

TAVI- All the complications

Dr Kathy Lau



ECHO
AUSTRALIA

17-19 March 2025



1



Faculty Financial Disclosure

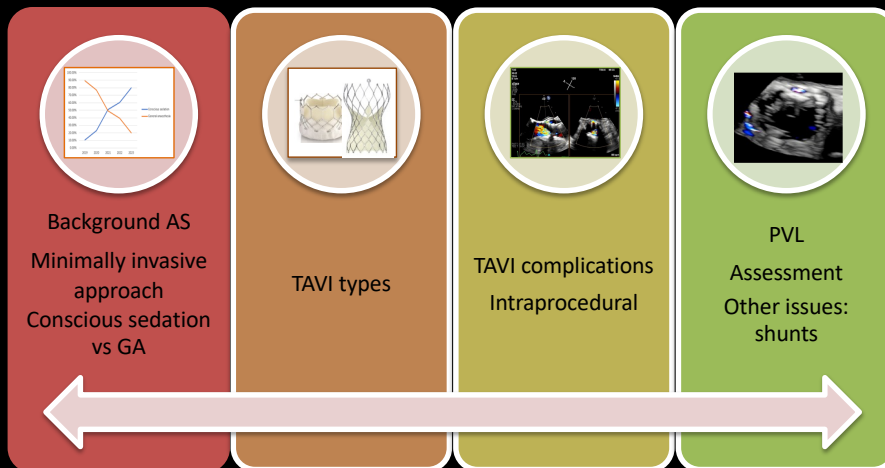
No disclosures

Declaration: The contents of this presentation may not represent the ideas and beliefs of the employer.



2

Presentation outline

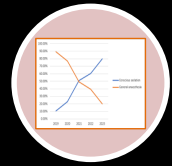


Severe Aortic Stenosis

- Early intervention.
- 50% patient with AS die within 2 years unless effective treatment provided
 - Trend toward increasing waiting times for SAVR
 - Long waiting times for TAVI & significant mortality awaiting intervention
 - Increasing heart failure-related hospitalisations
- TTE:
 - Central role in evaluating severity of AS
- CT key role:
 - Evaluating feasibility of TAVI
 - Determining risk of complications.

Minimally invasive treatments- sedation TAVI

- Reduced use of ICU
- Quicker patient recovery
- Shorter length of hospital stay compared with surgical intervention
- Benefits are to reduce:
 - Capacity challenges related to staffing
 - Catheterization laboratory time
 - Waiting lists for beds.



Background A5
Minimally invasive approach
Conscious sedation vs GA



5

Implications for assessment of complications

- Minimalist approach:

(Curr Probl Cardiol 2022;47:100998.)
Next-Day Discharge vs Early Discharge After Transcatheter Aortic Valve Replacement: Systematic Review and Meta-Analysis
Rahul Gupta^{a,*}, Sugandhi Mahajan^b, Anila Mehta^b, Mark Nyame^b, Nikhil A. Mehta^c, Adil Cheema^b, Luna Khanal^b, Aaqib H. Malik^d, Wilbert S. Aronow^d, Apurva V. Vyas^e, Sanjay S. Mehta^e, and Nainesh C. Patel^f

From the ^aLehigh Valley Heart Institute, Lehigh Valley Health Network, Allentown, PA; ^bDepartment of Internal Medicine, Carle Foundation Hospital, Urbana, IL; ^cDepartment of Cardiology, University of Missouri Kansas City, Kansas City, MO; ^dDepartment of Cardiology, Westchester Medical Center and New York Medical College, Valhalla, NY; and ^eHeart and Vascular Institute, ...

> *AsiaIntervention*. 2022 Oct 6;8(2):143-144. doi: 10.4244/AIJ-D-22-00010
Impact of frailty on a minimalist approach to discharge following TAVI

Janarthanan Sathananthan¹, Sandra B Lauck¹, John Cairns¹, Karin H Hur¹, Madhu Natarajan³, Harindra C Wijesundera⁴, David J Cohen⁵, Martin B John G Webb¹, David A Wood¹

Heart, Lung and Circulation (2023) 32, 232-239
1443-9866/23/\$60.00
<https://doi.org/10.1016/j.hlc.2023.09.011>

Dedicated Next Day Discharge Post Minimalist TAVI: The Tasmanian Experience

Scott Eaves, MBChB^{a,*}, Conor Lees, MBBS^a, David Jin, MD^a, Clare Rayner, MD^a, Sarang Palleri, MD^a, Stephanie Rowe, MD^a, John Lee, MD^a, Umair Hayat, MBBS^a, Heath Adams, MBBS^{a,b}

^aDepartment of Cardiology, Royal Hobart Hospital, Hobart, Tas, Australia

> *Front Cardiovasc Med*. 2023 Aug 14;10:1227217. doi: 10.3389/fcvm.2023.1227217. eCollection 2023.

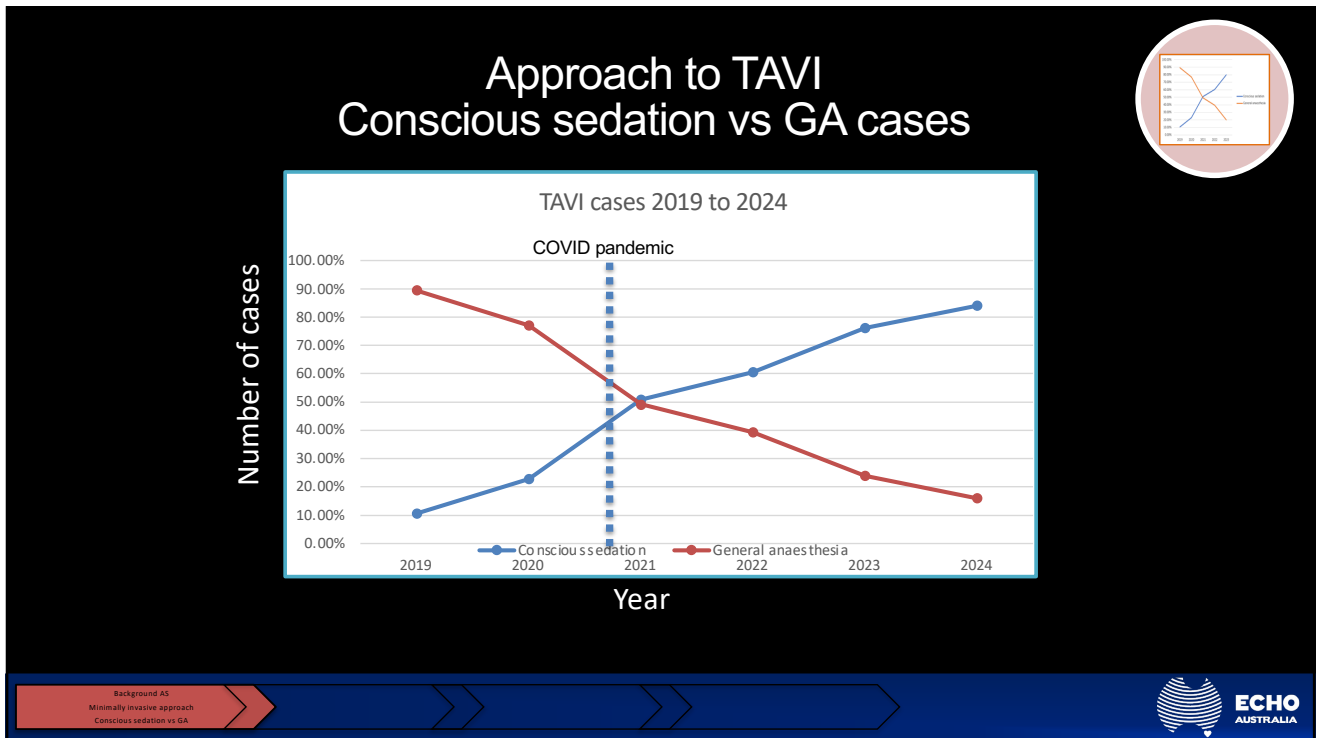
Contemporary European practice in transcatheter aortic valve implantation: results from the 2022 European TAVI Pathway Registry

Liesbeth Rosseel^{1,2}, Darren Mylotte³, Bernard Cosyns^{2,4}, Maarten Vanhaverbeke⁵, David Zweiker⁶, Rui Campante Teles^{7,8}, Oskar Angerås^{9,10}, Antoinette Neylon¹¹, Tanja Katharina Rudolph¹², Joanna J Wykrzykowska¹³, Tiffany Patterson¹⁴, Giulia Costa¹⁵, Soledad Ojeda¹⁶, Apostolos Tzikas¹⁷, Marcel Abras¹⁸, Lionel Leroux¹⁹, Eric Van Belle²⁰, Didier Tchétché²¹, Sabine Bleiziffer²², Martin J Swaans²³, Radoslaw Parma²⁴, Daniel J Blackman²⁵, Nicolas M Van Mieghem²⁶, Marek Grygier²⁷, Simon Redwood¹⁴, Bernard Prendergast¹⁴, Guy Van Camp²⁸, Ole De Backer²⁹

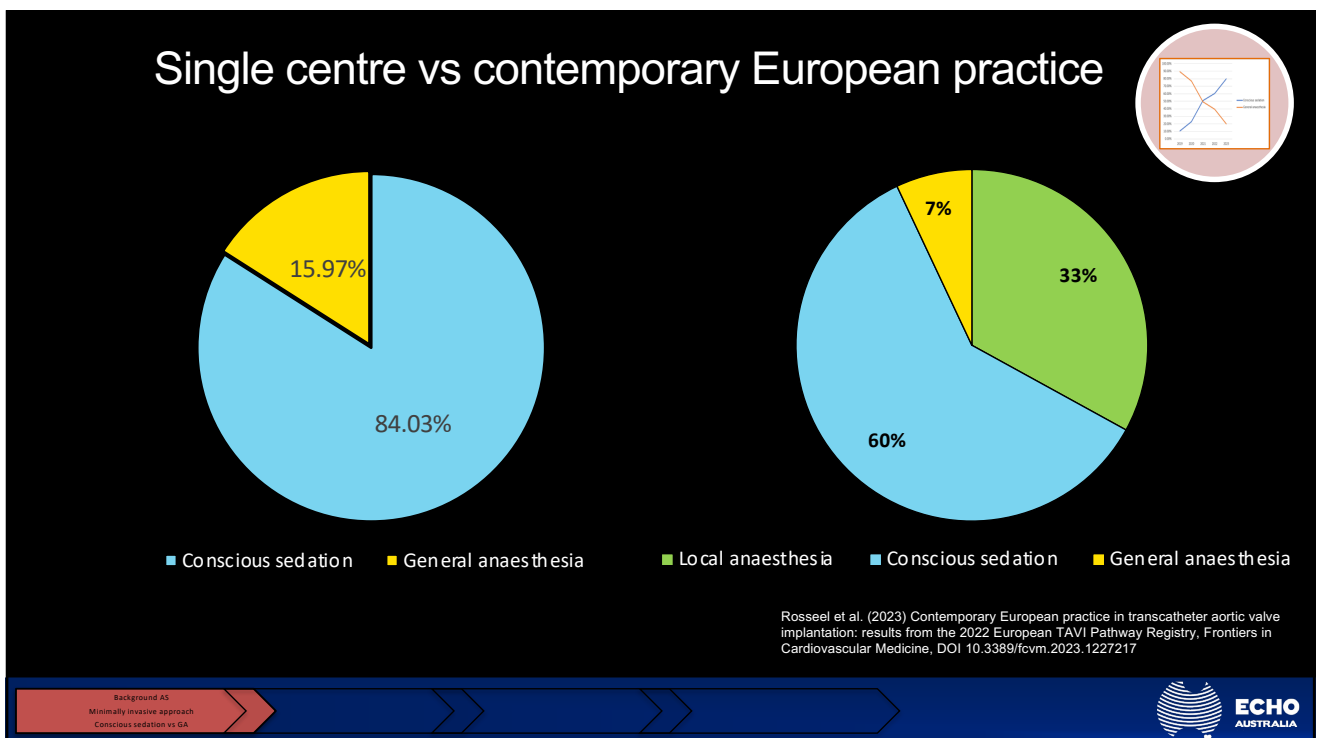
Background A5
Minimally invasive approach
Conscious sedation vs GA



6



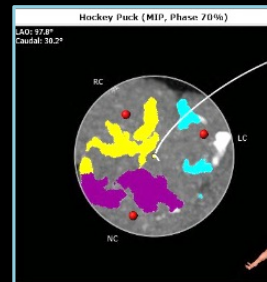
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8

Case selection for transesophageal imaging

- Heart team meeting
- All high-risk patients, not for SAVR
- Contraindication to contrast-enhanced computed tomography (CT): renal failure
- Determinants intraprocedural TOE:
 - Anatomical indications
 - Patient risk factors: gastroesophageal abnormalities, severe pulmonary hypertension, severe LV dysfunction.



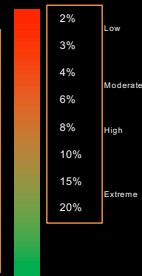
STS Adult Cardiac Surgery Database Version 4.20

RISK SCORES

Procedure: Isolated AVR

CALCULATE

Risk of Mortality:	9.637%
Renal Failure:	NA
Permanent Stroke:	4.409%
Prolonged Ventilation:	37.013%
DSW Infection:	0.397%
Reoperation:	5.342%
Morbidity or Mortality:	46.604%
Short Length of Stay:	4.541%
Long Length of Stay:	26.164%



9

Intraprocedural TOE indications:



LVOT sizing:

- 3D LVOT sizing

Concerns after MDCT assessment:

- Degree of aortic root calcification
- Leaflet morphology and pathology
- Extension along aortomitral junction
- Calcification ascending aorta
- Risk coronary artery occlusion
- Exclusion of possible LA thrombus

Anatomical indication:

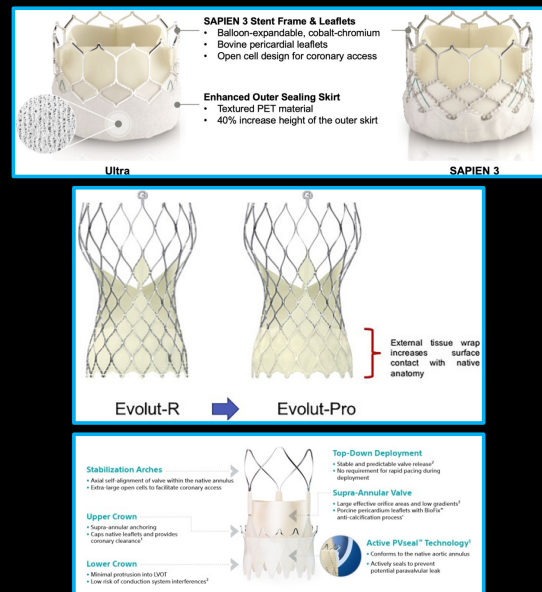
- LV basal septal bulge and small + hyperdynamic LV



10

TAVI valve types:

- 2 types of transcatheter valves:
 - Balloon-expandable valve-
 - Third generation SAPIEN™ valves (Edwards Lifesciences, USA)
 - SAPIEN 3 & SAPIEN 3 Ultra Resilia valves
 - Self-expandable valve-
 - CoreValve™ (Medtronic, USA)
 - Evolut R, Evolut Pro & Evolut Pro+ valves (Medtronic, USA)
 - ACURATE TA (Symetis SA, Switzerland)



11

Incidence of complications with recent TAVI valves

J. Clin. Med. 2023, 12, 5645

5 of 12

Table 2. Incidence of the main TAVI complications in studies with more recent transcatheter valves.

	High-Intermediate-Risk Patients		Intermediate-Risk Patients				Low Risk Patients			
	UK TAVI		PARTNER 2A		SURTA VI		PARTNER 3		EVOLUT	
	TAVI	SAVR	TAVI	SAVR	TAVI	SAVR	TAVI	SAVR	TAVI	SAVR
Stroke	2.4	2.3	5.5	6.1	3.4	5.6	0.6	2.4	3.4	3.4
PVL at least moderate	2.4	0.9	3.7	0.6	3.5	0.7	0.8	0	3.4	0.4
Mild PVL	43.7	12.3	22.5	2.8	28.3	NA	28.7	4.2	36	3
New pacemaker implantation	11	6.7	8.5	6.9	25.9	6.6	6.5	4	17.4	6.1
Major vascular complications	10.1	2.3	7.9	5	6	1.1	2.2	1.5	3.8	3.2
Aortic valve reintervention	2.2	1.1	1.4	0.6	2.8	0.7	0.6	0.5	0.7	0.6
Severe PPM	NA	NA	NA	NA	NA	NA	NA	NA	1.1	4.4
Coronary artery obstruction	NA	NA	0.4	0.6	0.2	0	0.2	0.7	0.9	0.4

Numbers represent % of patients. The incidence of stroke, at least moderate PVL, mild PVL, new pacemaker implantation, major vascular complications, severe PPM and coronary artery obstruction is reported at 30days, with the exception of the UK TAVI trial, when the incidence and the severity of PVL were reported at 6 weeks. The incidence of aortic valve reintervention is reported at the end of the study period. TAVI, transcatheter aortic valve intervention; SAVR, surgical aortic valve replacement; PVL, paravalvular leak; PPM, patient prosthesis mismatch.

Review TAVI after More Than 20 Years, Postolache, et al., (2023) J. Clin. Med., 12, 5645. <https://doi.org/10.3390/jcm12175645>

12

Incidence of complications with recent TAVI valves

J. Clin. Med. 2023, 12, 5645

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PVL at least moderate	2.4	0.9	3.7	0.6	3.5	0.7
Mild PVL	43.7	12.3	22.5	2.8	28.3	NA
New pacemaker implantation	11	6.7	8.5	6.9	25.9	6.6
Major vascular complications	10.1	2.3	7.9	5	6	1.1
Aortic valve reintervention	2.2	1.1	1.4	0.6	2.8	0.7
Severe PPM	NA	NA	NA	NA	NA	NA
Coronary artery obstruction	NA	NA	0.4	0.6	0.2	0

Numbers represent % of patients. The incidence of stroke, at least moderate PVL, mild PVL, new pacemaker implantation, major vascular complications, aortic valve reintervention is reported at 30 days, with the exception of the UK TAVI trial, when the incidence and the severe PPM is reported at the end of the study period. TAVI, transcatheter aortic valve intervention; SAVR, surgical aortic valve replacement; PPM, paravalvular prosthesis mismatch.

Review TAVI after More Than 20 Years, Postolache, et al., (2023) J. Clin. Med., 12, 5645. <https://doi.org/10.3390/jcm12175645>



13

Minimalist TAVI: supine imaging

Procedural TTE (if required)

- Focussed assessment pericardial effusion, aortic regurgitation (valvular vs paravalvular leak), LV function, damage to MV apparatus.
- LV dysfunction: coronary obstruction
- Iatrogenic VSD

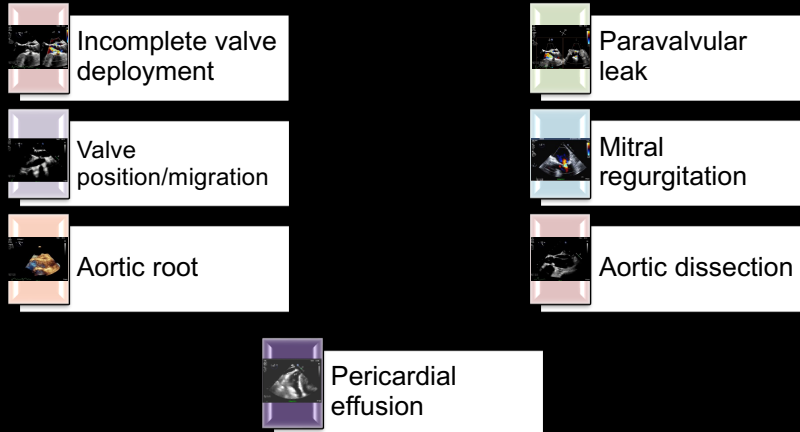
Post procedural/Next day TTE

- Complete TTE: including comprehensive valvular assessment
- Generate baseline for future studies



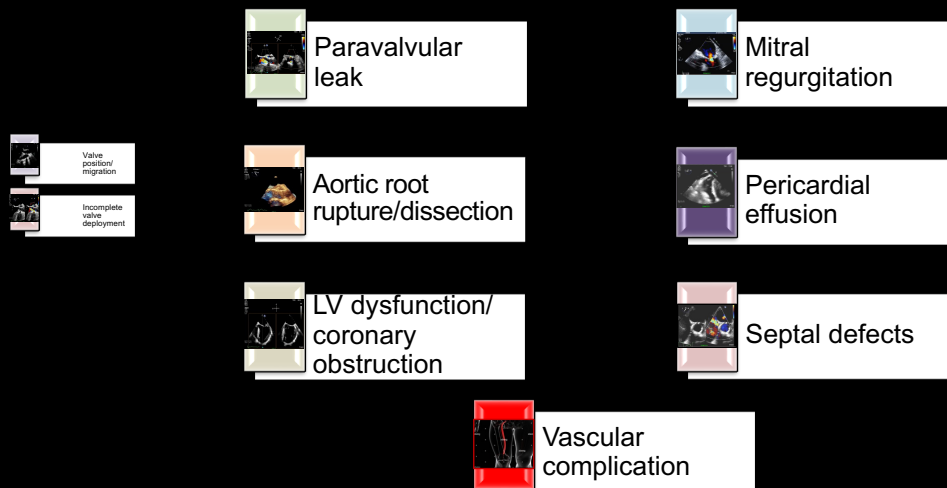
14

TAVR Complications



15

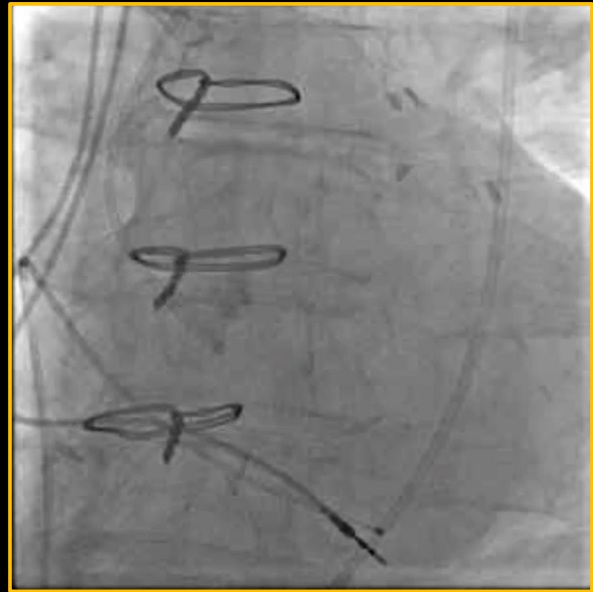
Intraprocedural hypotension- Potential complications



16

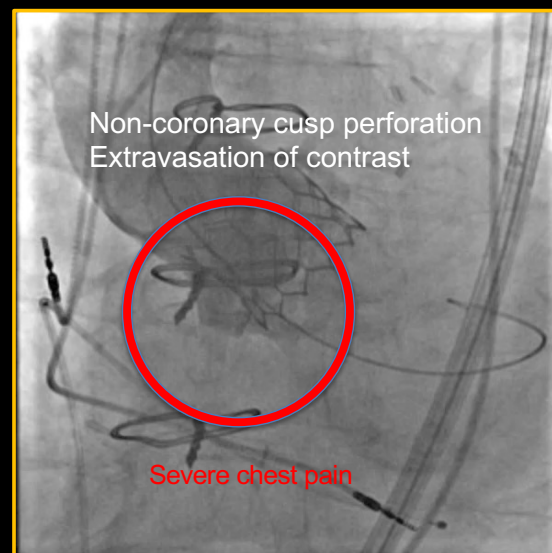
Case 1: 78 yo male

- Severe AS
- PMHx:
 - CABG 2014- patent on coronary angiogram
 - HTN
 - Dyslipidaemia
 - PPM
 - Prostate Ca Tx radiotherapy



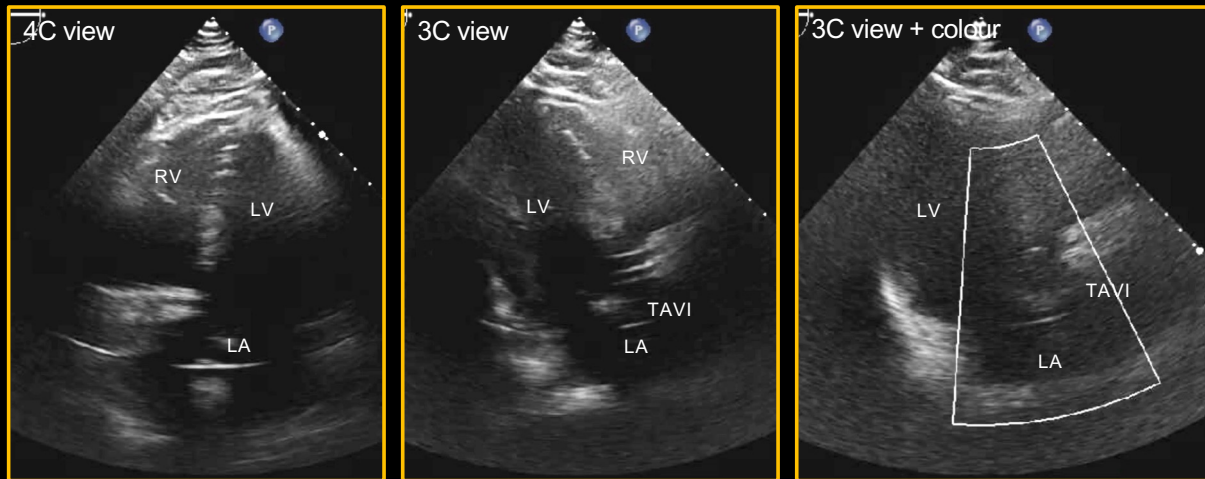
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29mm Edwards SAPIEN S3



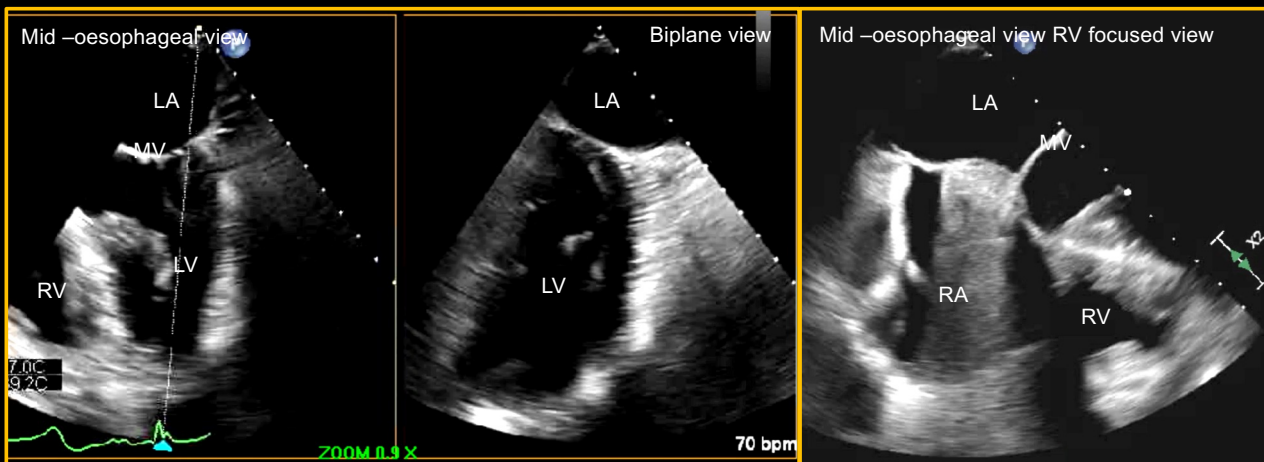
18

Urgent TTE supine Hybrid Lab



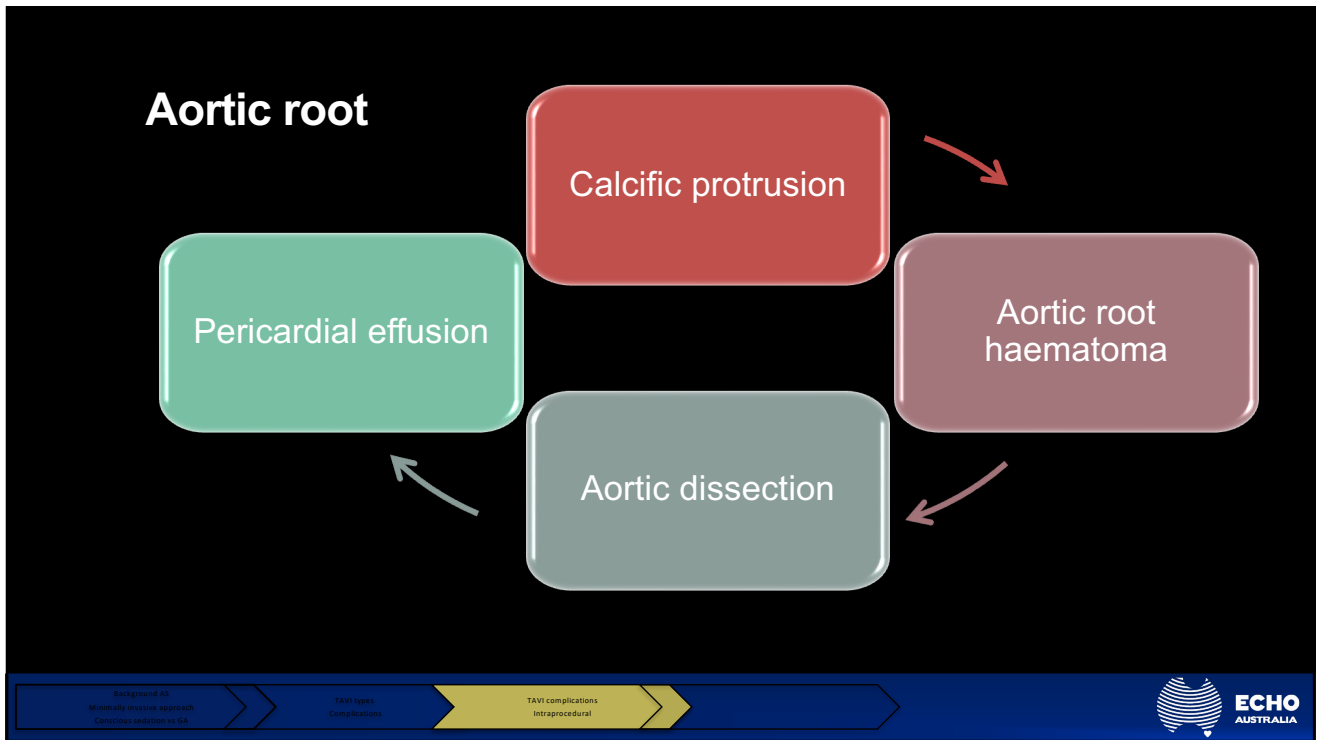
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TOE

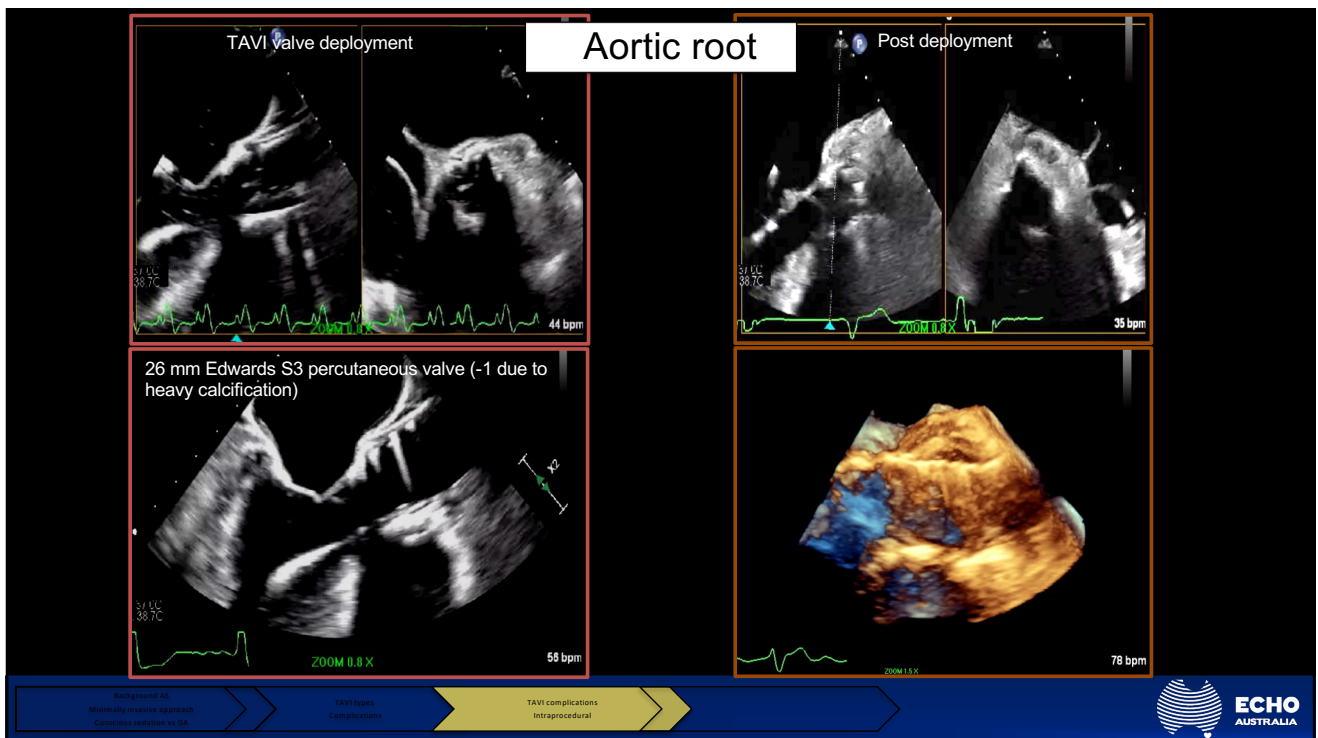


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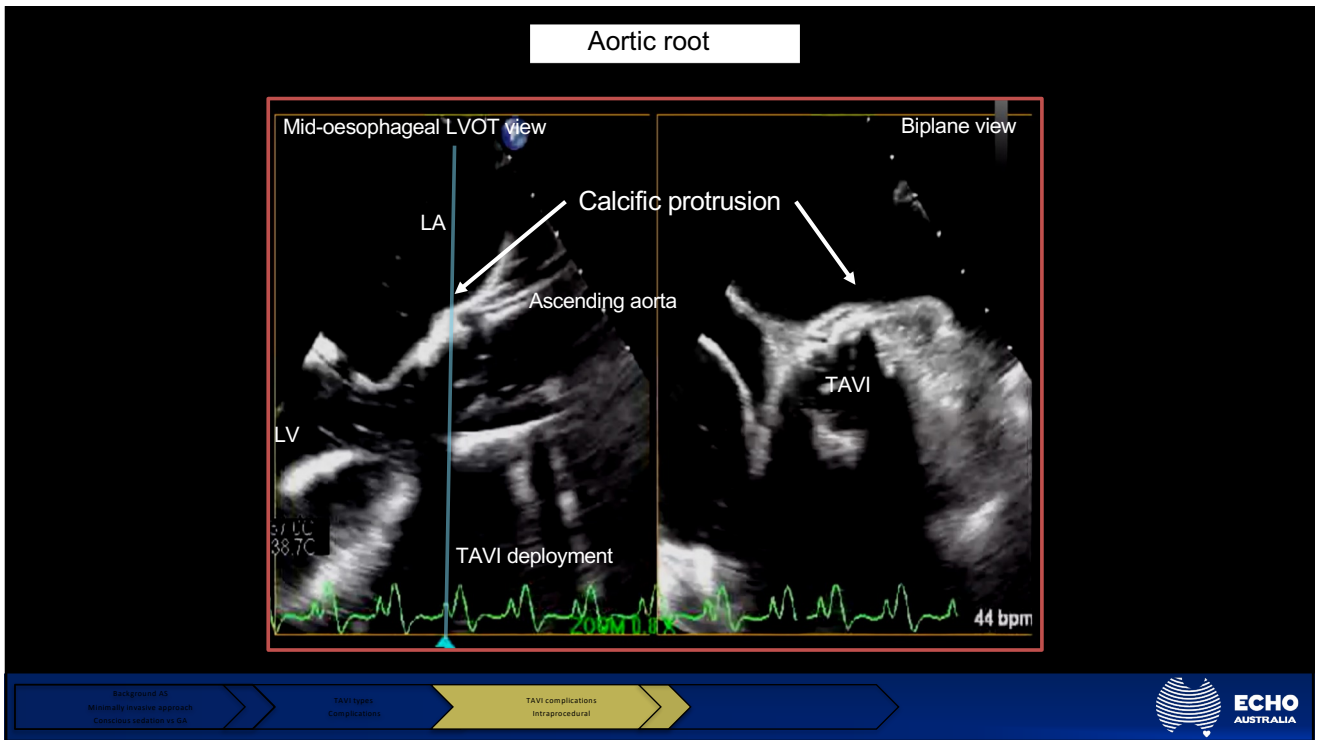




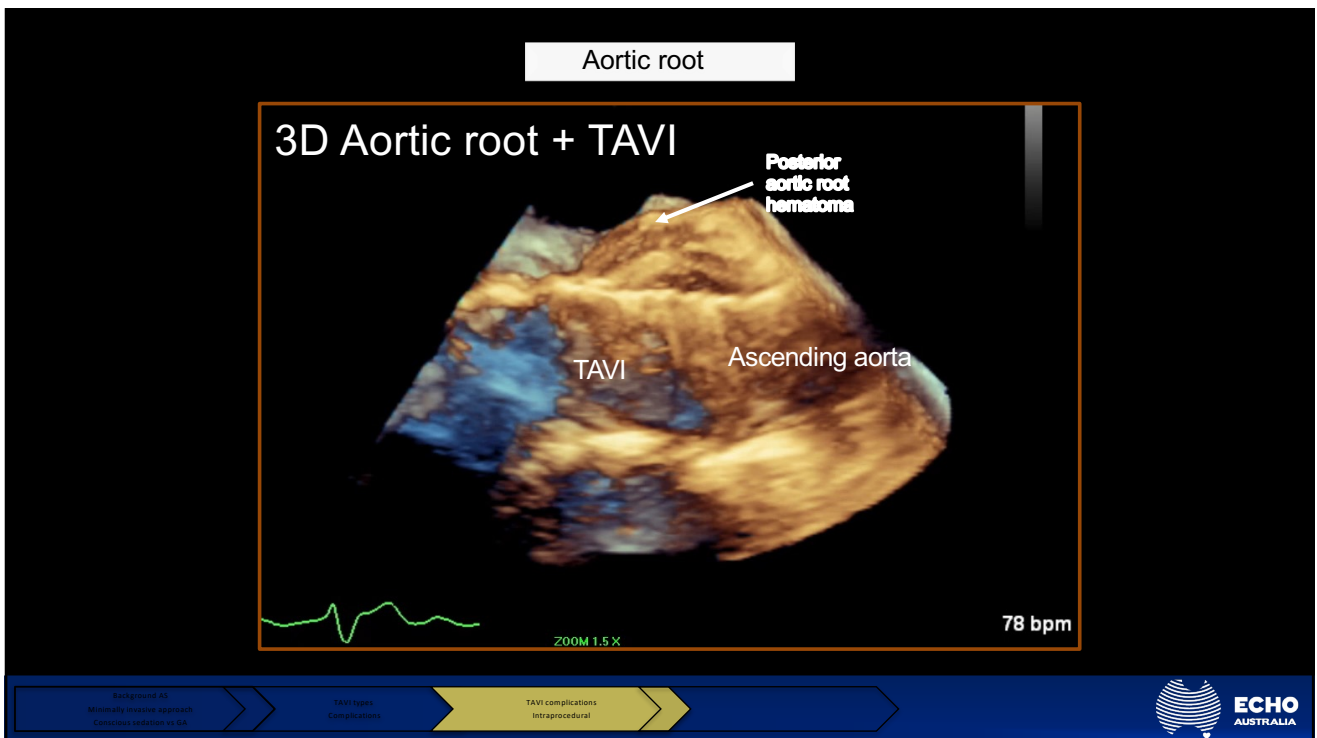
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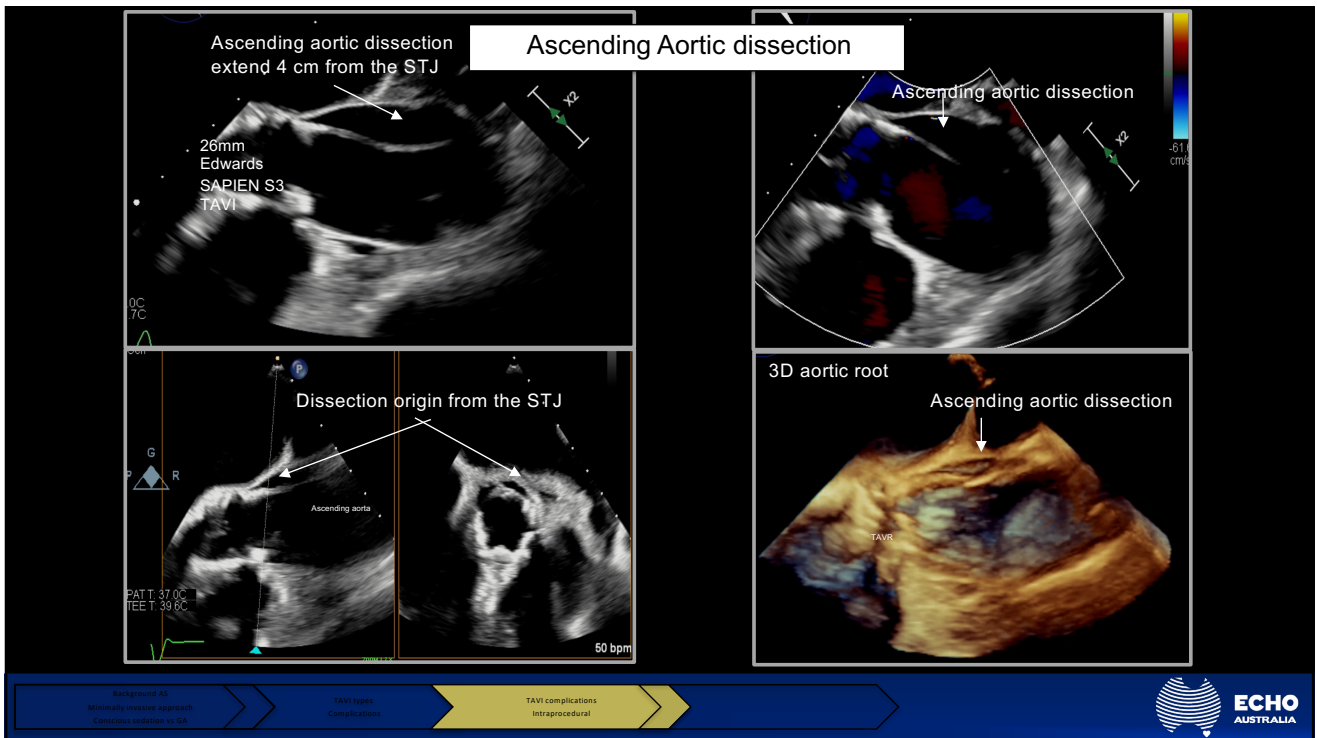
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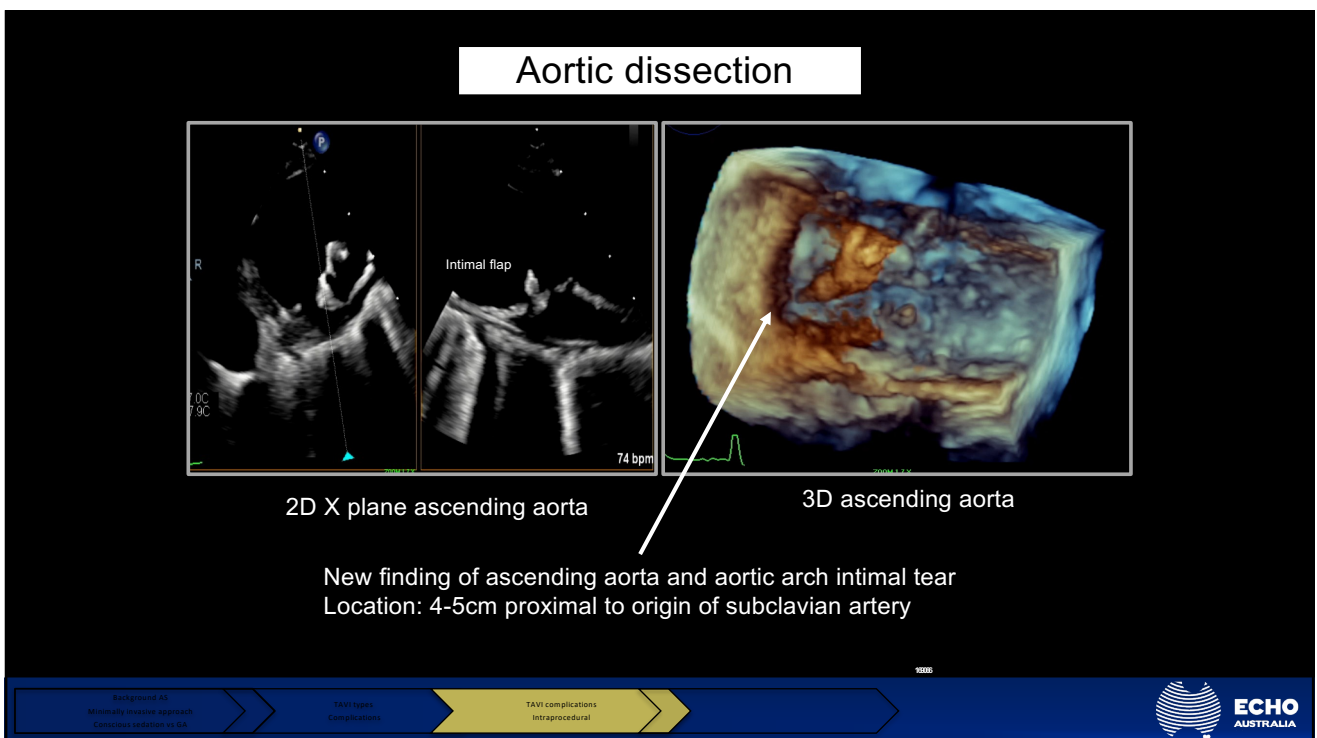
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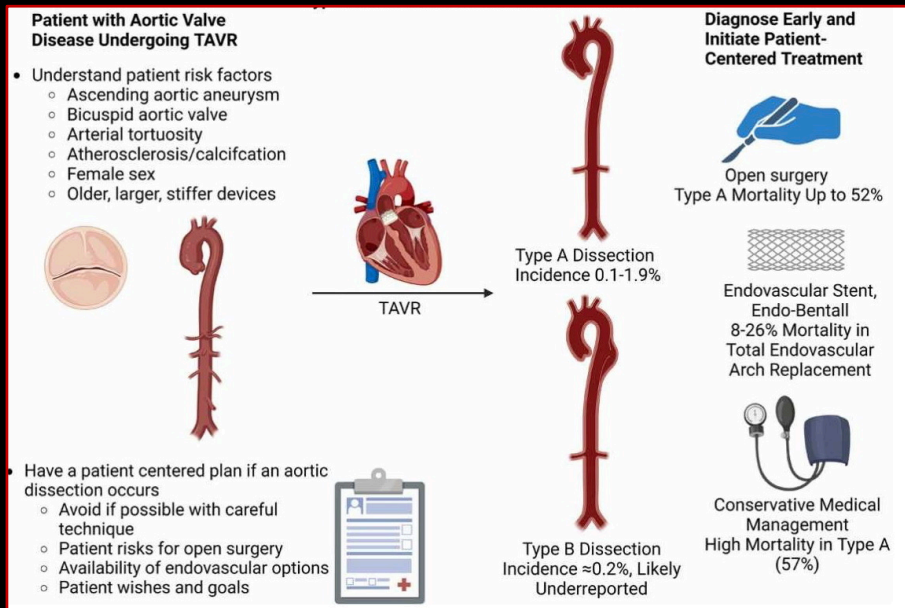


27



28

Expert review Aortic dissection in TAVI



DeGraaff B, DeRoo SC, George I. Aortic Dissection Following Transcatheter Aortic Valve Replacement. Semin Thorac Cardiovasc Surg. 2024 Dec 13:S1043-0679(24)00110-2. doi: 10.1053/j.semtcvs.2024.11.006. Epub ahead of print.



29

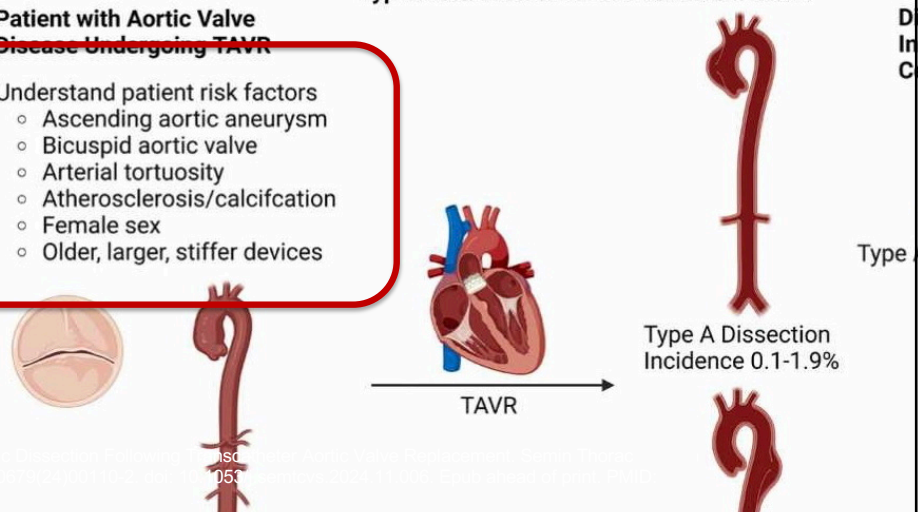
Expert review Aortic dissection in TAVI

Risks for Aortic
dissection

Patient with Aortic Valve Disease Undergoing TAVR

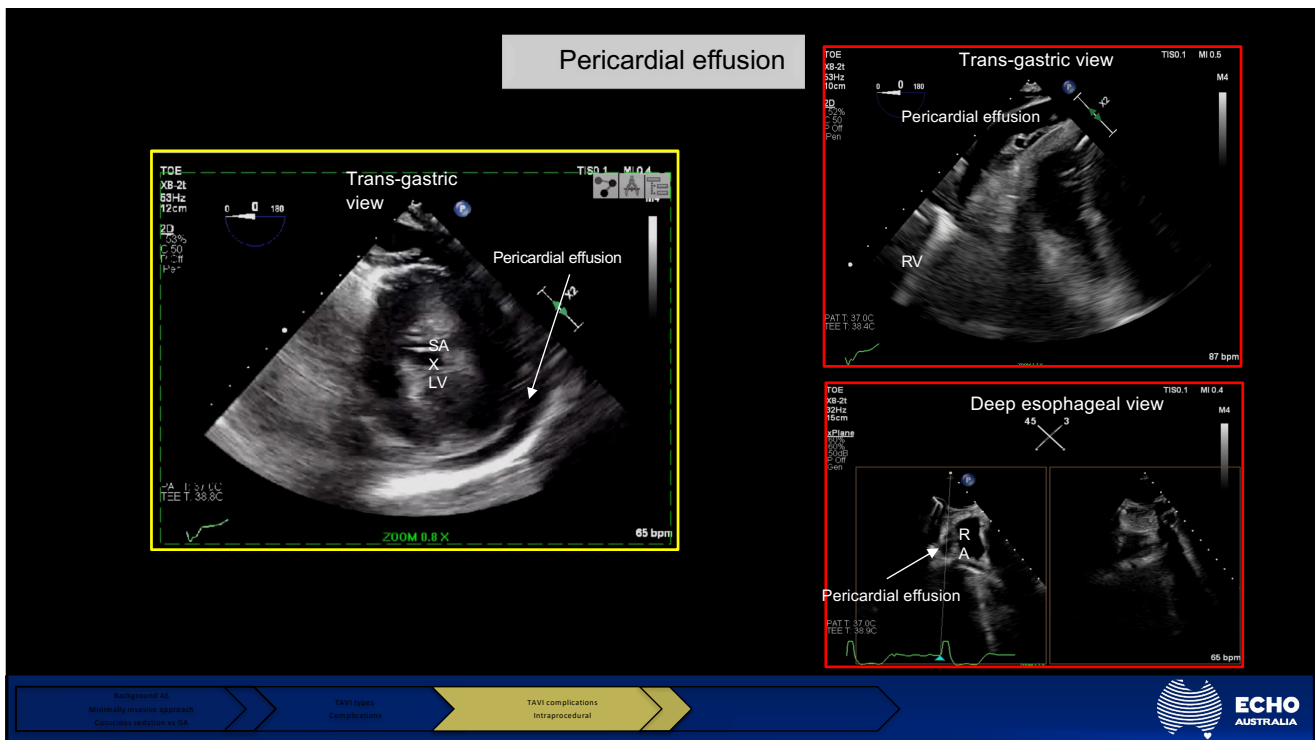
- Understand patient risk factors
 - Ascending aortic aneurysm
 - Bicuspid aortic valve
 - Arterial tortuosity
 - Atherosclerosis/calcification
 - Female sex
 - Older, larger, stiffer devices

Type A and B Aortic Dissection After TAVR



DeGraaff B, DeRoo SC, George I. Aortic Dissection Following Transcatheter Aortic Valve Replacement. Semin Thorac Cardiovasc Surg. 2024 Dec 13:S1043-0679(24)00110-2. doi: 10.1053/j.semtcvs.2024.11.006. Epub ahead of print.

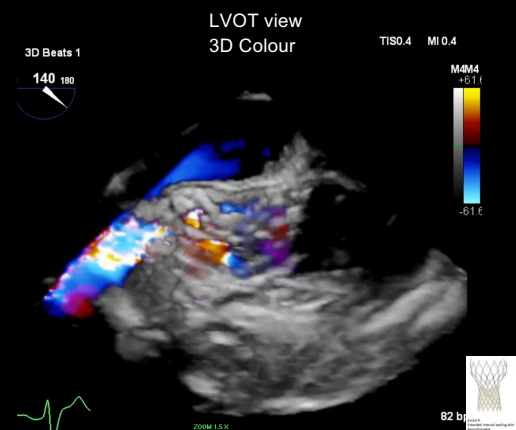
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31

Paravalvular leak incidence after TAVI

- Decreased significantly in last 20 years
- Latest generation devices in low-risk populations
 - Mild PVL: 29% balloon-expandable (BE) devices + 36% self-expanding (SE) devices at 30 days
 - Moderate to severe PVL: 0.8% in BE devices + 3.4% SE devices at 30 days.

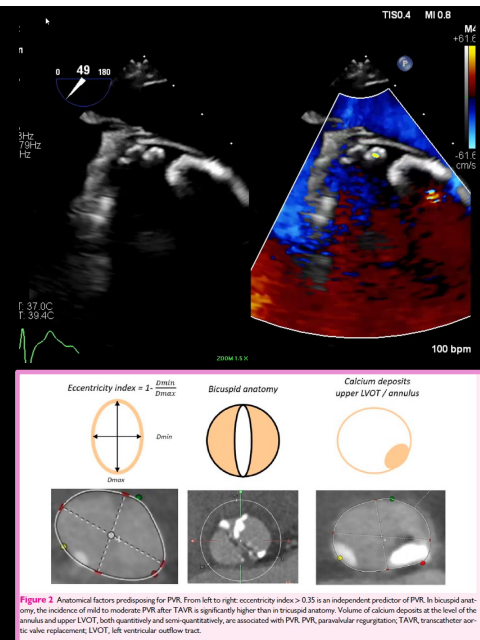


Van Wely et al (2024). Paravalvular regurgitation after transcatheter aortic valve replacement: incidence, quantification, and prognostic impact, EHJ.

32

Paravalvular leak incidence after TAVI

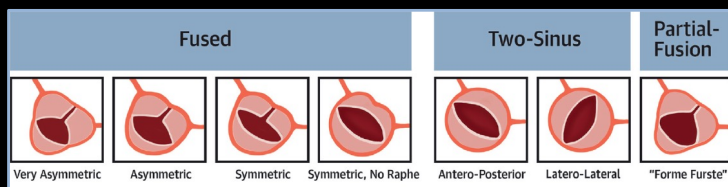
- To reduce PVL:
 - Detailed pre-procedural evaluation
 - Improvements in patient + prosthesis selection
 - Avoiding under-sizing
 - Recognizing importance of severe valvular calcifications in predicting risk of PVL
 - Design of prosthetic valves
 - Increased operator experience
 - Mod to severe AR → Poor prognosis



33

BICUSPID AORTIC VALVE

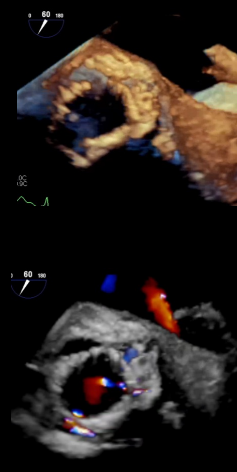
- Bulky irregular calcification affecting annulus + outflow tract
- Variants in commissural fusions (raphe)
- Larger annular dimensions
- Asymmetric cusps
- Aortopathy (dilation, coarctation or aneurysm)



International Consensus Statement on Nomenclature and Classification of the Congenital Bicuspid Aortic Valve developed to characterize, identify, and risk-stratify patients with a bicuspid aortic valve (BAV)

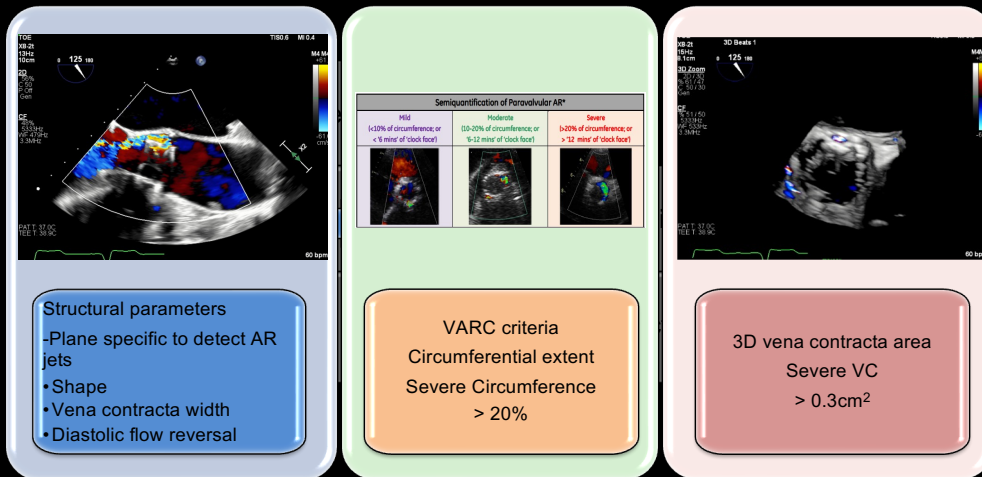
Transcatheter Aortic Valve Replacement
Beyond Severe Aortic Stenosis
JACC State-of-the-Art Review (JACC. 2025;85:944-964)

Franz J. Beckers, MD,* Gilbert H.L. Tang, MD, MSc, MBA,^{1,2} Annapoorna S. Kini, MD,³ Stamatios Lekakis, MD, PhD,⁴ George D. Dangas, MD, PhD,⁵ Ronana Mehran, MD,⁶ Sahil Kheta, MD, MPH,⁷ Martin Goldman, MD,⁸ Valentin Fuster, MD, PhD,⁹ Deepak L. Bhatt, MD, MPH, MBA,¹⁰ John G. Webb, MD,¹¹ Sumit K. Sharma, MD,¹²



34

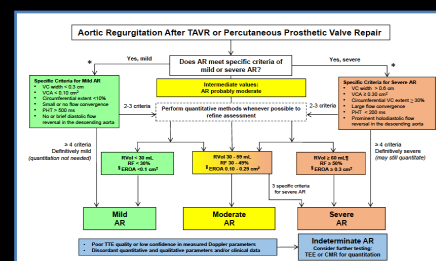
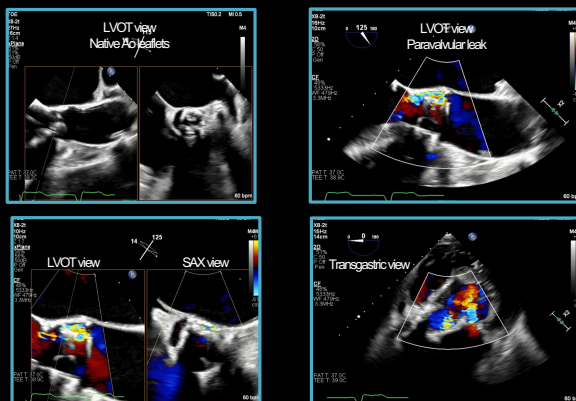
Paravalvular leak



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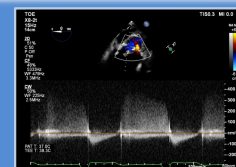
TAVR Paravalvular leak

Guidelines for evaluation of valvular regurgitation after Percutaneous valve repair or replacement.



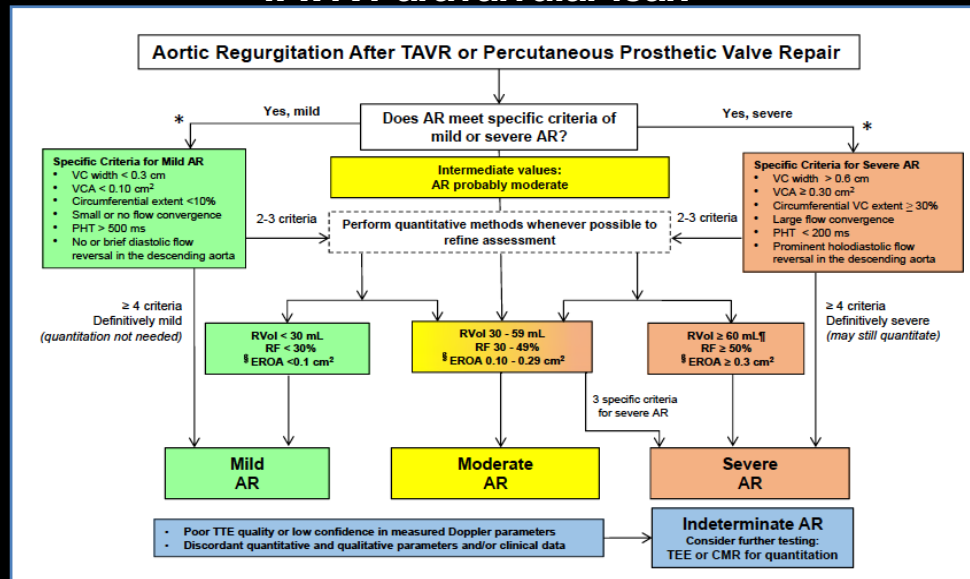
Assessment- plane specific to detect AR jets

- Shape of the valve
- Vena contracta + AR jet width
- Diastolic flow reversal descending aorta (PW Doppler)
- Continuous wave signal Intensity (CW Doppler)
- AR Pressure half time (CW Doppler)



36

TAVR Paravalvular leak

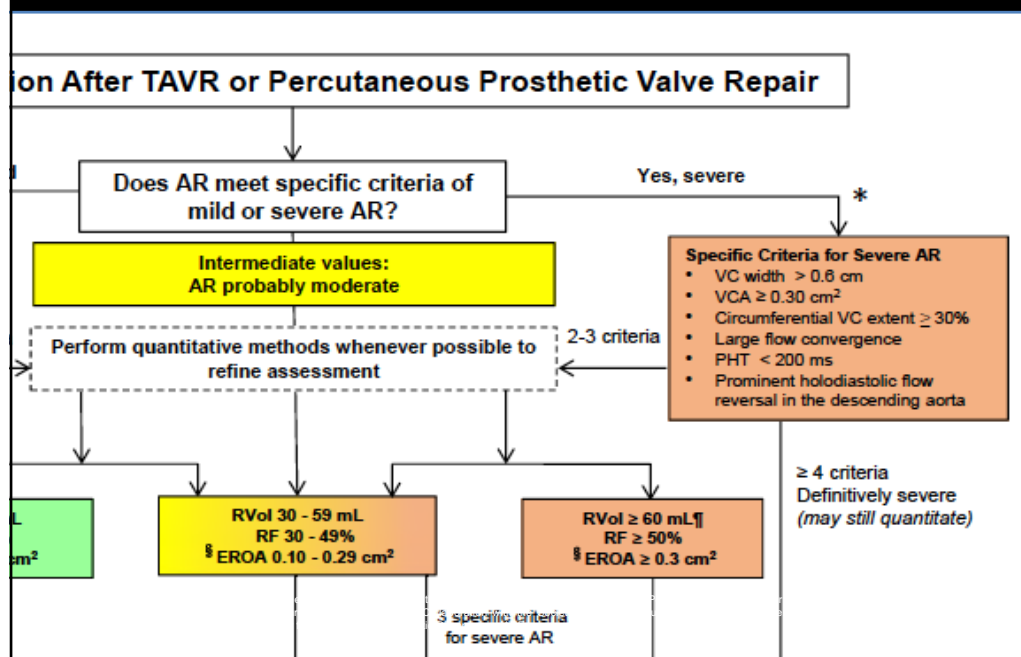


Zoghbi et al (2019) Guidelines for the Evaluation of Valvular Regurgitation After Percutaneous Valve Repair or Replacement. A Report from the American Society of Echocardiography Developed in Collaboration with the Society for Cardiovascular Angiography and Interventions, Japanese Society of Echocardiography, and Society for Cardiovascular Magnetic Resonance, JASE.



37

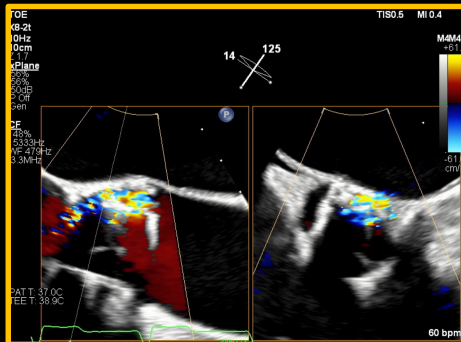
TAVR Paravalvular leak



38



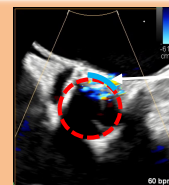
TAVR Paravalvular leak



Semiquantification of Paravalvular AR*		
Mild (<10% of circumference; or < '6 mins' of 'clock face')	Moderate (10-20% of circumference; or '6-12 mins' of 'clock face')	Severe (>20% of circumference; or > '12 mins' of 'clock face')

From TPCH B. Anderson and D. Burstow. Normal echo parameters

VARC criteria
Circumferential extent



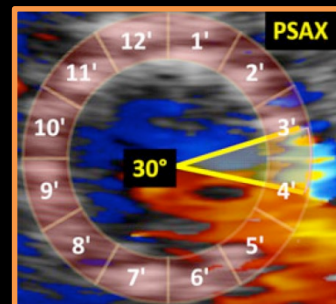
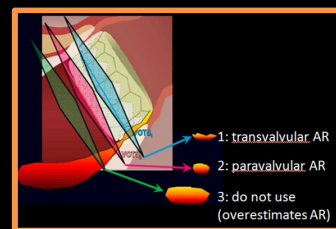
Focal calcification
causing tunnel and
deformity of valve
→ paravalvular AR



39

Transthoracic evaluation TAVR paravalvular regurgitation

Detection of Paravalvular AR after TAVR with Color Doppler

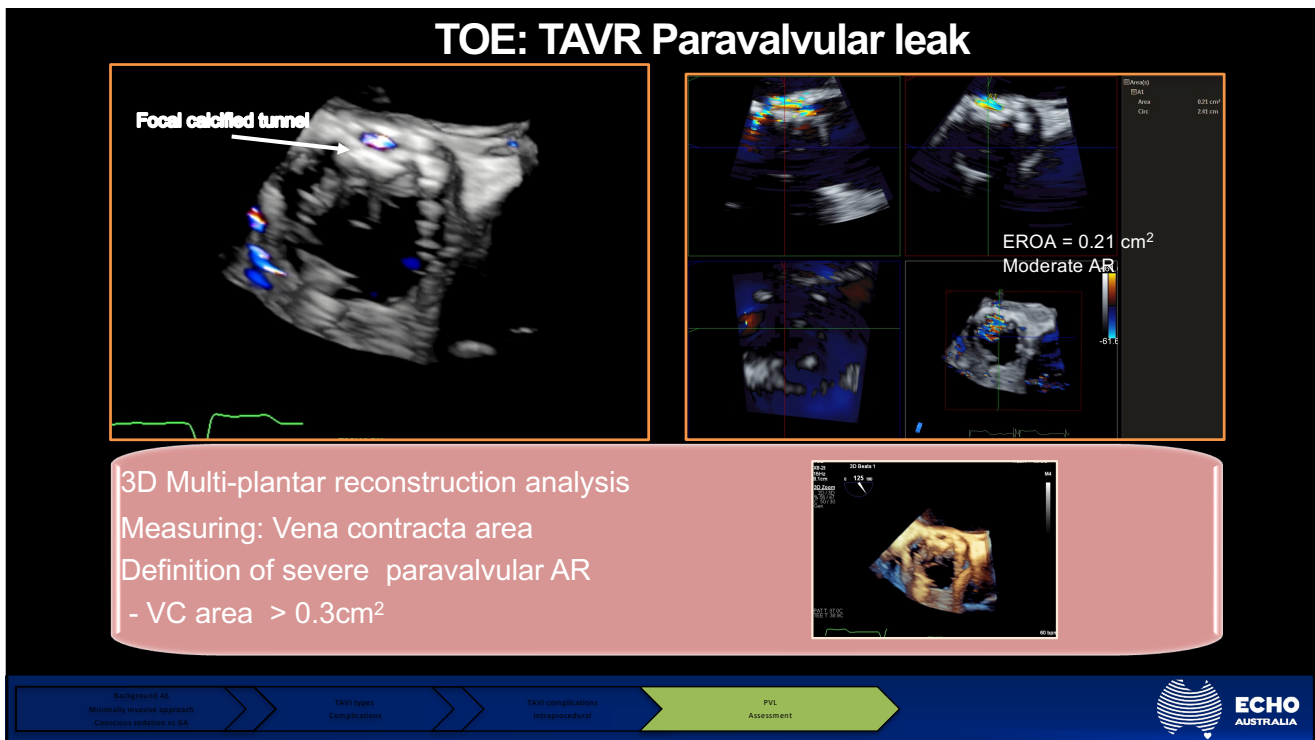


Circumferential extent
 $CE = 30^\circ \div 360^\circ = 8\%$

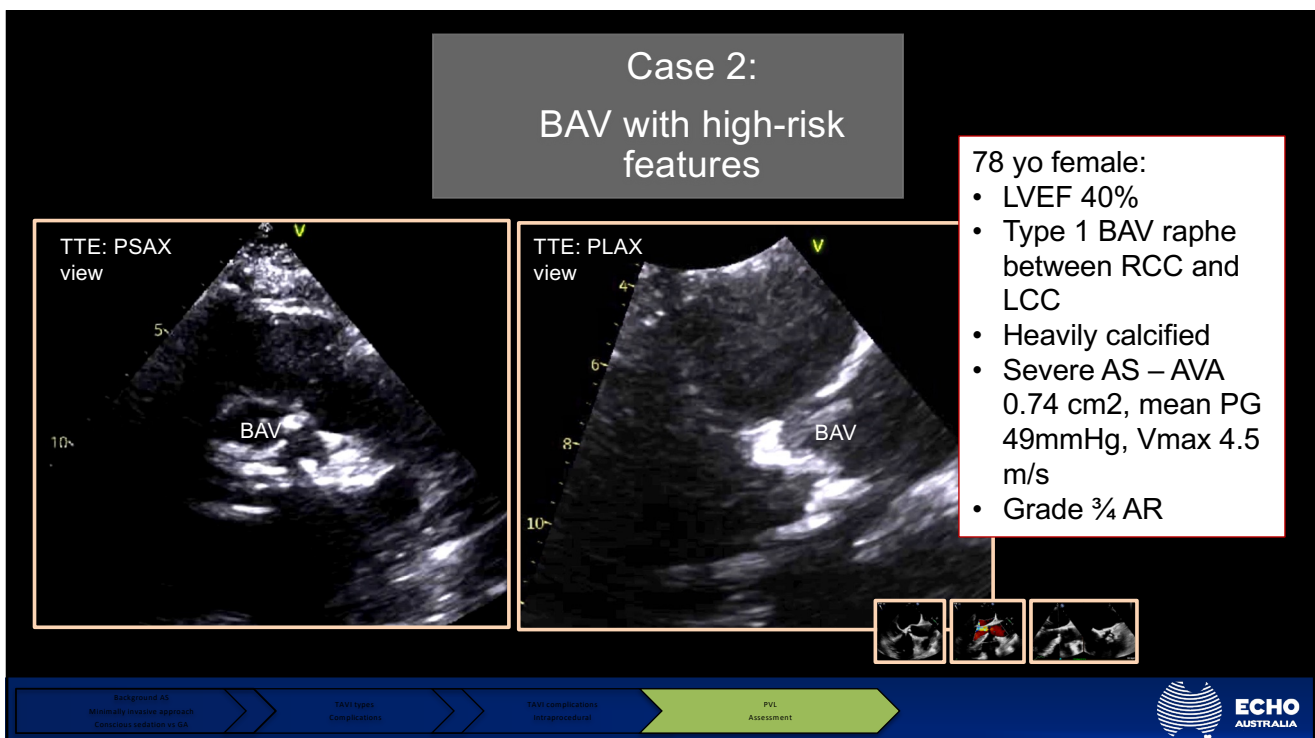
Zoghbi et al (2019) Guidelines for the Evaluation of Valvular Regurgitation After Percutaneous Valve Repair or Replacement. A Report from the American Society of Echocardiography Developed in Collaboration with the Society for Cardiovascular Angiography and Interventions, Japanese Society of Echocardiography, and Society for Cardiovascular Magnetic Resonance, JASE.



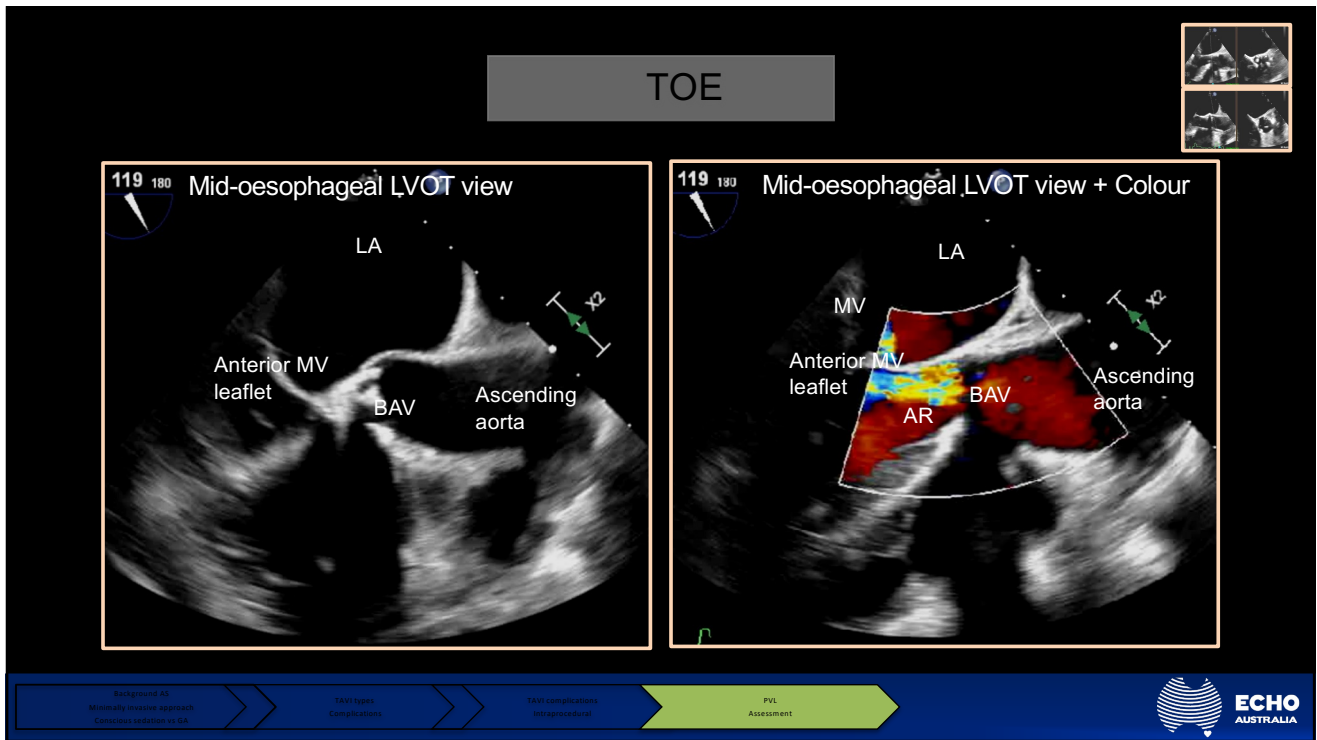
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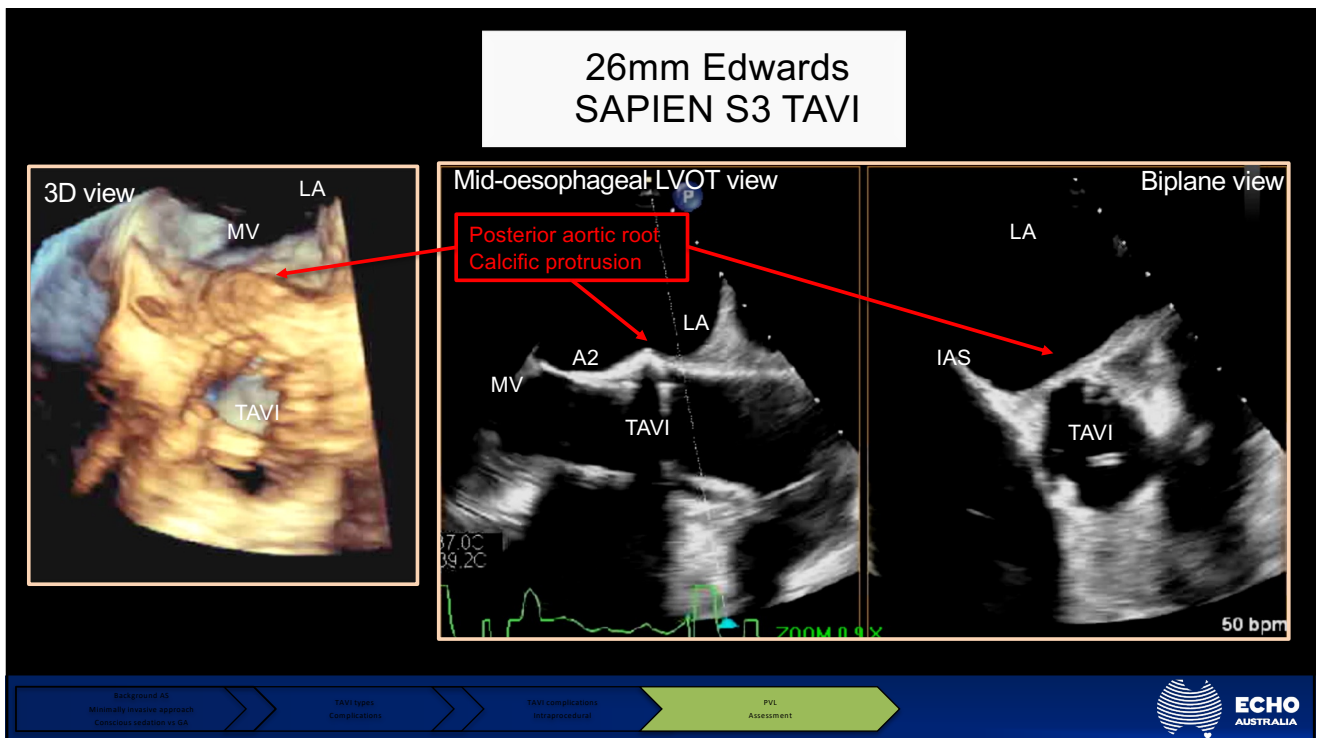
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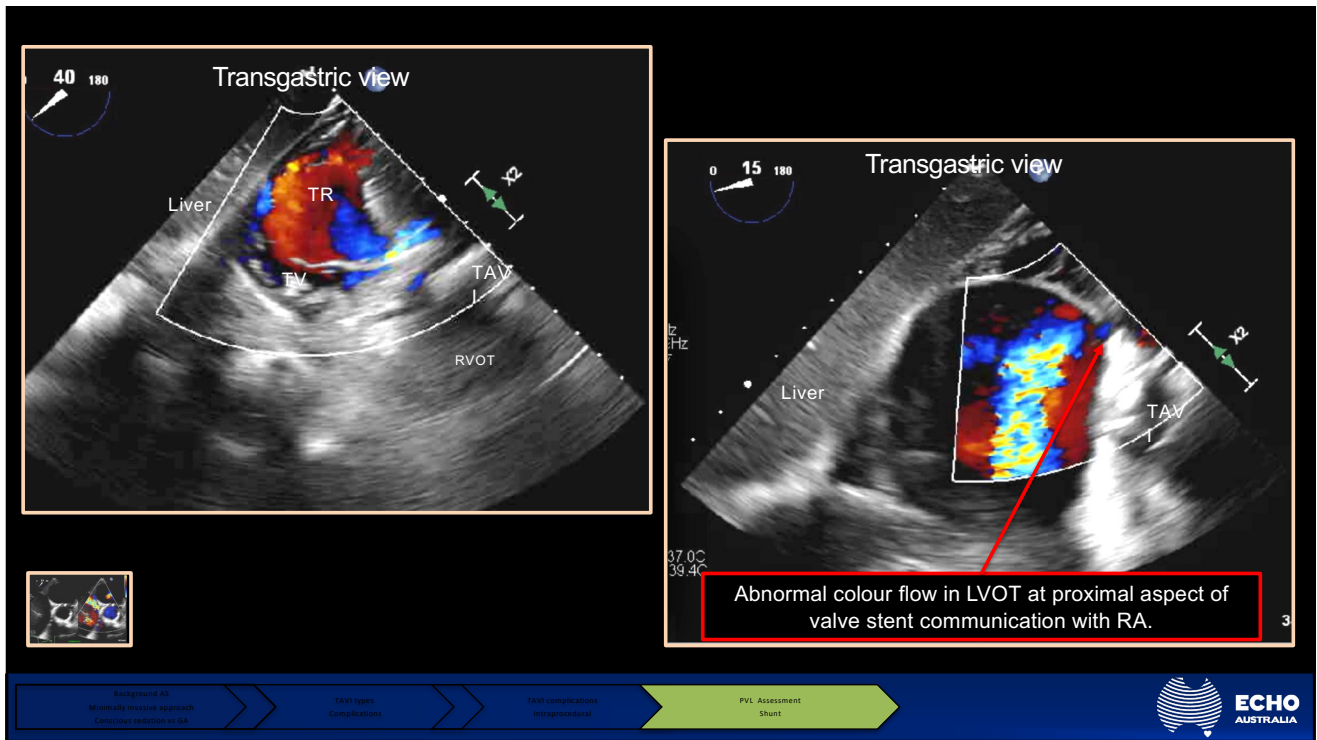
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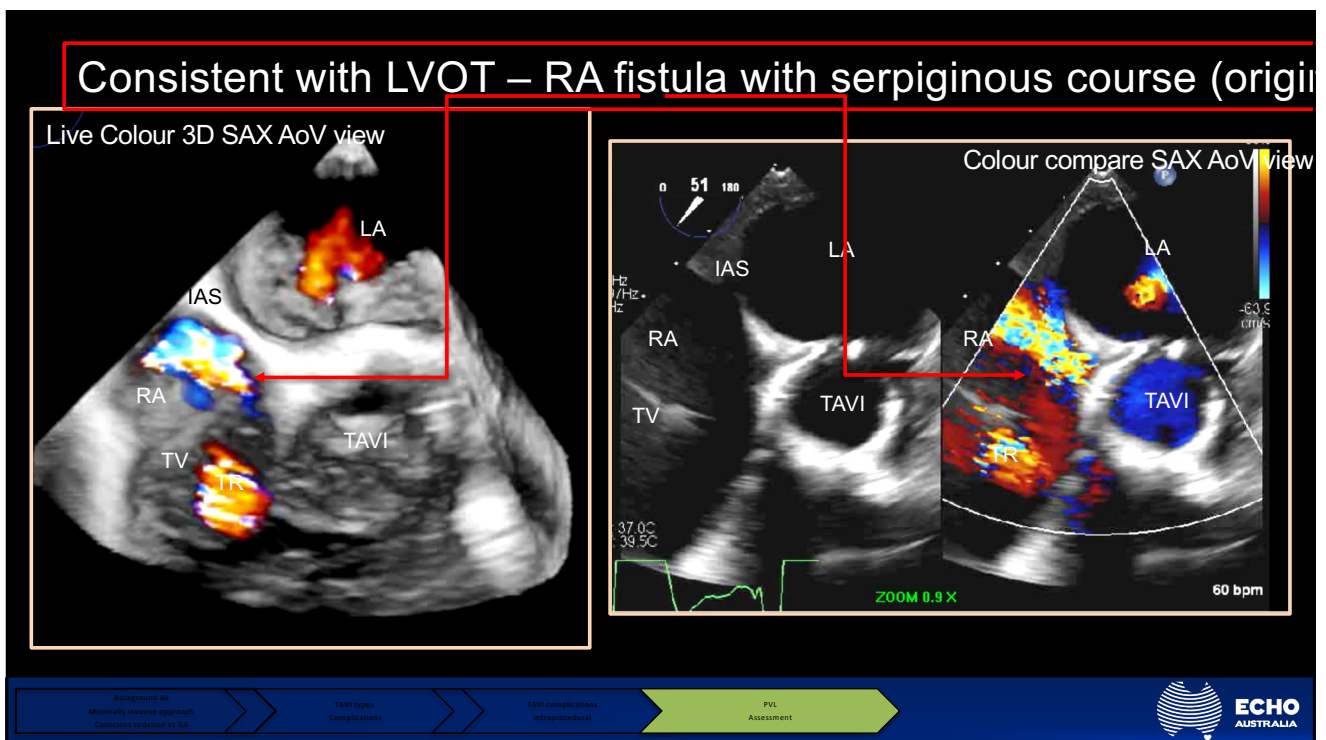
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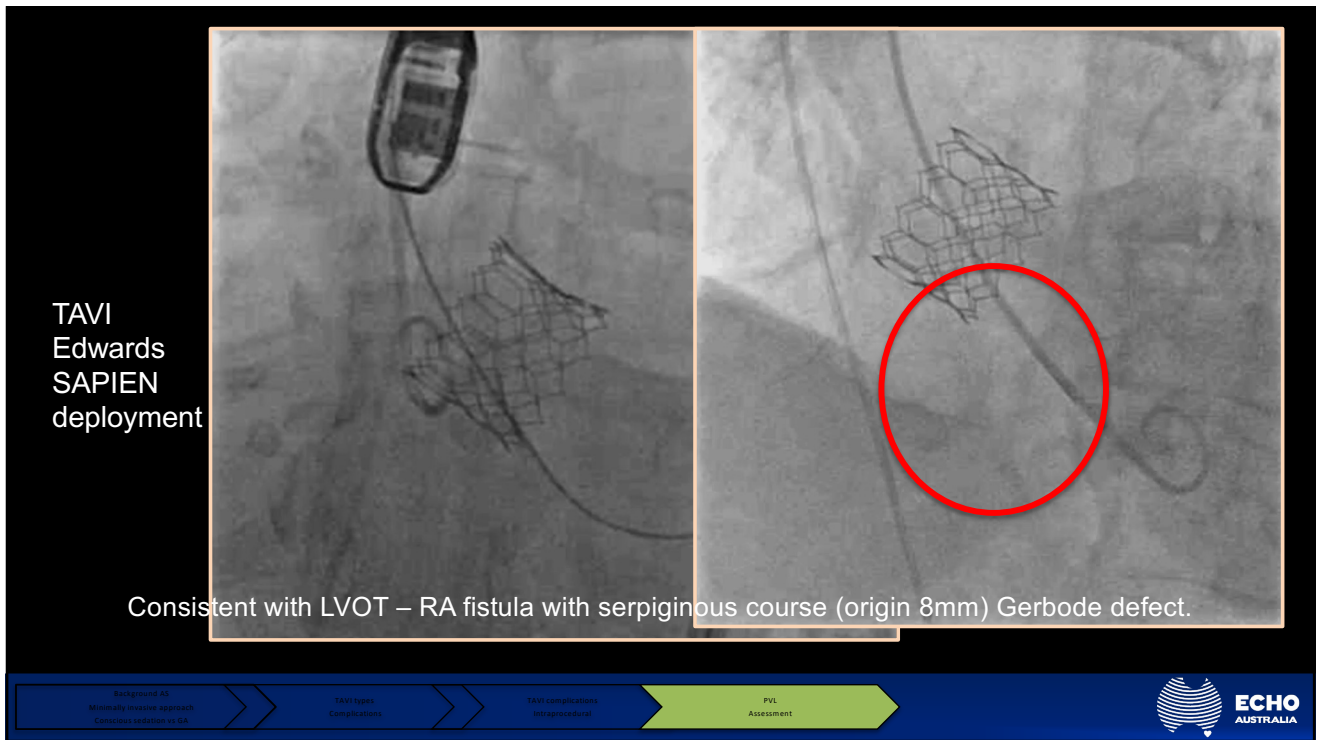
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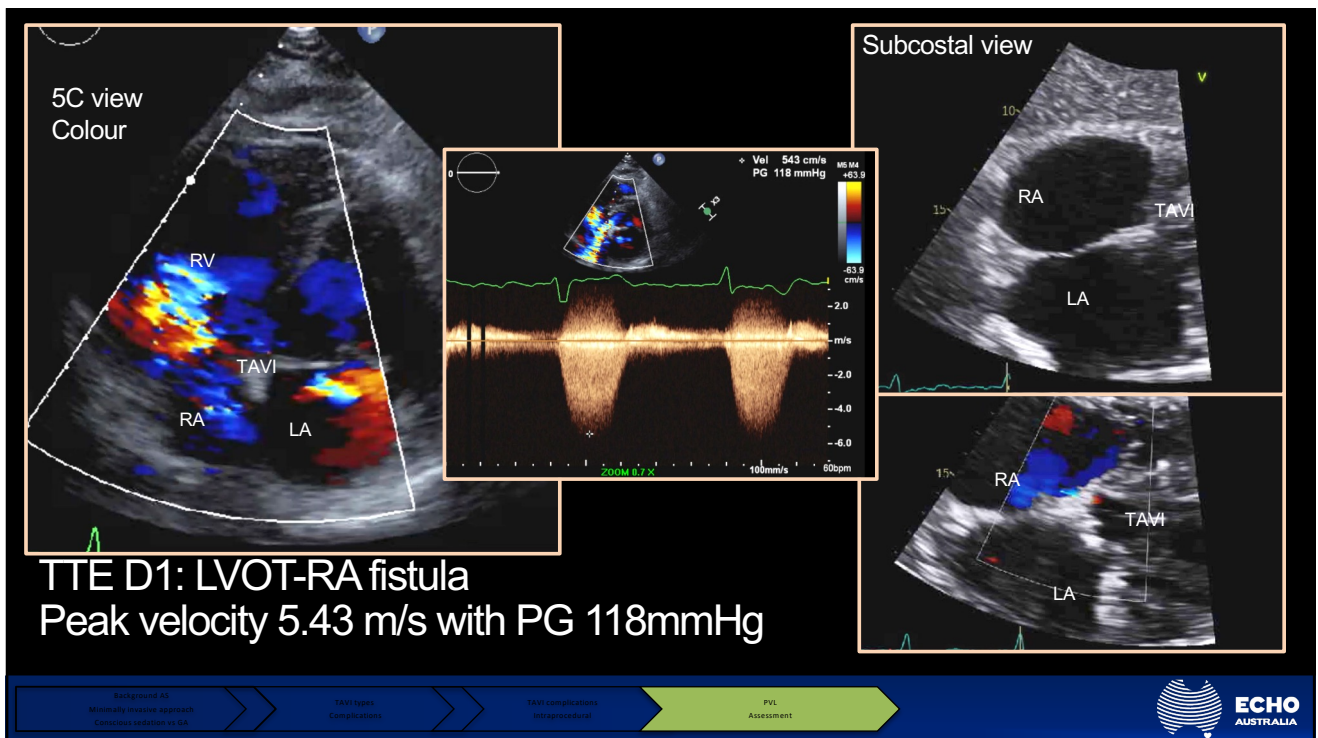
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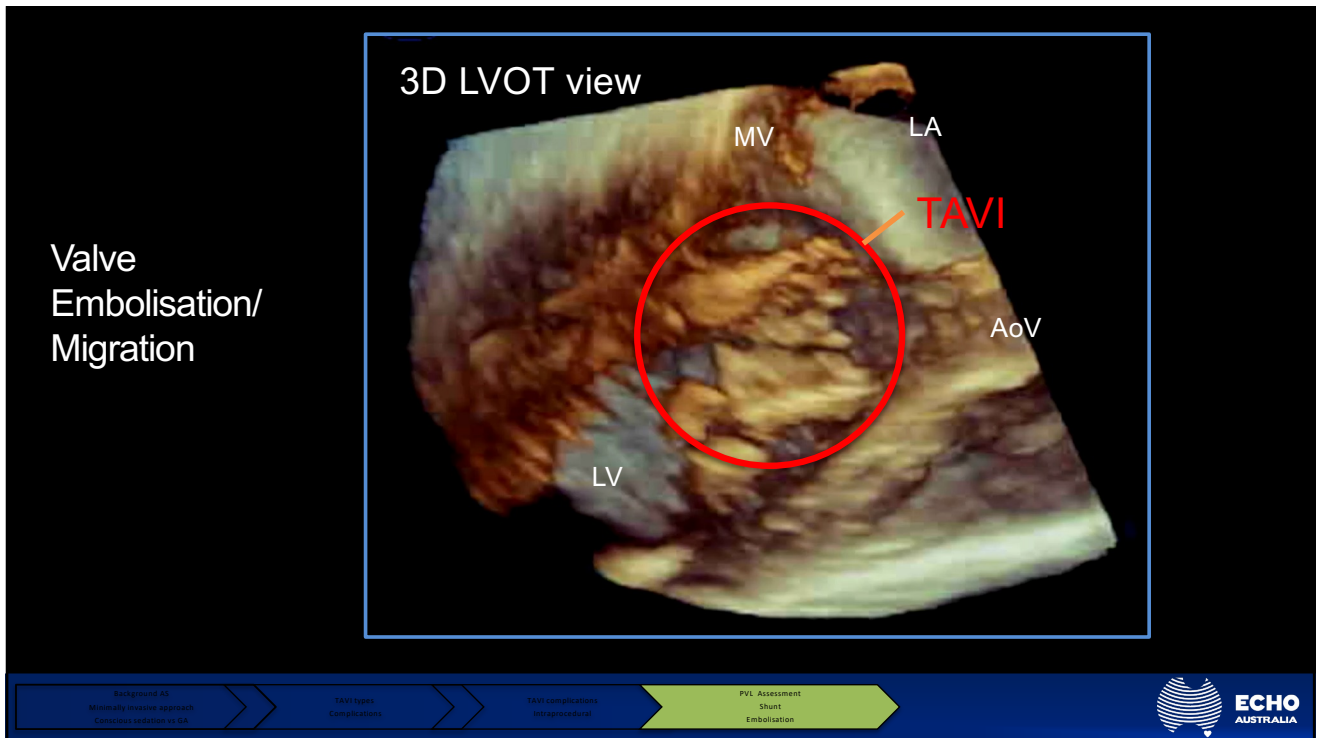
46



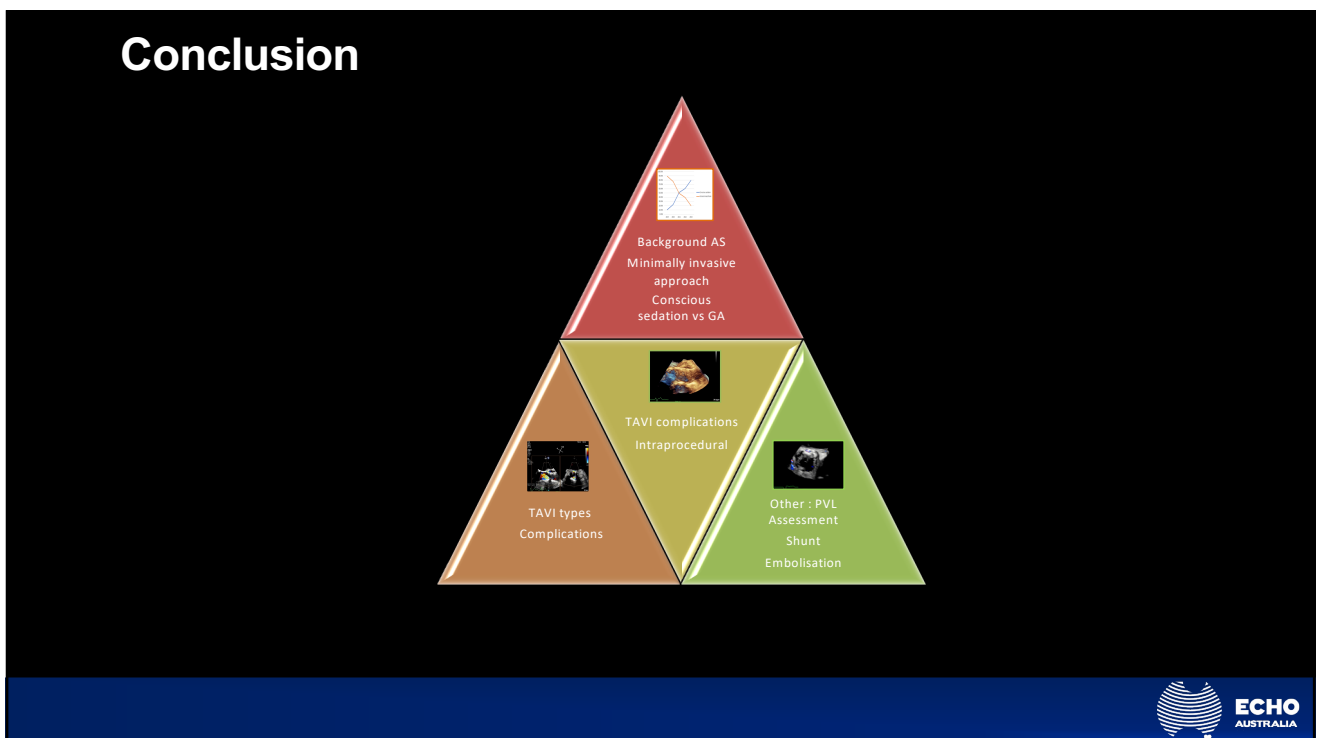
47



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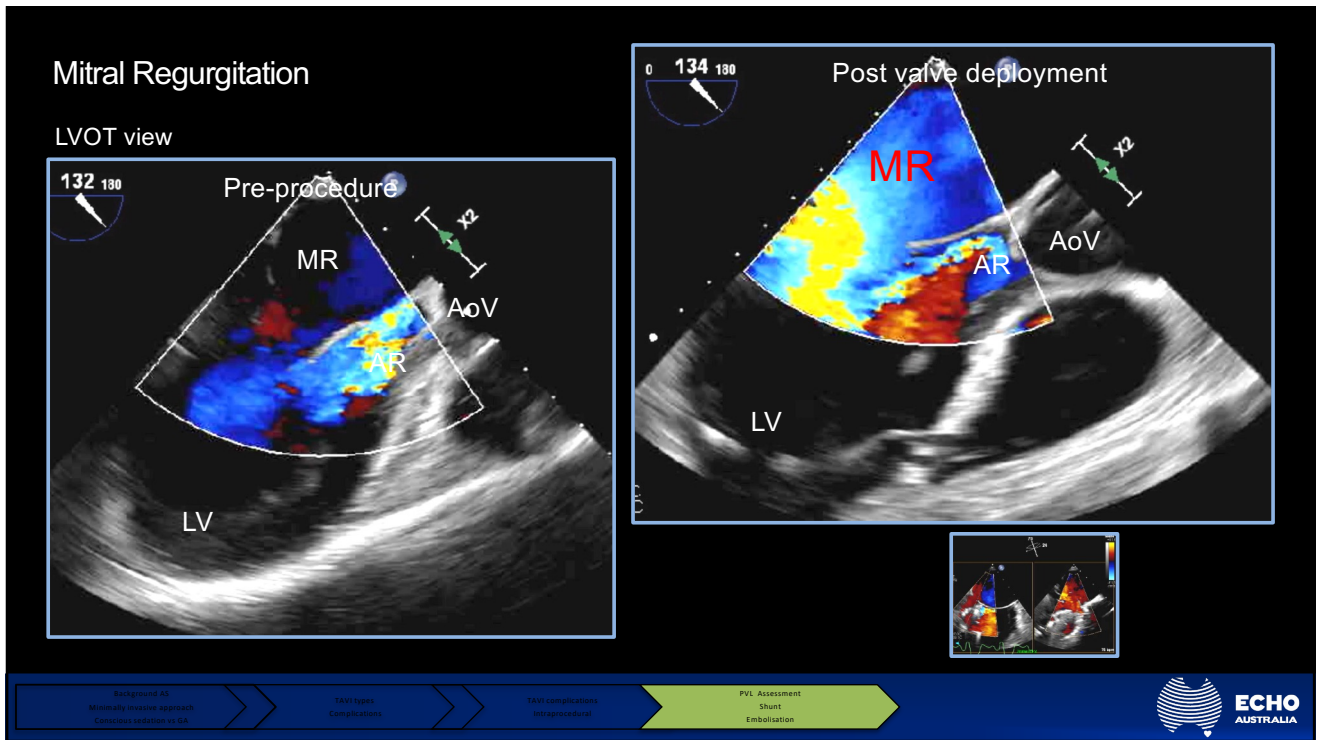
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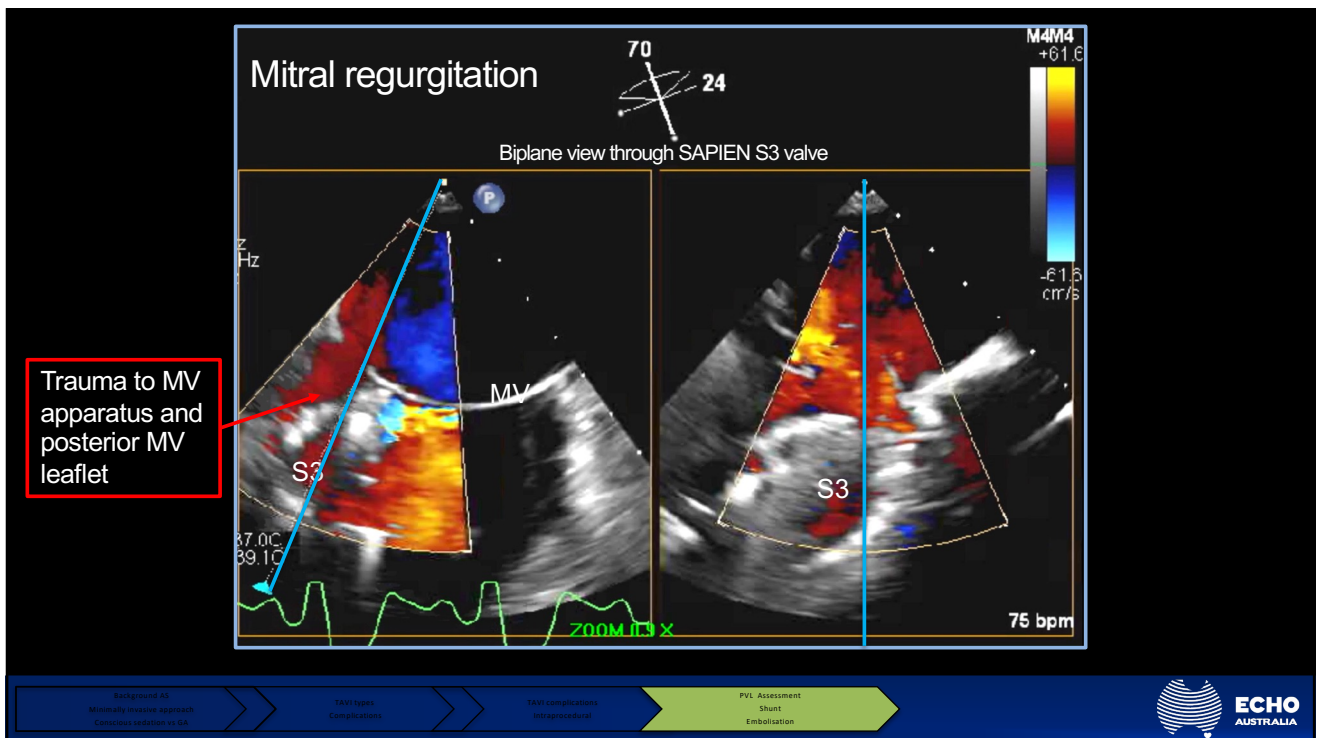
51



52

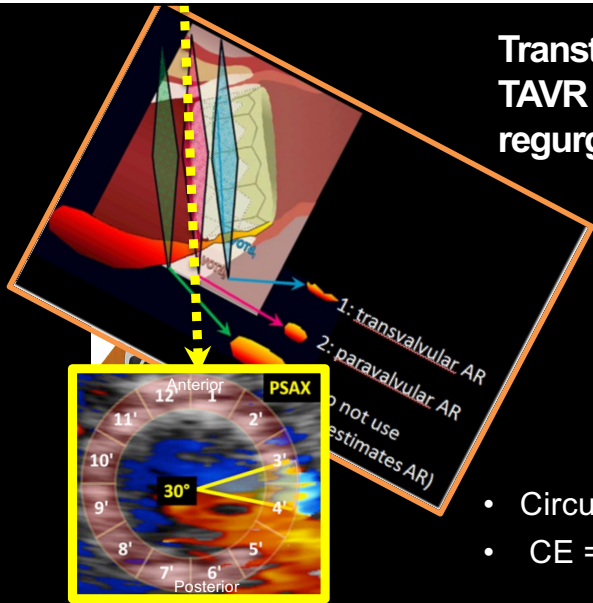


53



54

Transthoracic evaluation TAVR paravalvular regurgitation



- 1: transvalvular AR
- 2: paravalvular AR
- do not use estimates AR

- Circumferential extent
- $CE = 30^{\circ} \div 360^{\circ} = 8\%$

Zoghbi et al (2019) Guidelines for the Evaluation of Valvular Regurgitation After Percutaneous Valve Repair or Replacement. A Report from the American Society of Echocardiography Developed in Collaboration with the Society for Cardiovascular Angiography and Interventions, Japanese Society of Echocardiography, and Society for Cardiovascular Magnetic Resonance, JASE

Background AS

Minimally invasive approach

Access routes in AS

TAVI types


Complications

TAVI complications

Intraoperative

PVL

Assessment

ECHO
AUSTRALIA

Coronary re-access

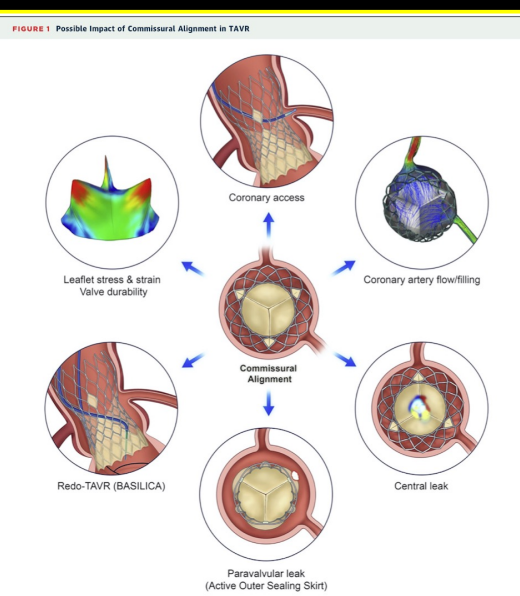
STATE-OF-THE-ART REVIEW

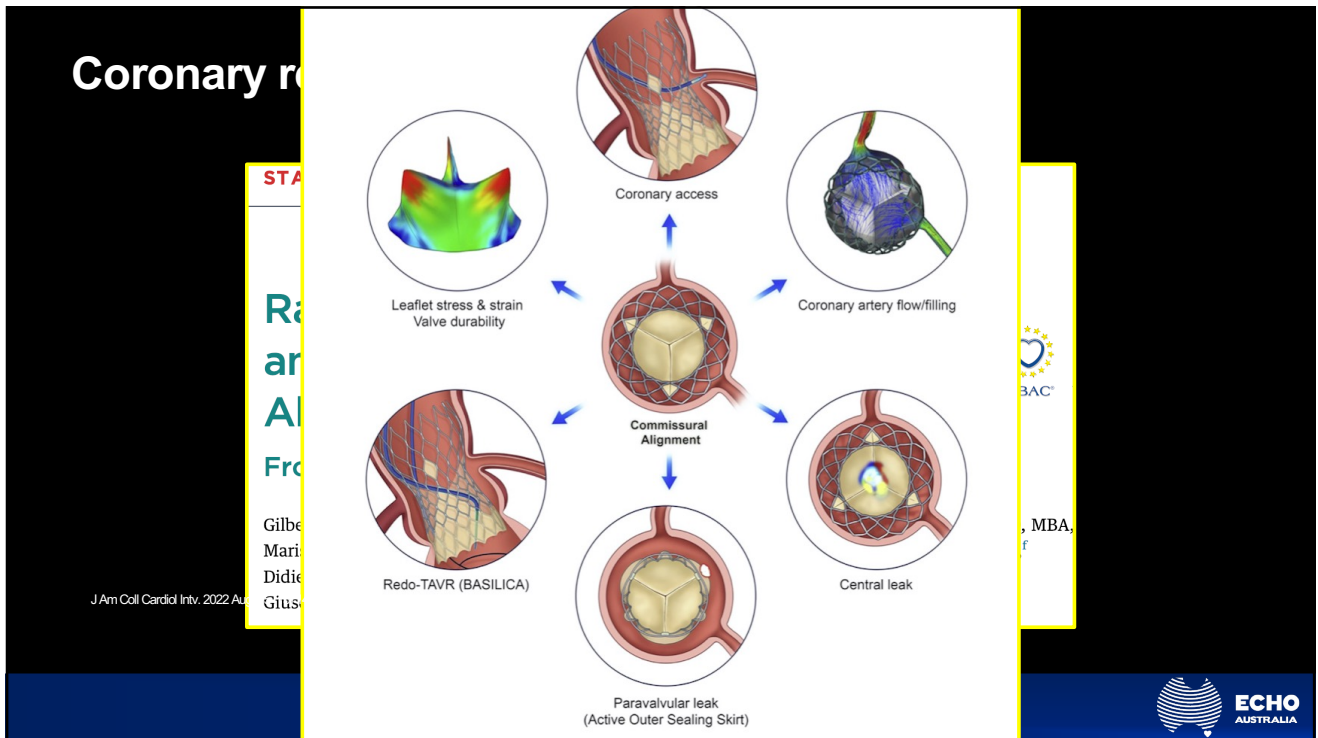
Rationale, Definitions, and Outcomes of Core Alignment in TAVR

From the ALIGN-TAVR Consortium

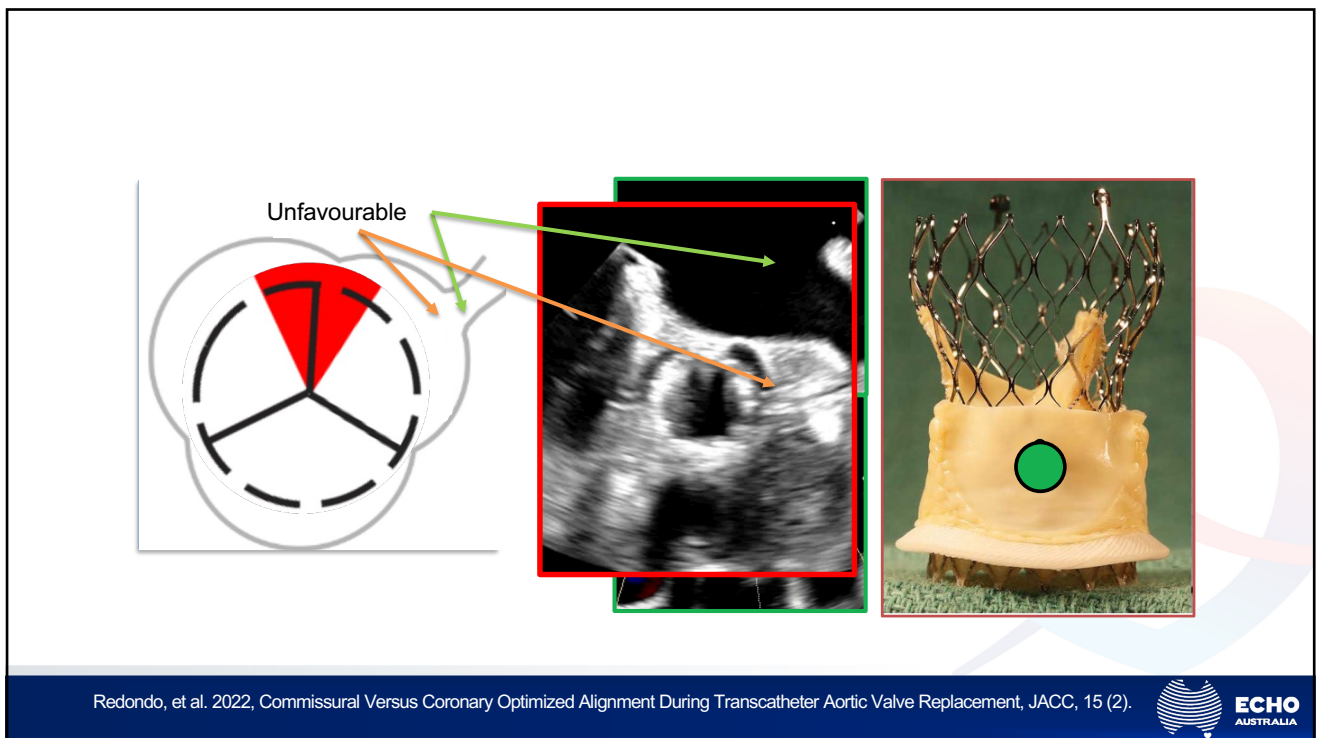
Gilbert H.L. Tang, MD, MSc, MBA,^a Ignacio J. Amat-Sant Marisa Avvedimento, MD,^d Alfredo Redondo, MD,^{b,e} Ma Didier Tchetché, MD,^g Hélène Eltchaninoff, MD,^h Won-K Giuseppe Tarantini, MD, PhD,^k Lars Søndergaard, MD^c

J Am Coll Cardiol Interv. 2022 Aug





57



58

TAVR for AR

Challenging due:

1. Anatomical issues, including a larger elliptical aortic annulus
2. Associated aorta or aortic root dilatation
3. Lack of annular calcification that can anchor THVs.
4. Larger stroke and regurgitant volume creates a “suction effect,” impedes proper positioning.



Jenavalve