian, Gerrit-Anne van Es, Pascal Vranckx, John G. Webb, Stephan Windecker, and Patrick W. Serruys

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CLINICAL RESEARCH

Valvular Medicine

Standardized Endpoint Definitions for Transcatheter Aortic Valve Implantation Clinical Trials

A Consensus Report From the Valve Academic Research Consortium

Martin B. Leon, Nicolo Piazza, Eugenia Nikolsky, Eugene H. Blackstone, Donald E. Cutlip, Arie Pieter Kappetein, Mitchell W. Krucoff, Michael Mack, Roxana Mehran, Craig Miller, Marie-angèle Morel, John Petersen, Jeffrey J. Popma, Johanna J. M. Takkenberg, Alec Vahanian, Gerrit-Anne van Es, Pascal Vranckx, John G. Webb, Stephan Windecker, Patrick W. Serruys

New York, New York

EXPEDITED REVIEW

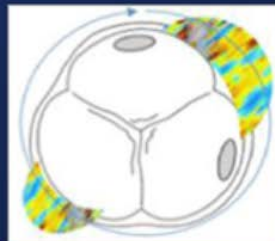
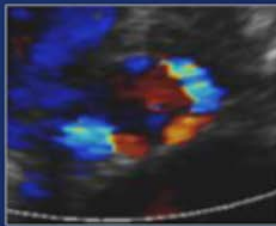
Heart Valve Disease

Updated Standardized Endpoint Definitions for Transcatheter Aortic Valve Implantation

The Valve Academic Research Consortium-2 Consensus Document†

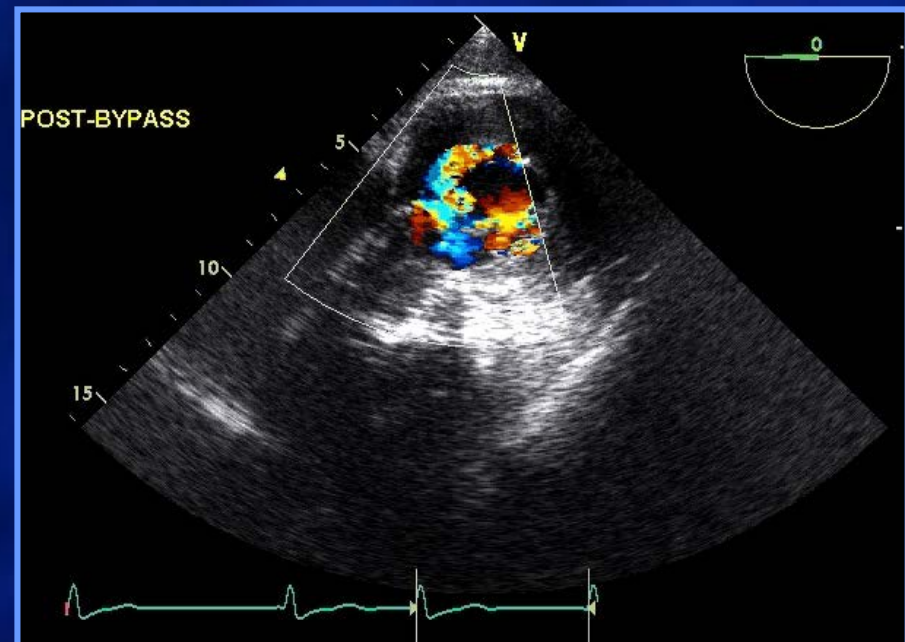
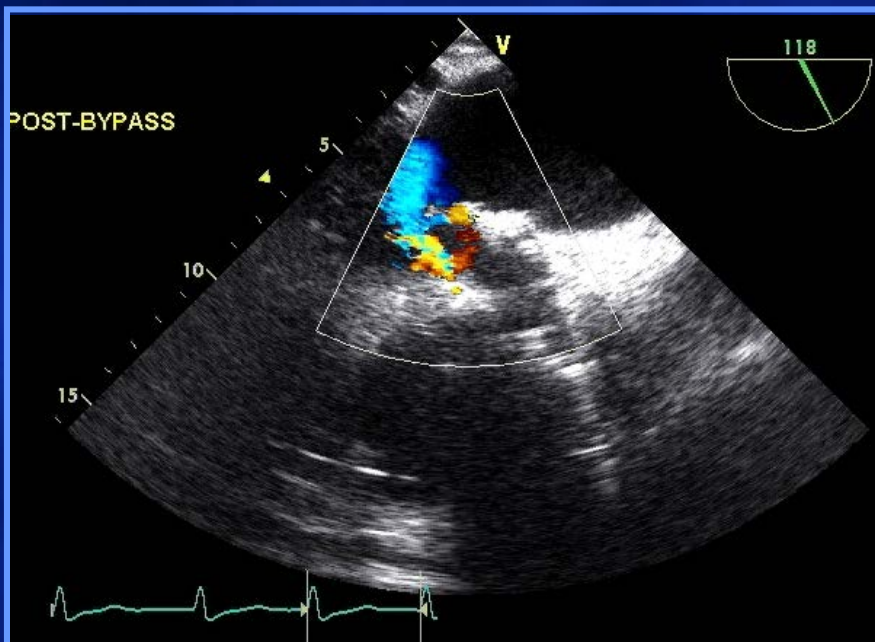
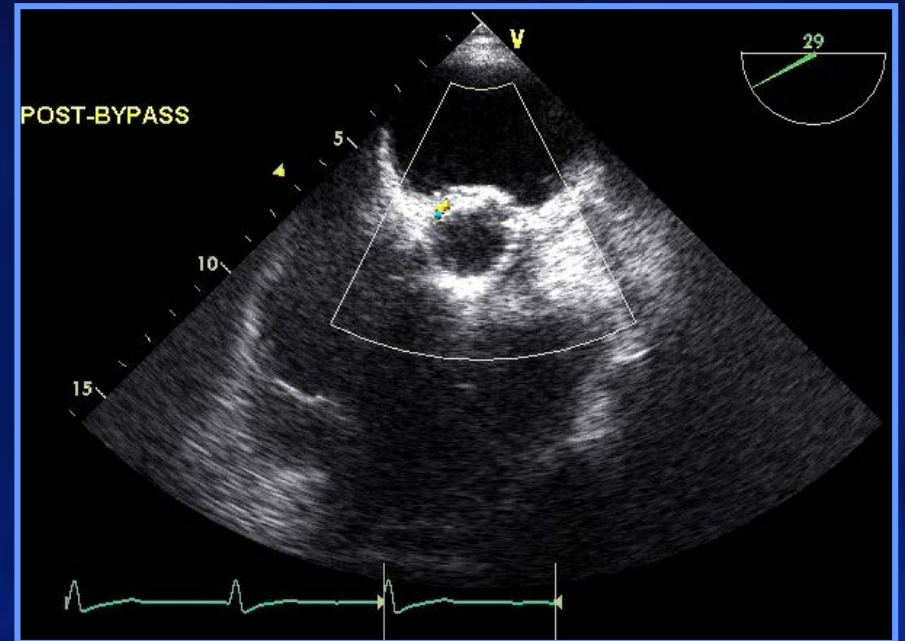
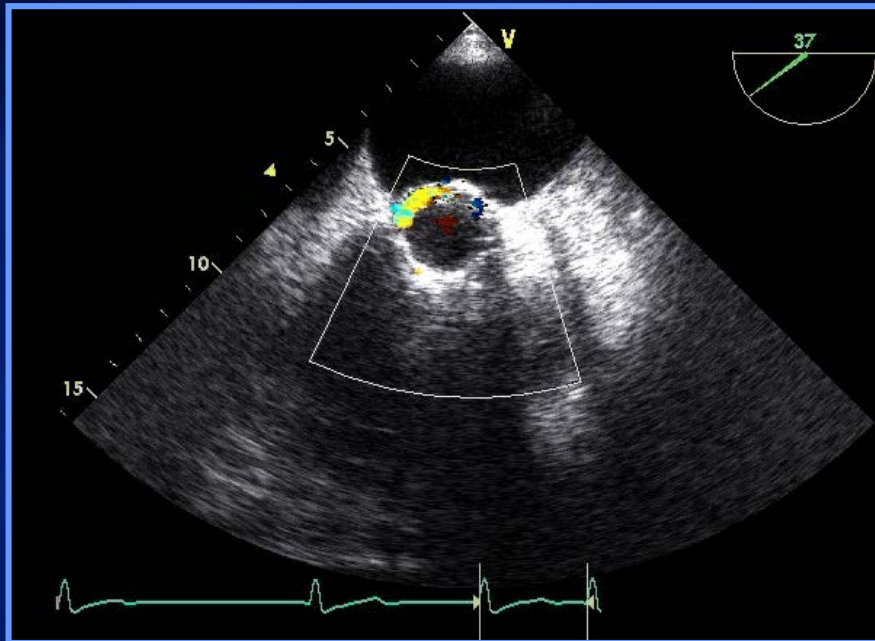
A. Pieter Kappetein,* Stuart J. Head, Philippe Généreux, Nicolo Piazza, Nicolas M. van Mieghem, Eugene H. Blackstone, Thomas G. Brott, David J. Cohen, Donald E. Cutlip, Gerrit-Anne van Es, Rebecca T. Hahn, Ajay J. Kirtane, Mitchell W. Krucoff, Susheel Kodali, Michael J. Mack, Roxana Mehran, Josep Rodés-Cabau, Pascal Vranckx, John G. Webb, Stephan Windecker, Patrick W. Serruys, Martin B. Leon

Rotterdam, the Netherlands

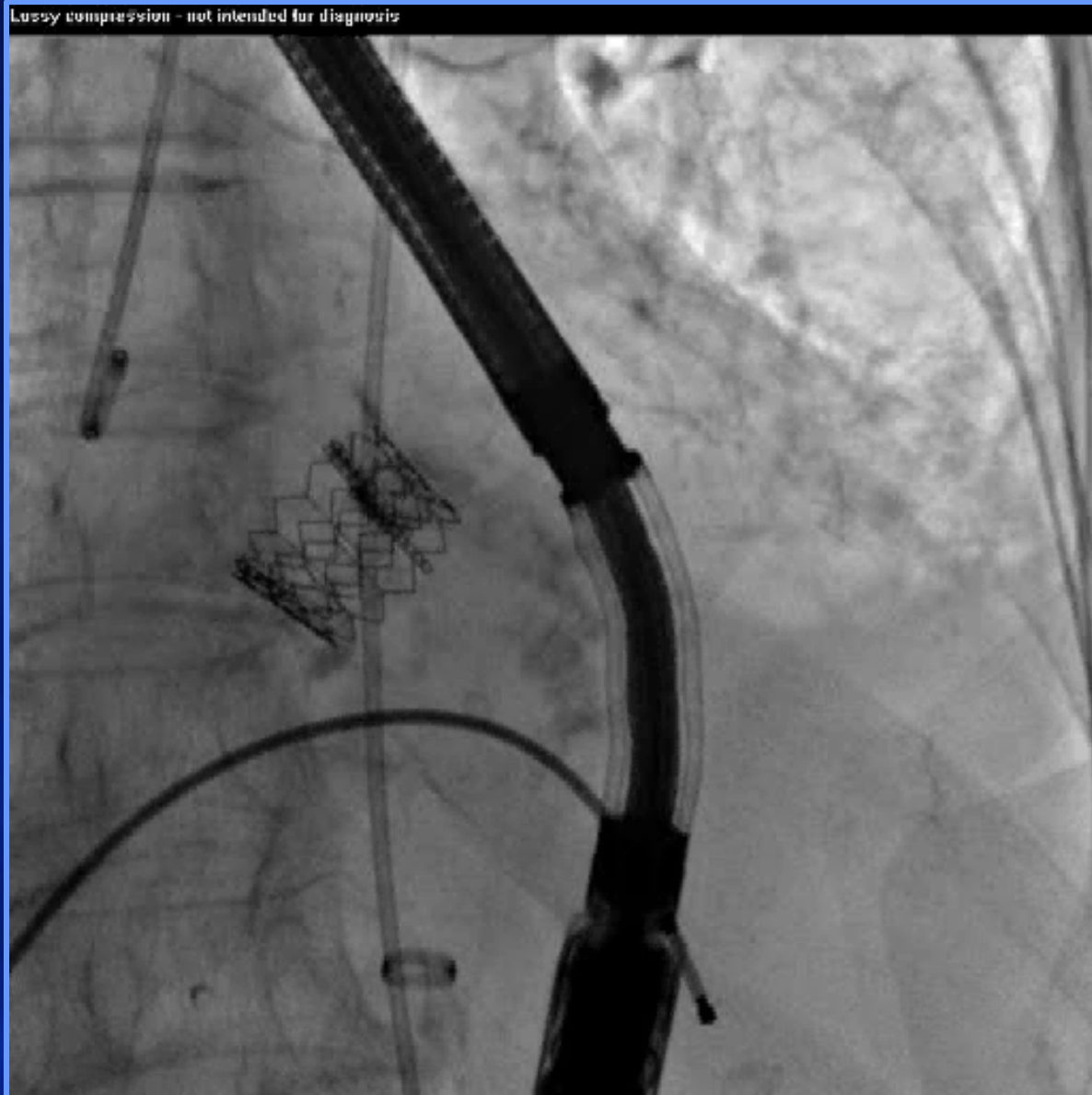


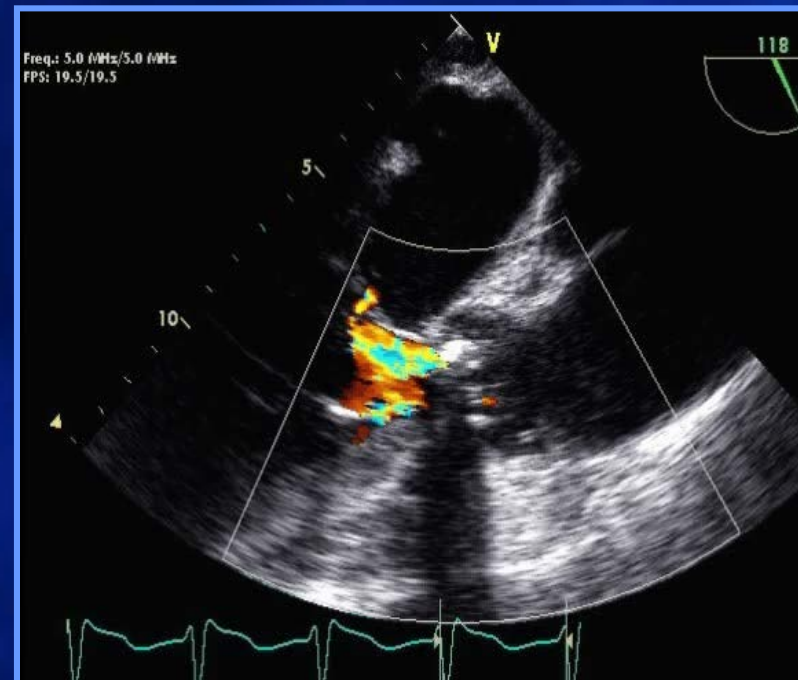
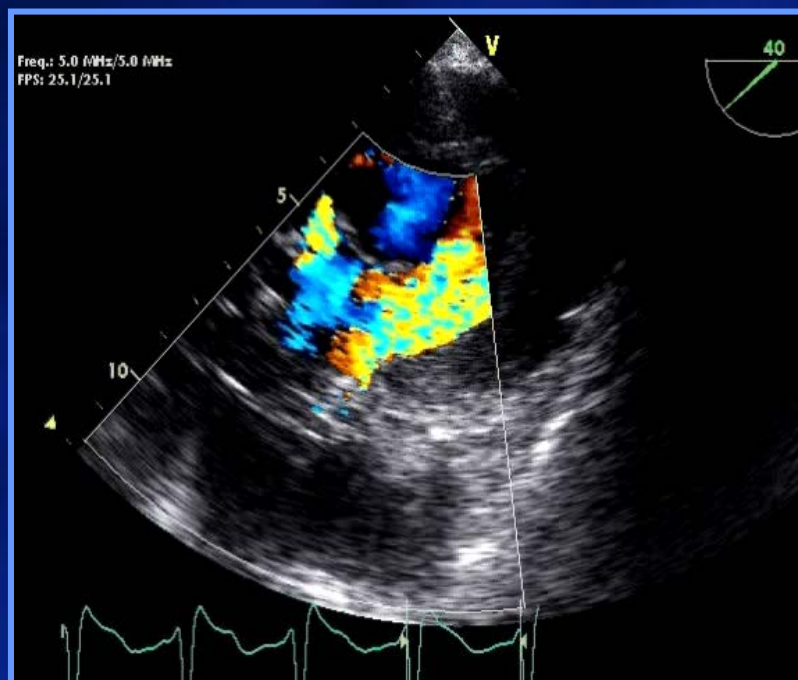
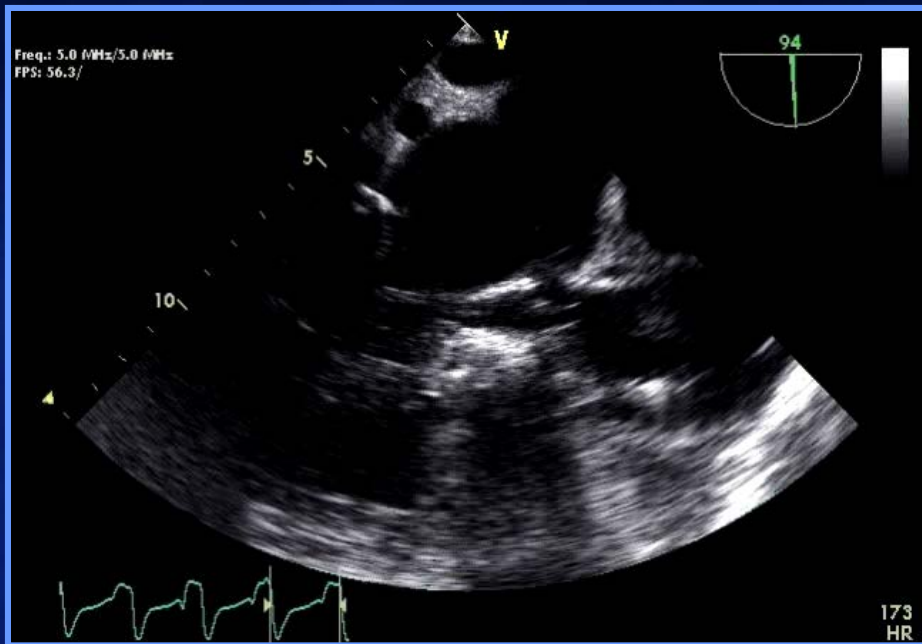
Circumference = 6"
AR = 0.6+1.1 = 1.7"
Ratio = 28%
Severity = Severe >30%

It's not so easy sometimes!

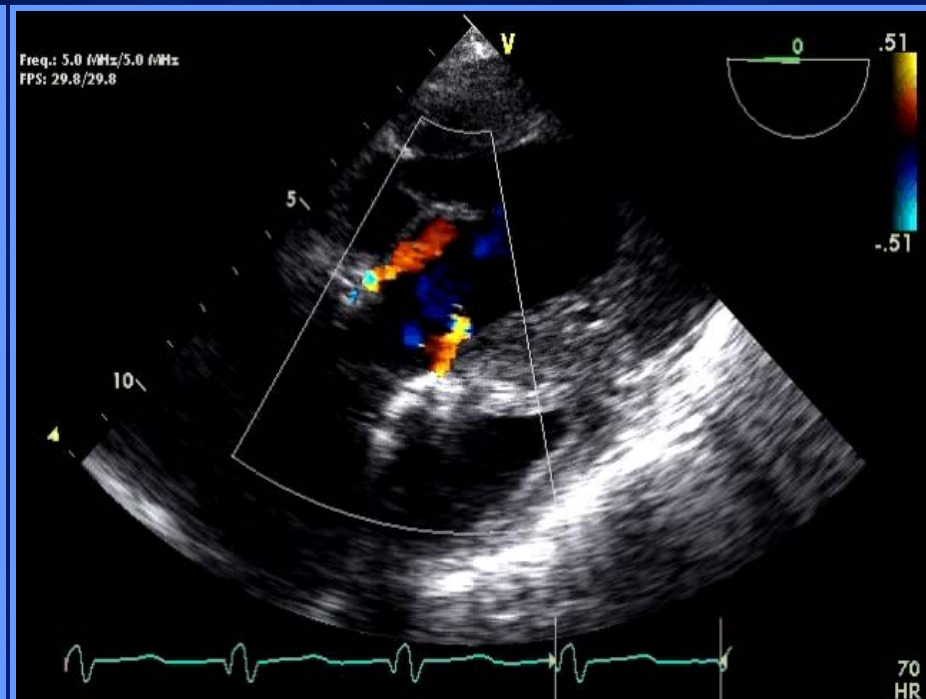


Final Aortogram: Mild AR





2nd Balloon Inflation



CLINICAL RESEARCH

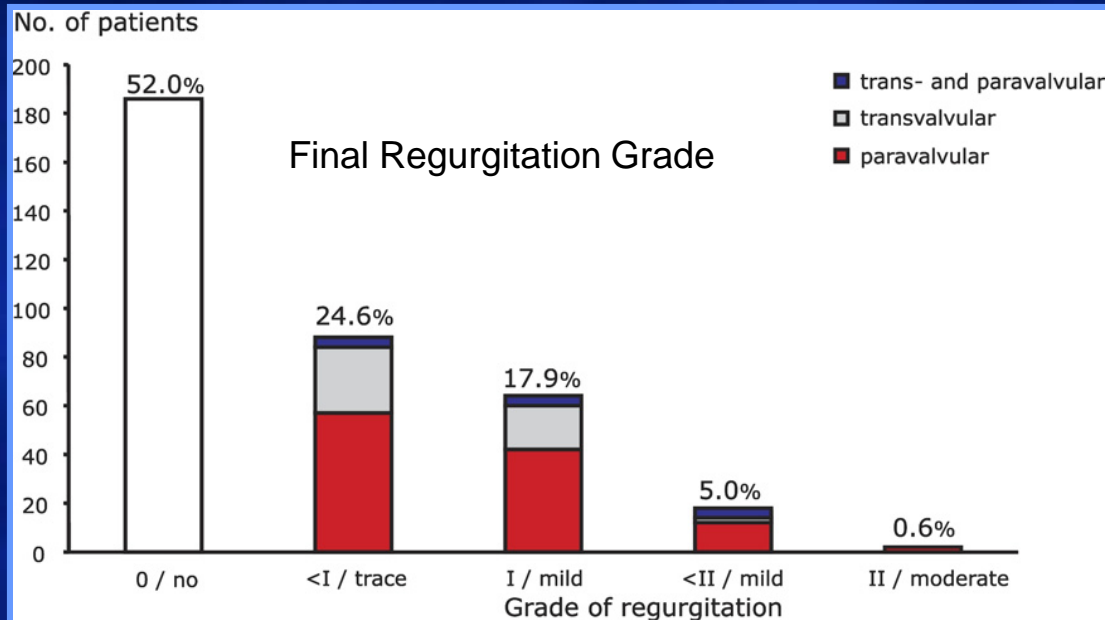
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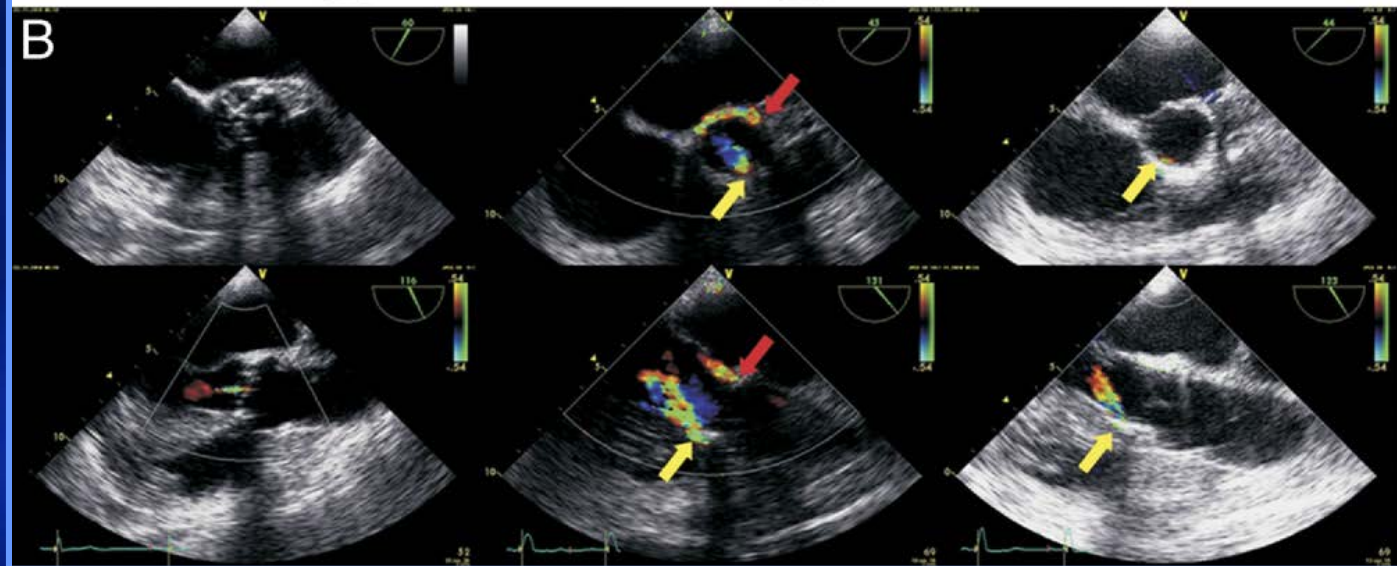
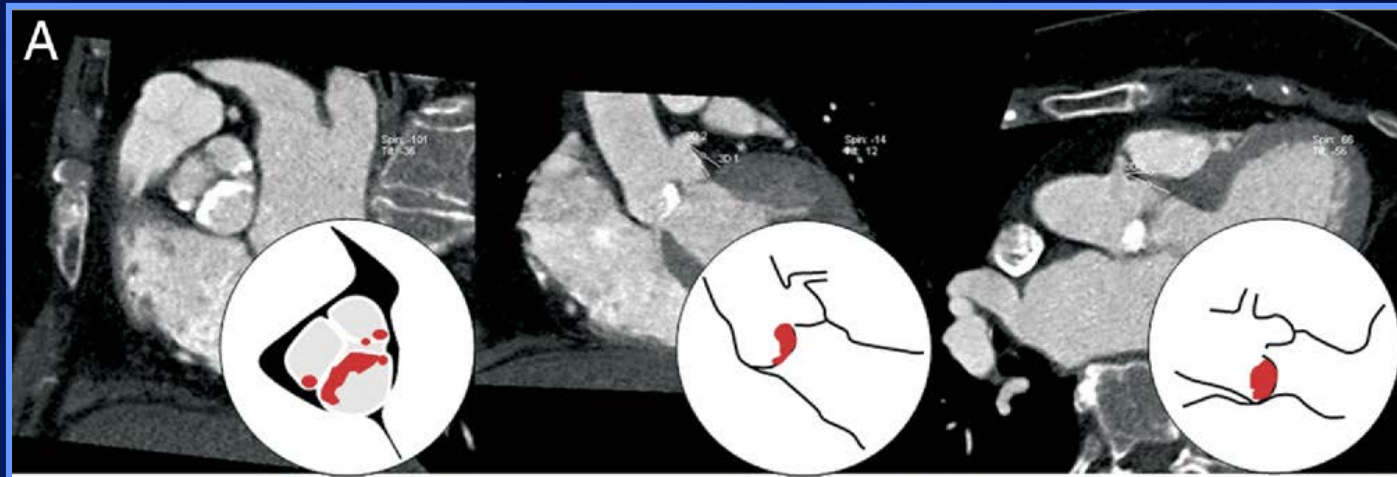
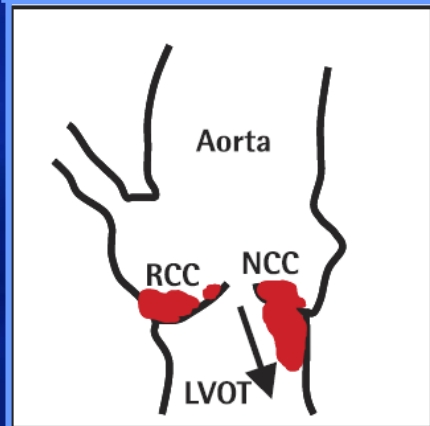
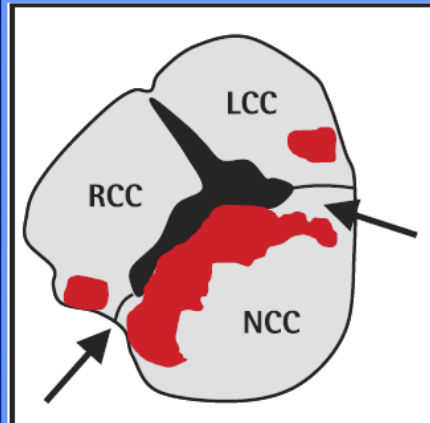
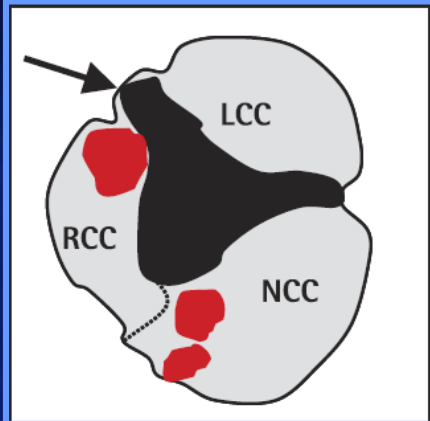
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Berlin, Germany



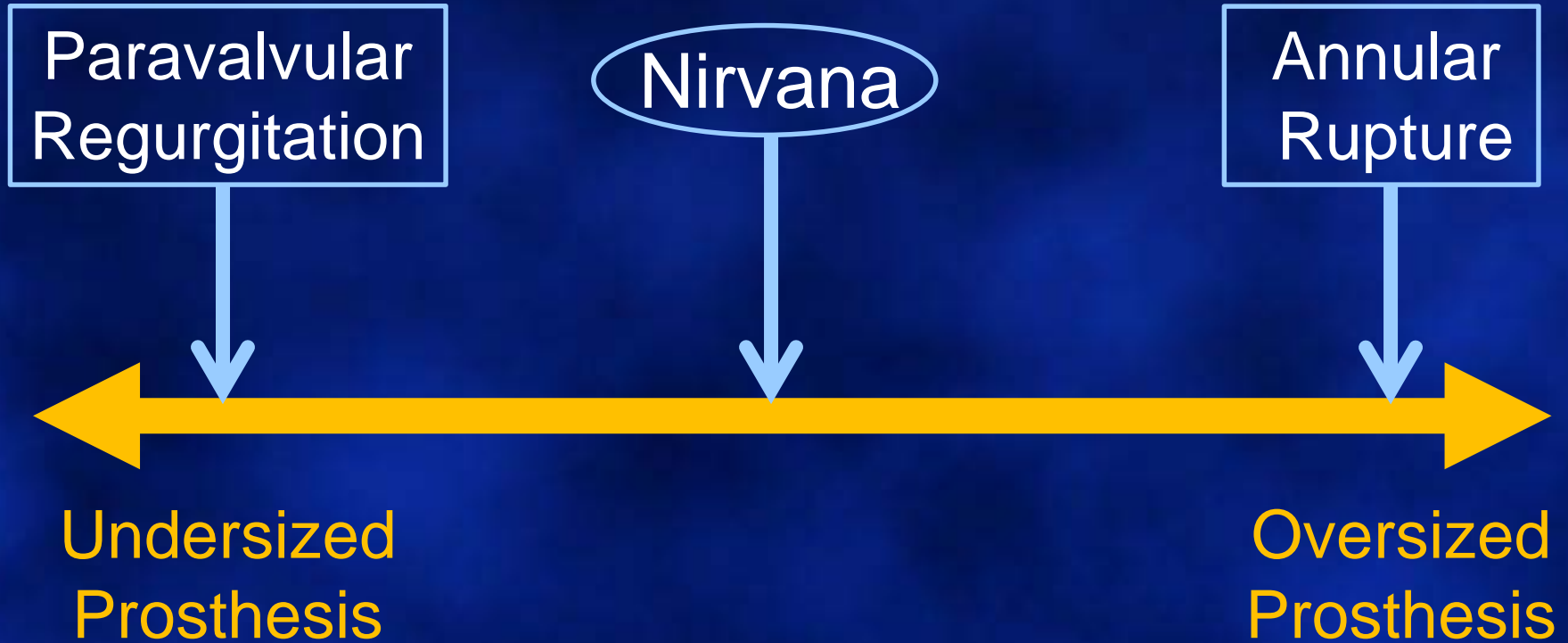
N = 258
Redilation 5%
Second valve 4%

Risk of Periprosthetic AR

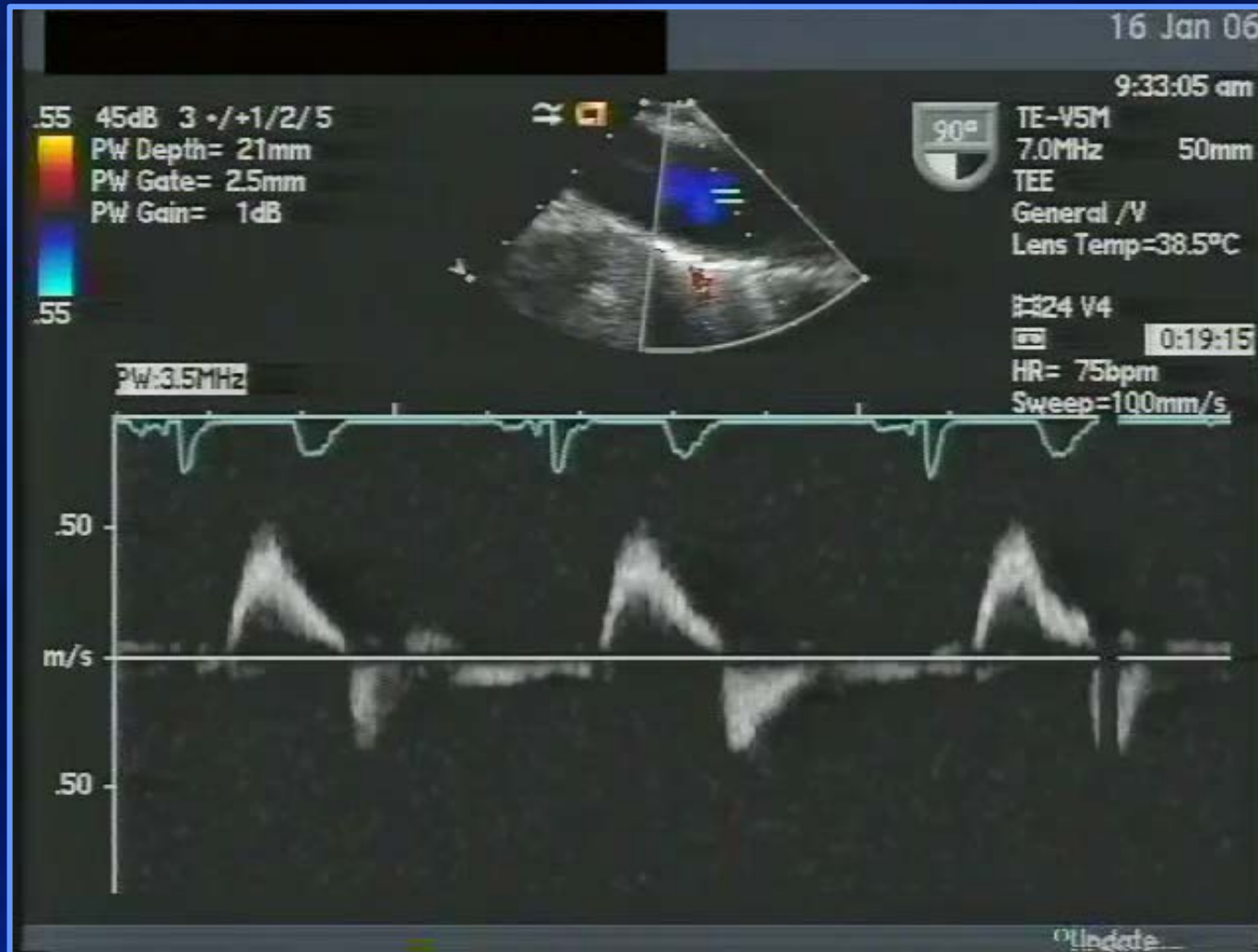


- Asymmetric cusp calcification
- Oval shaped annulus
- Device landing zone calcification

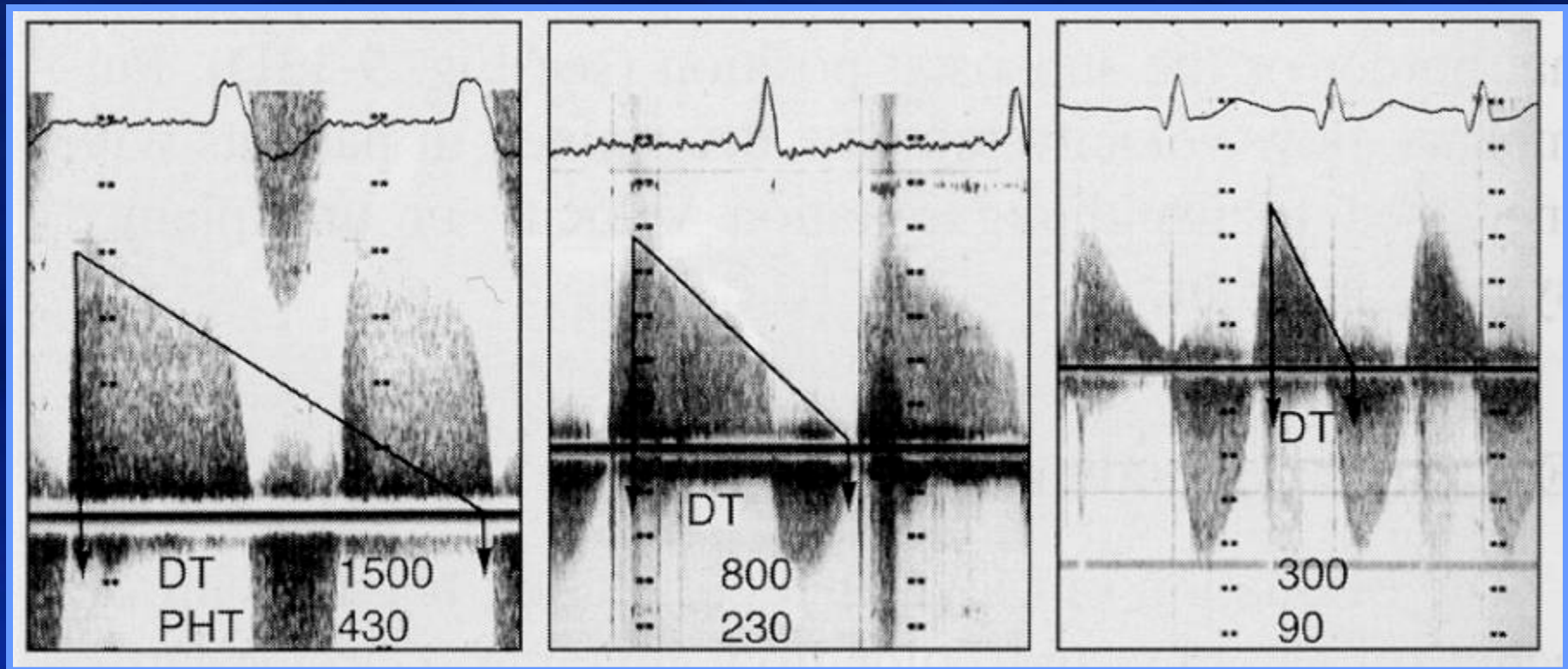
TAVR Nirvana Scale




Pulse Doppler Descending Thoracic Aorta



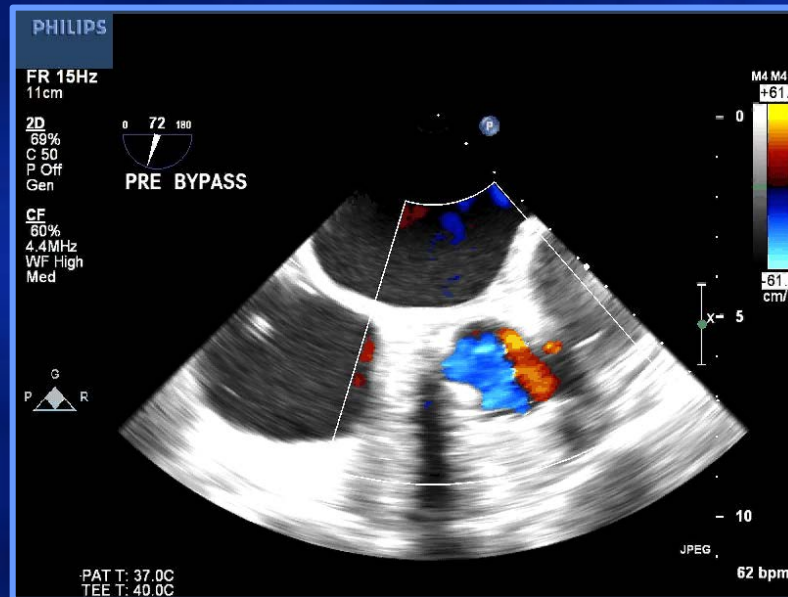
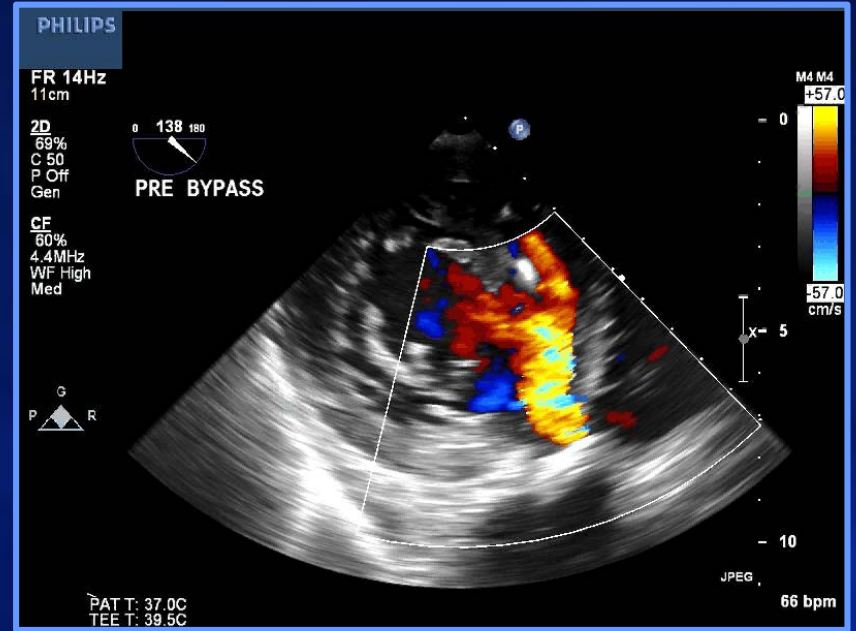
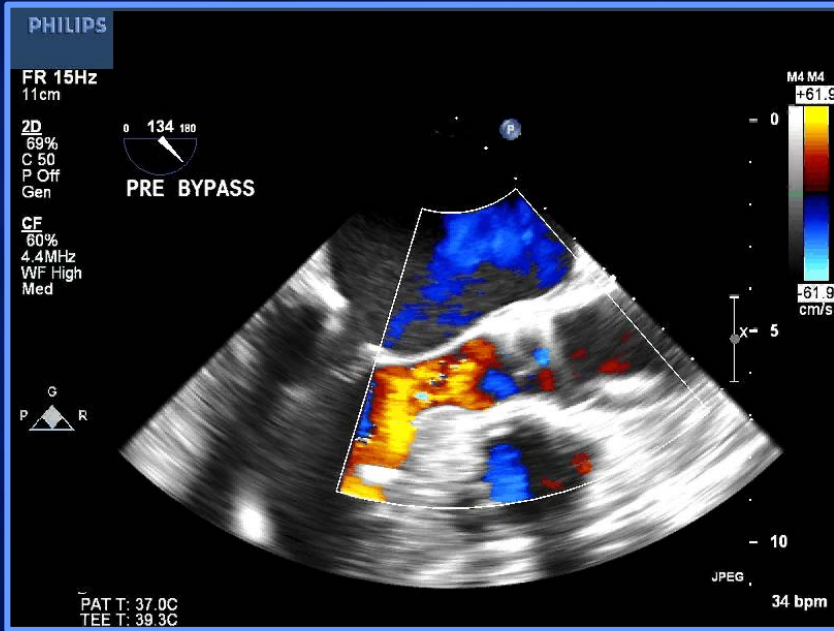
Pressure Half Time Aortic Regurgitation



Mild AR >400 msec  **Severe AR <250 msec**

Oh et al: The Echo Manual

Guidewire Induced Prosthetic AR



Other Post Valve Deployment Complications

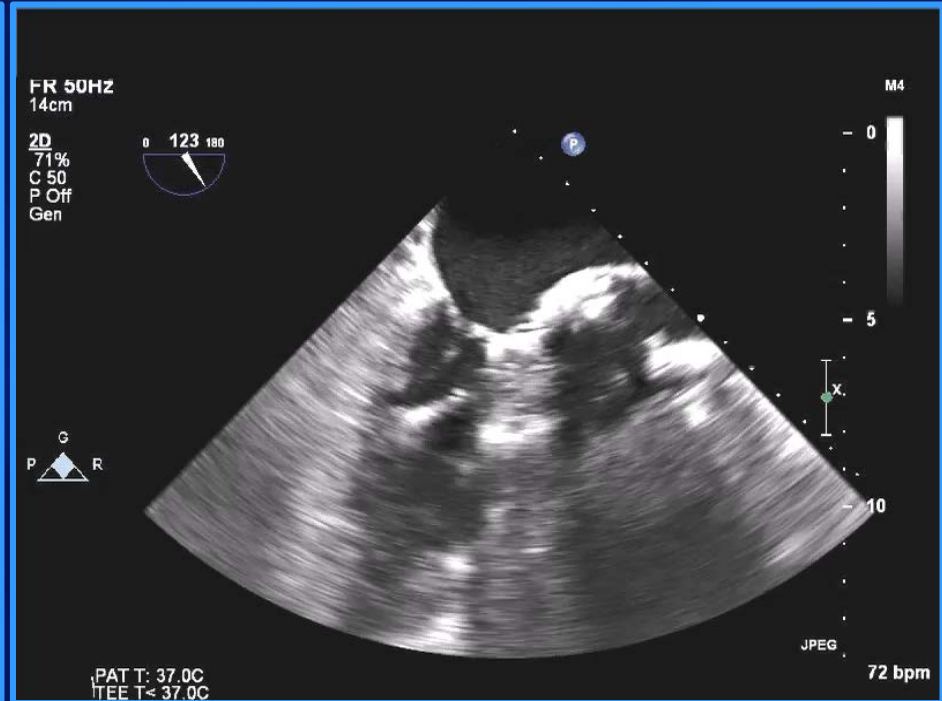
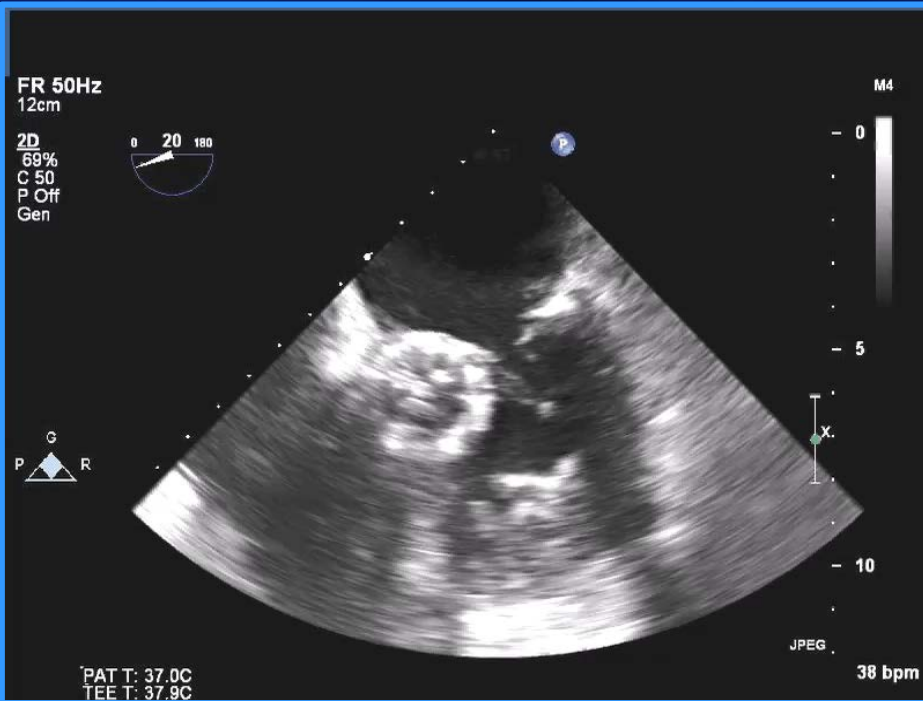
- **Cardiac perforation (effusion/cardiac tamponade)**
- **Rupture of aortic root or annulus**
- **Traumatic VSD/septal hematoma**
- **Avulsion of Asc Ao intima**
- **New /worsening TR**

Intra-procedural Hypotension

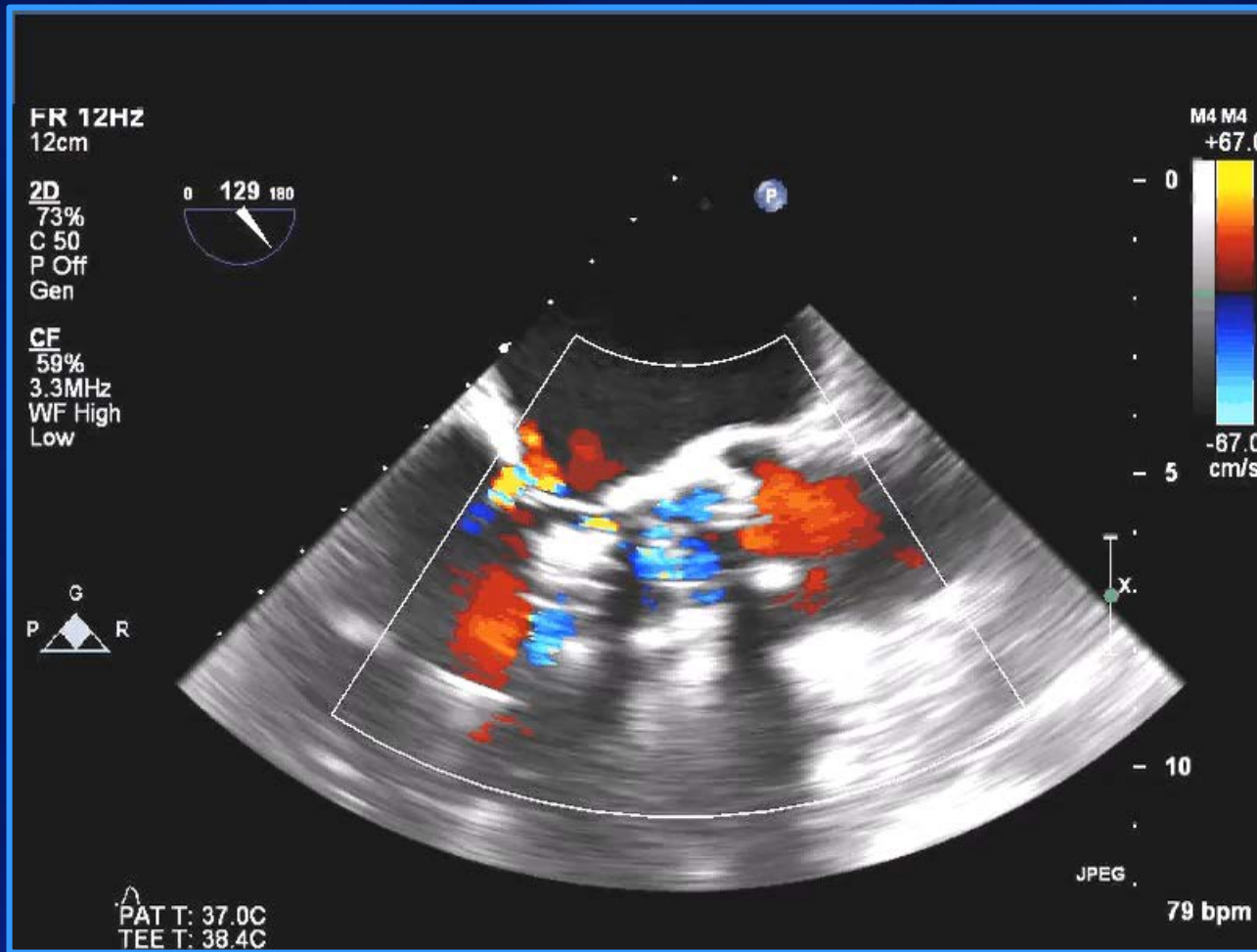
What to Look For

- **Severe AR (usually periprosthetic but may be prosthetic)**
- **Cardiac tamponade**
- **Aortic rupture**
- **VSD**
- **Severe MR**
- **LV dysfunction**

TAVR: Too Low



TAVR: Too Low

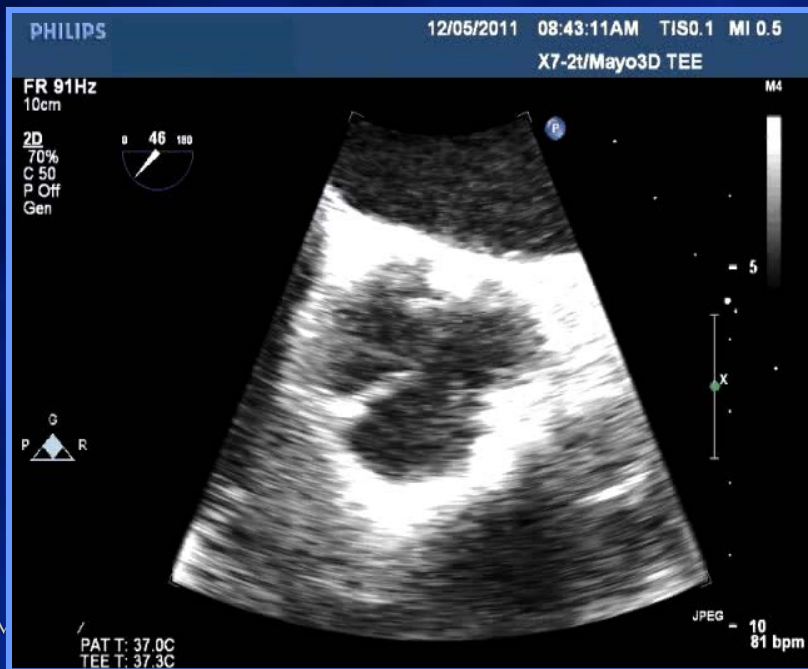


TAVR: Too Low

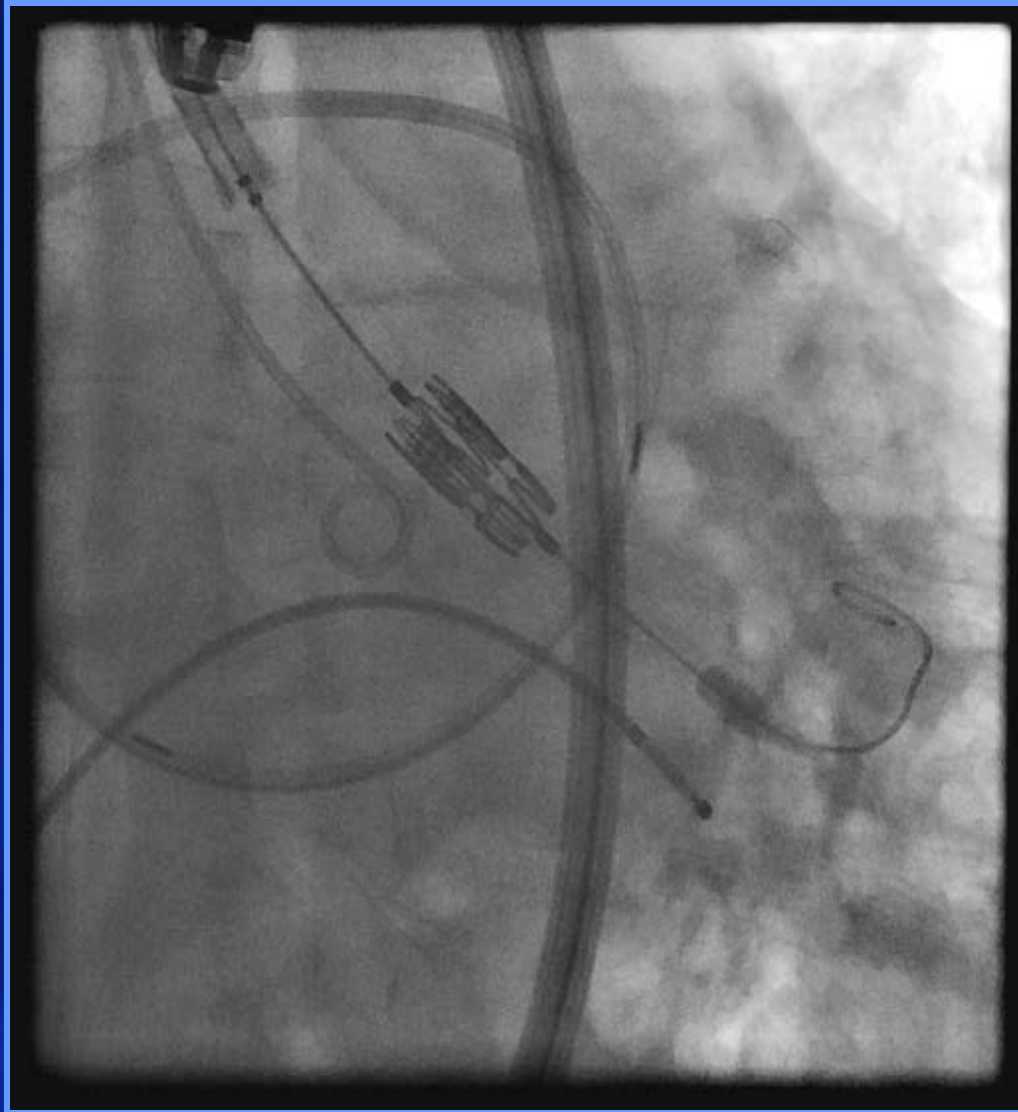


79-year-old male

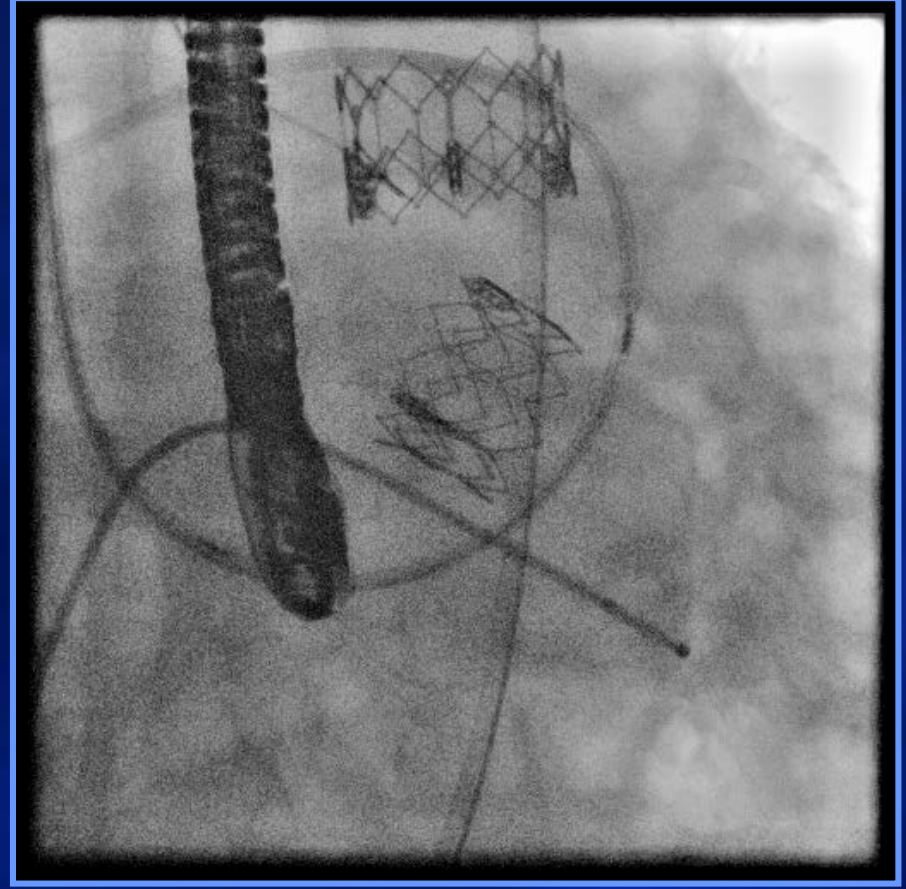
- Severe Symptomatic Aortic Stenosis
 - Cohort B patient
- AVA 0.9 cm², AV MG 54 mmHg
- LVOTd 2.4 cm
- LV EF 67%



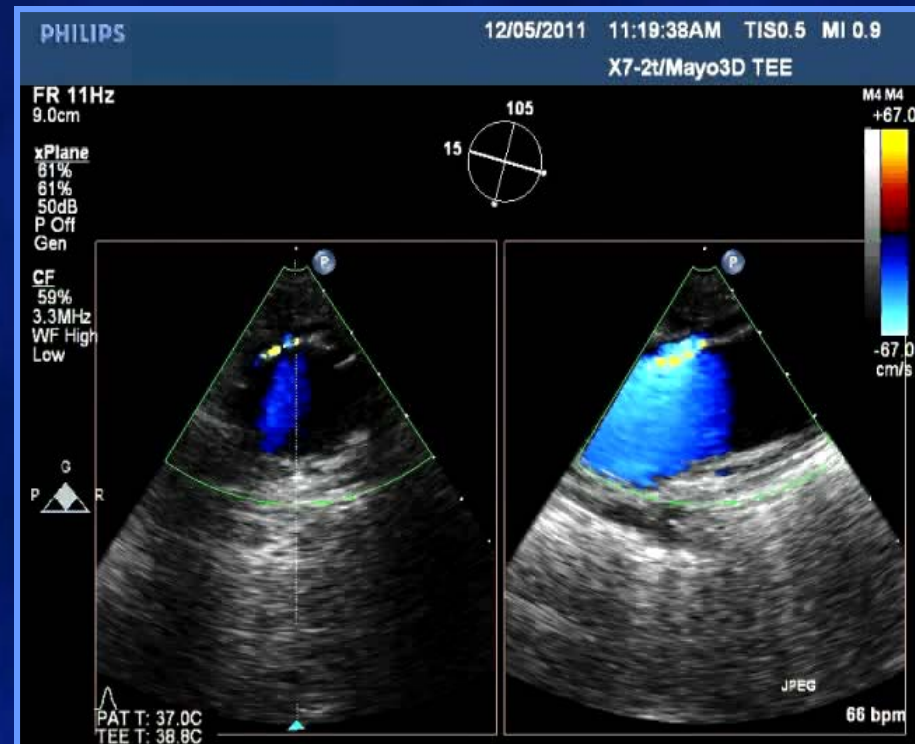
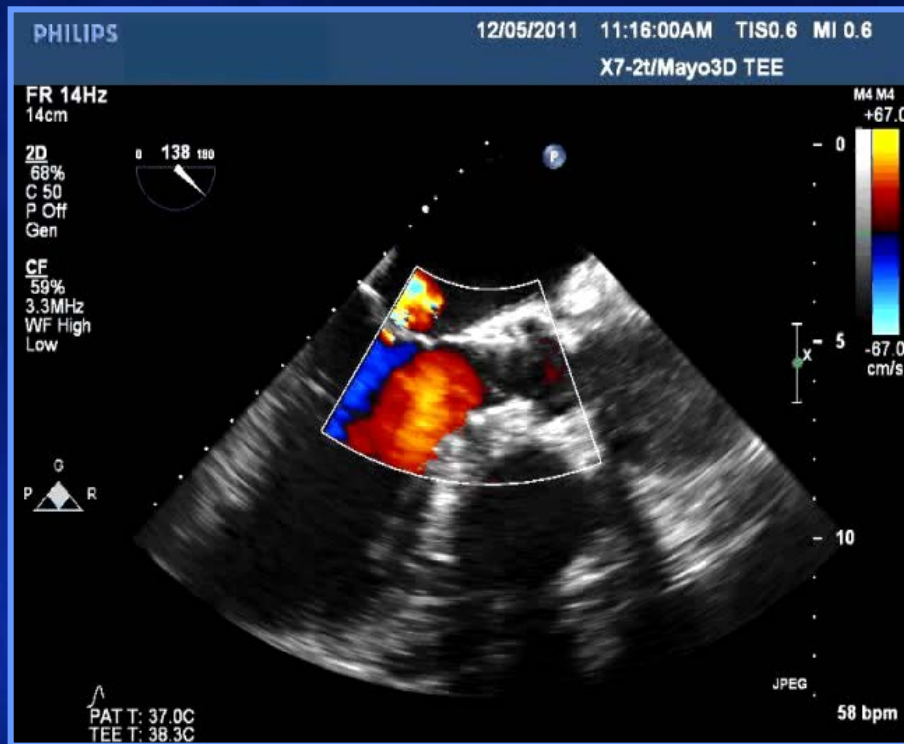
79-year-old male for TAVR



Try and Try Again



79-year-old male S/P TAVI

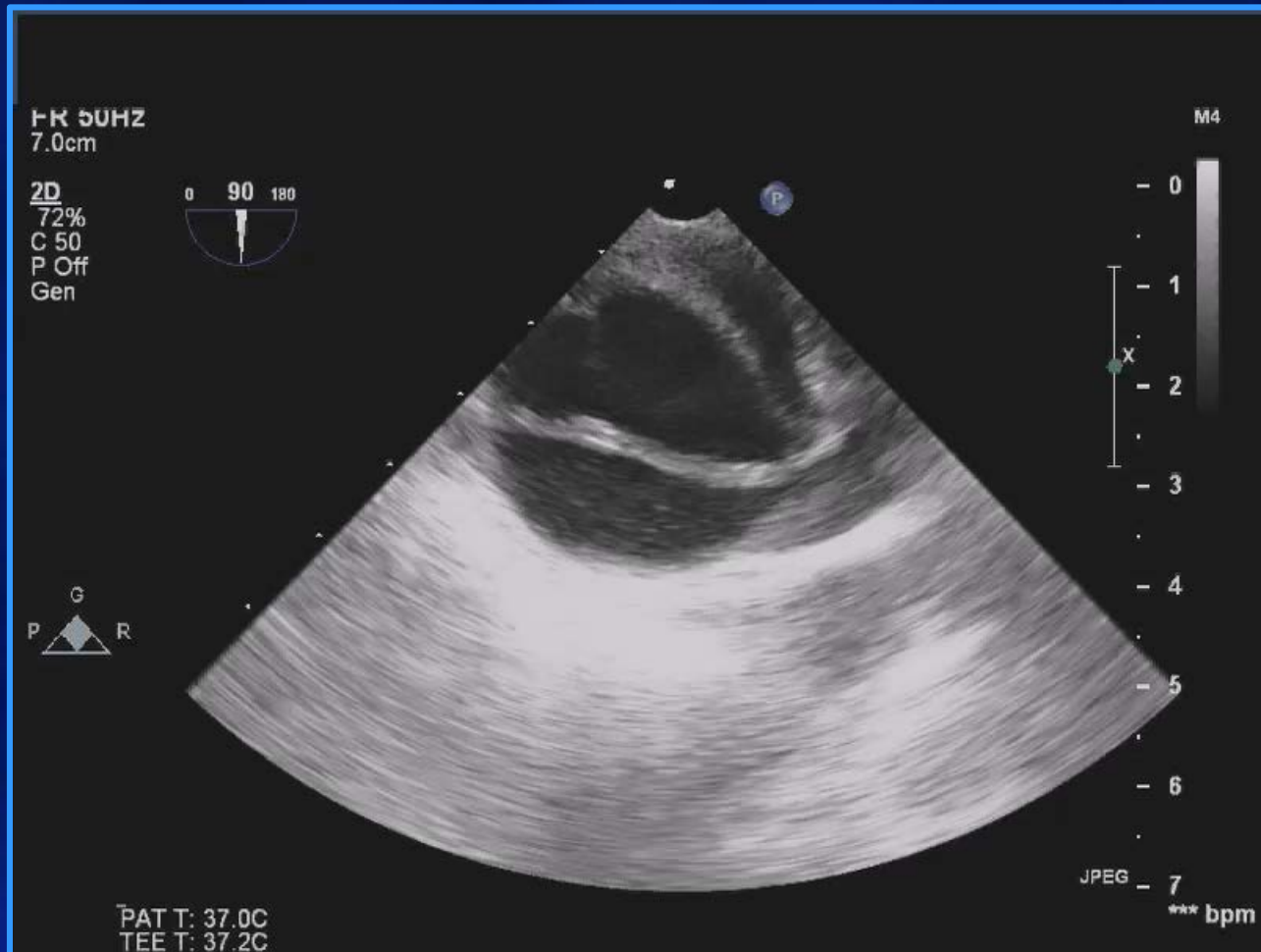


Acute Thrombus





Aortic Dissection Post-TAVR



TAVR: Long-Term Follow-up

- **TTE**
 - At Discharge
 - 30 Days
 - 6 Months
 - 12 Months
 - Yearly, thereafter
- **TTE/TEE**
 - Clinical change on exam
 - Clinical deterioration

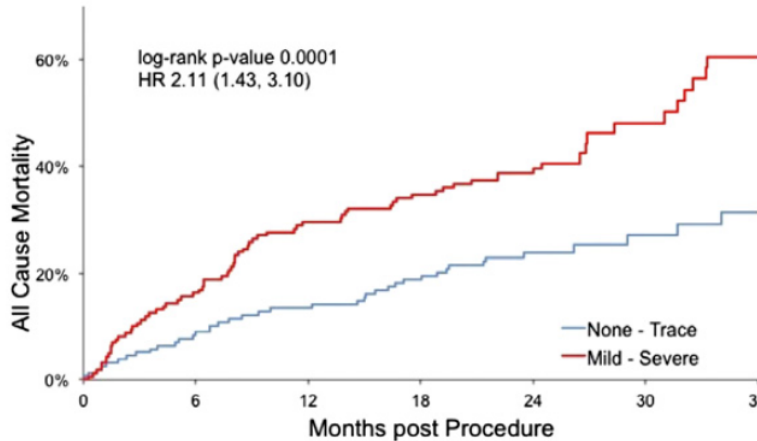
STATE-OF-THE-ART PAPER

Paravalvular Leak After Transcatheter Aortic Valve Replacement

The New Achilles' Heel? A Comprehensive Review of the Literature

Philippe Généreux, MD,*†‡ Stuart J. Head, MSc,§ Rebecca Hahn, MD,*† Benoit Daneault, MD,*† Susheel Kodali, MD,*† Mathew R. Williams, MD,*† Nicolas M. van Mieghem, MD,|| Maria C. Alu, MM,* Patrick W. Serruys, MD, PHD,|| A. Pieter Kappetein, MD, PHD,§ Martin B. Leon, MD*†

New York, New York; Montréal, Québec, Canada; and Rotterdam, the Netherlands



	0	6	12	18	24	30	36
None-Tr	158	142	134	121	84	39	
Mild-Sev	160	134	112	101	64	26	

Figure 2 Impact of Paravalvular Leak on 2-Year All-Cause Mortality

Reprinted with permission from Kodali et al. (8). HR = hazard ratio.

2 Year

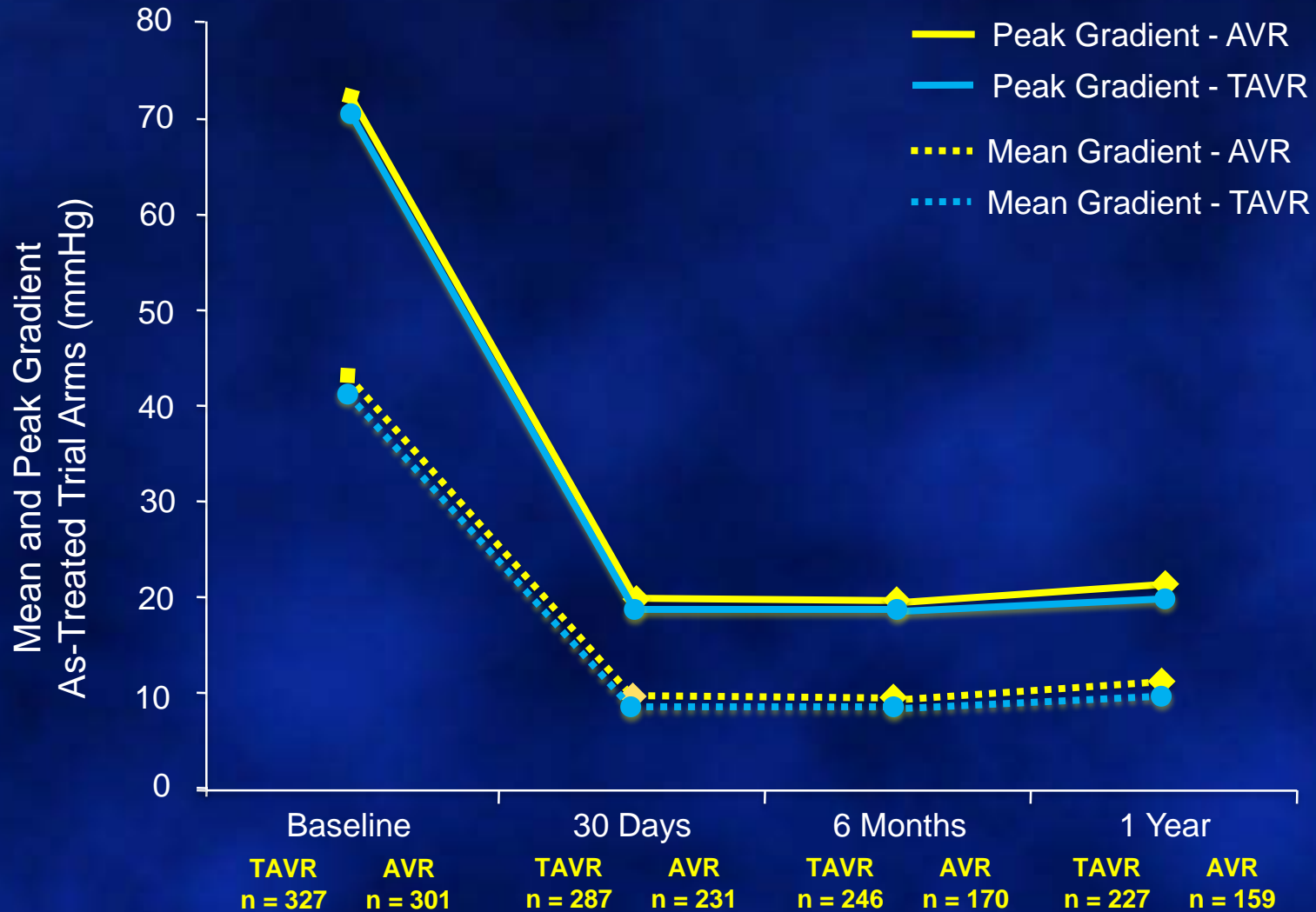
Post Procedure	None	Trace	Mild	Moderate	Severe
None	17	8	6	1	0
Trace	24	12	11	1	0
Mild	3	10	34	5	0
Moderate	2	1	5	3	0
Severe	0	0	0	0	0

Figure 1 Change in Paravalvular Leak Severity Over 2-Year Follow-Up

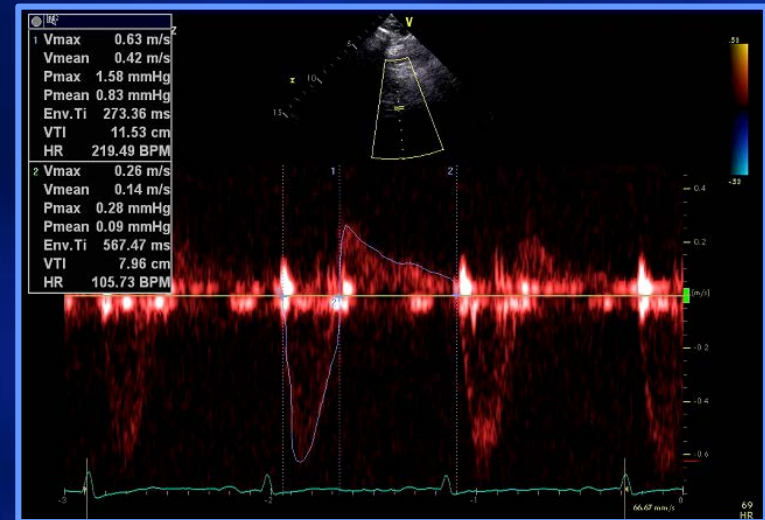
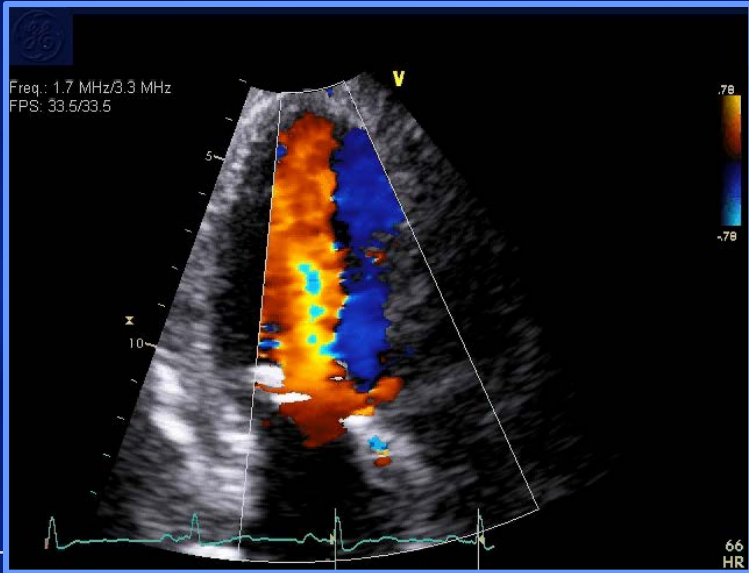
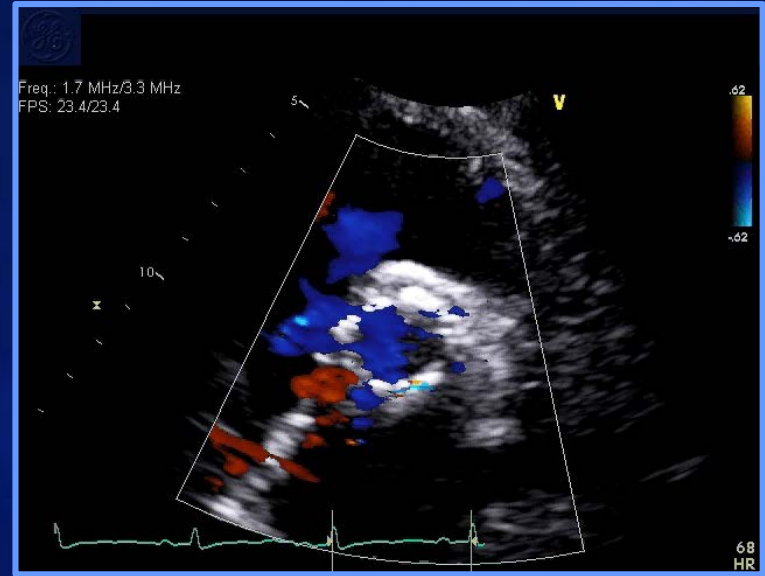
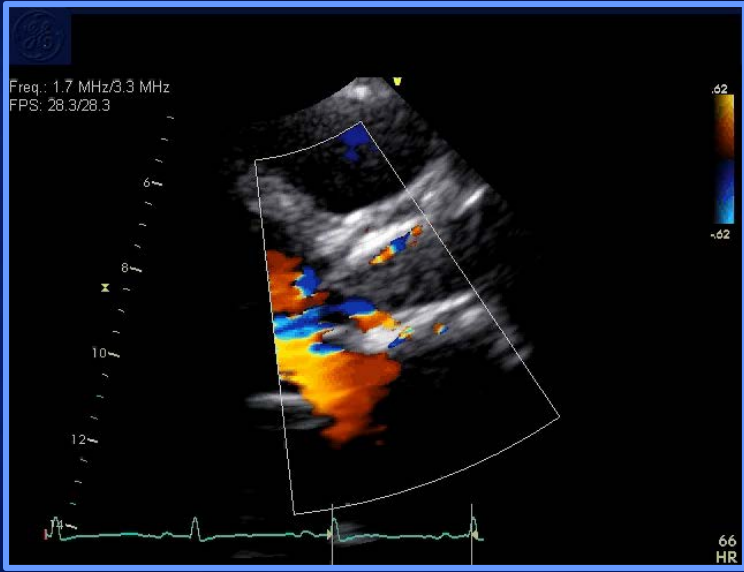
Adapted with permission from Kodali et al. (8).

Echo Findings

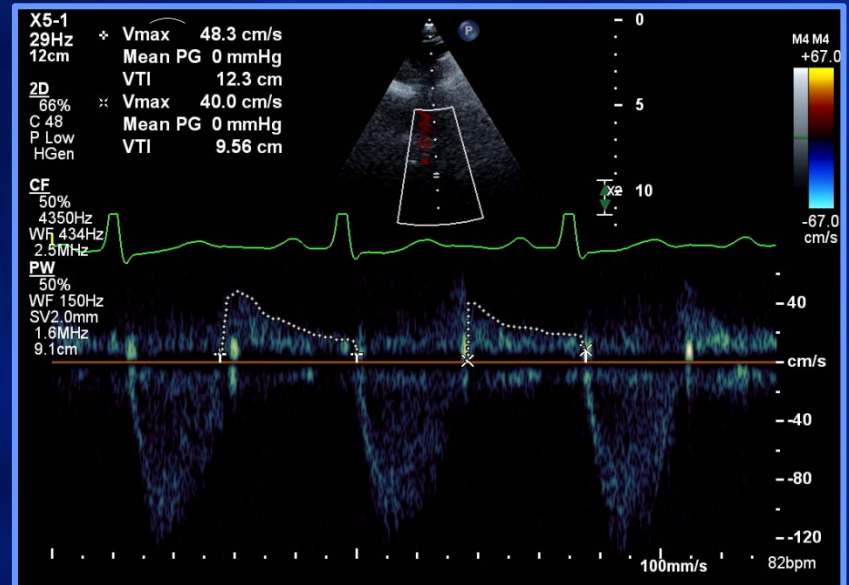
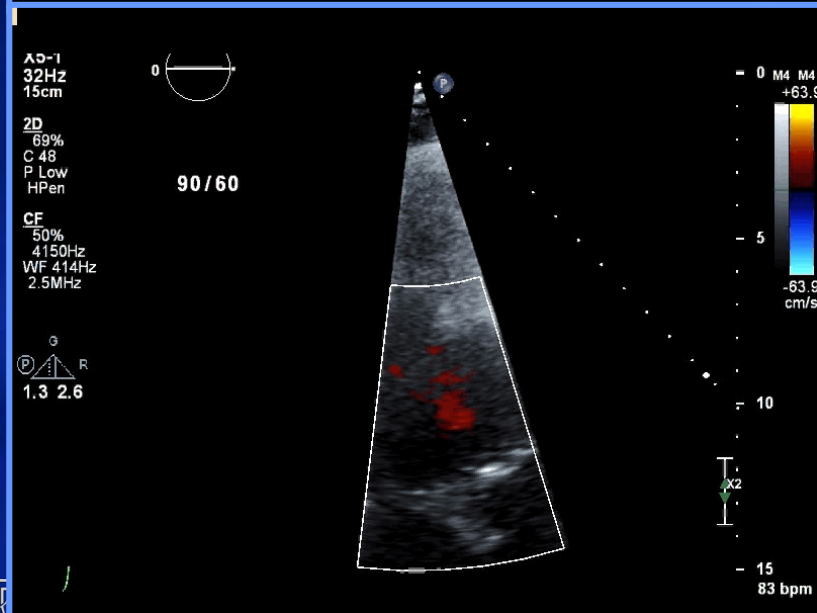
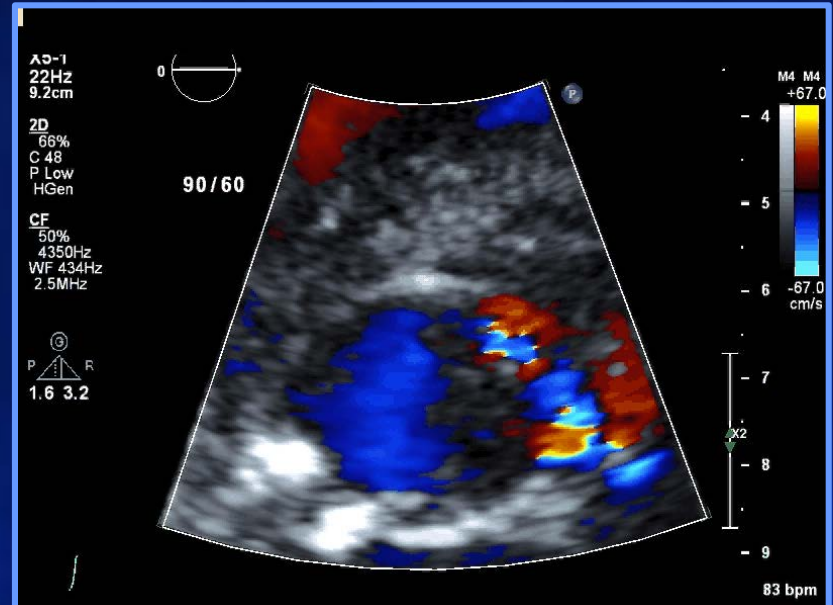
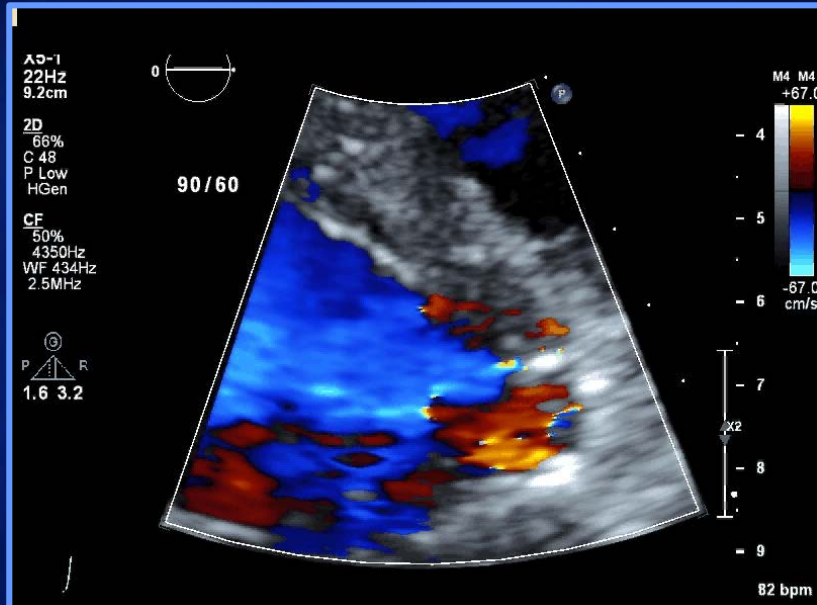
Aortic Valve Gradients



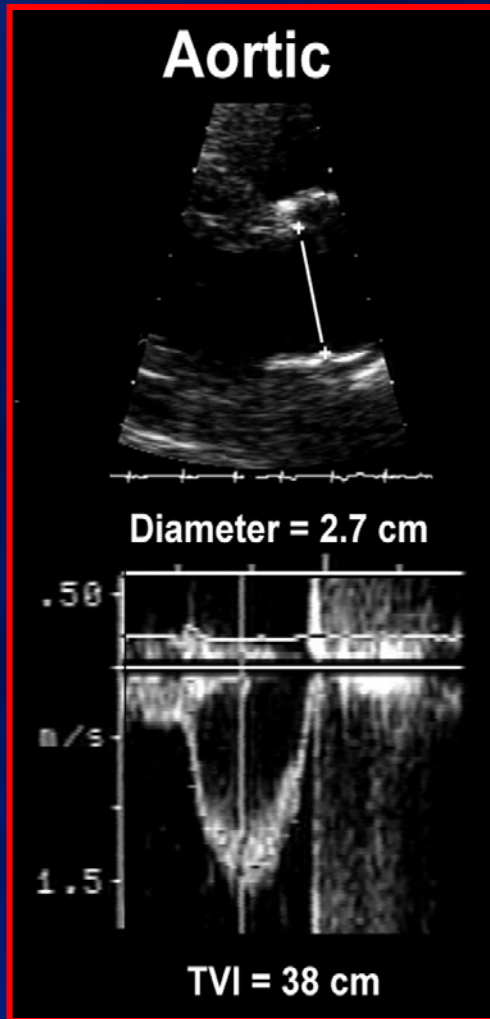
Mild-moderate Periprosthetic AR



Moderate Periprosthetic AR



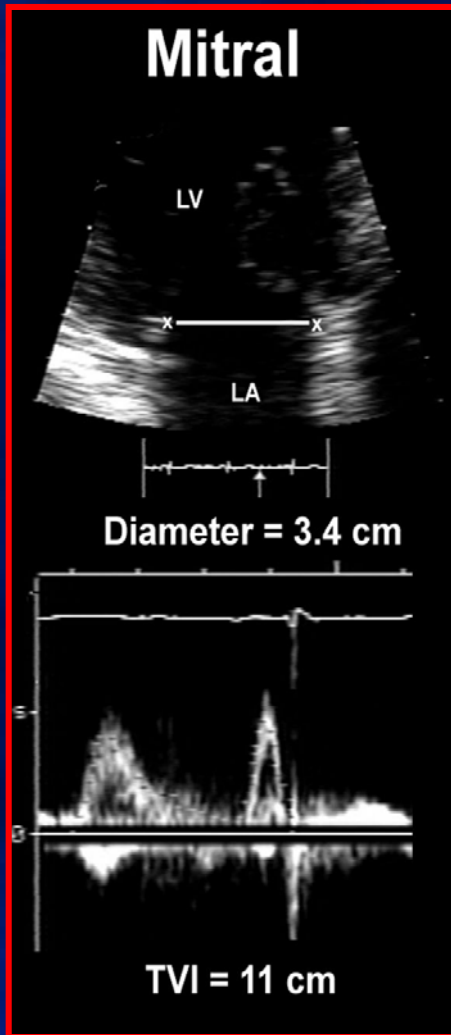
Continuity Method



Calculate SV_{LVOT}

- Measure LVOT diameter
- Obtain PW Doppler signal in LVOT
- Trace LVOT TVI
- Calculate LVOT SV
- $SV_{LVOT} = CSA_{LVOT} \times TVI_{LVOT}$

Continuity Method



Calculate SV_{MV}

- Measure diameter of mitral annulus
- Obtain PW Doppler signal at level of mitral annulus
- Trace MV annulus TVI
- Calculate mitral valve SV
- $SV_{MV} = CSA_{MV} \times TVI_{MV}$

Calculation of Regurgitant Volume

$$SV_{MV} = CSA_{MV} \times TVI_{MV}$$

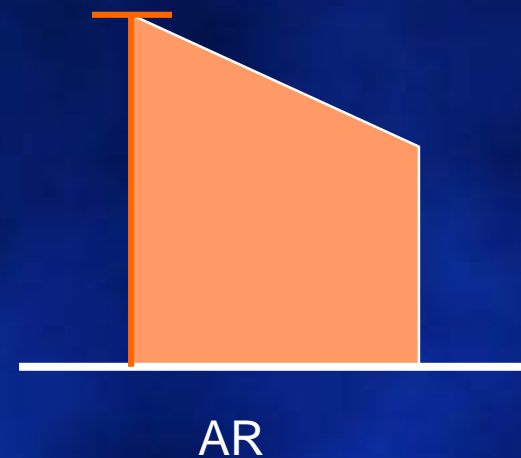
$$SV_{LVOT} = CSA_{LVOT} \times TVI_{LVOT}$$

$$RV_{MR} = SV_{MV} - SV_{LVOT}$$

$$RV_{AR} = SV_{LVOT} - SV_{MV}$$

Calculation of ERO

- Obtain optimal regurgitant jet with CW Doppler
- Use alternate windows to be parallel to flow
- Trace regurgitant TVI
- $ERO = RV / \text{regurgitant TVI}$
 - $ERO_{AV} = RV_{AR} / AR \text{ TVI}$



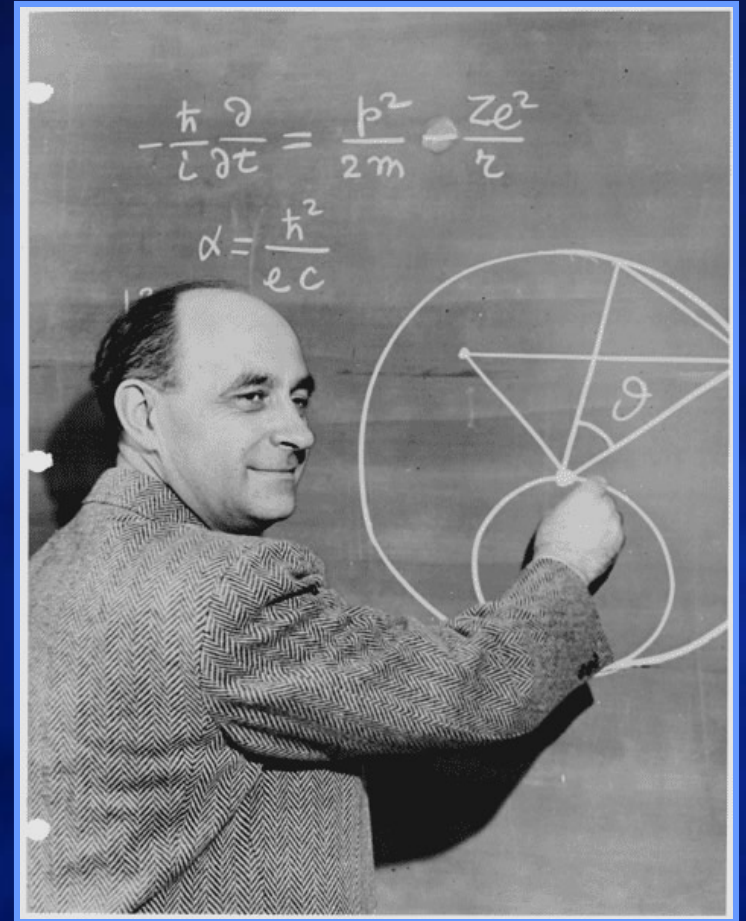
Echo for TAVR

Conclusions:

- Assess atherosclerosis
- Select device size
- Assess landing zone site for suitability of valve deployment/potential complications
- Guide valve deployment & monitor/assess periprocedural complications
- Long-term follow-up

“Before I came here I was confused about this subject. Having listened to your lecture I am still confused. But on a higher level”

-Enrico Fermi





Thank You!

mankad.sunil@mayo.edu
@MDMankad

