Lifetime Management of Aortic Valvular Heart Disease – A Heart Team Approach

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Disclosure

I have no financial conflicts of interest to disclose

Vignette

- 59-year-old male with no co-morbidities
- Severe AS, 0.8 cm^2
- High-level VP of medical technology company
- 2 daughters in college, near graduation
- High-stress job with significant travel, including international
- Prefers TAVR due to job demands and upcoming daughters' graduations

Objectives

Indications for AVR

The Heart Team

Factors to consider pre-TAVR

Bioprosthetic valve failure

Valve-in-Valve TAVR

Alternative Access TAVR

TAVR vs SAVR – who and when

Age of TAVR Patients (Average)

PARTNER 1A: 84 yrs

PARTNER 2: 82 yrs

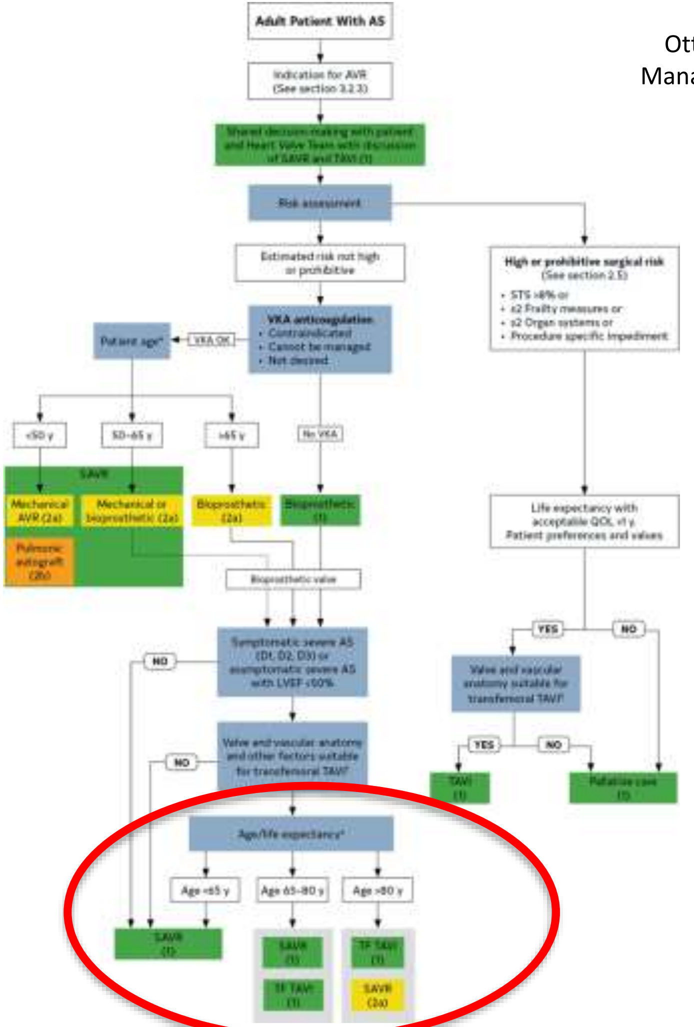
PARTNER 3: 73 yrs

CoreValve US Pivotal: 83 yrs

SURTAVI: 80 yrs

Evolut Low Risk: 74 yrs

Desai PV, Goel SS, Kleiman NS, Reardon MJ. Transcatheter Aortic Valve Implantation: Long-Term Outcomes and Durability. Methodist Debakey Cardiovasc J. 2023 May 16;19(3):15-25. doi: 10.14797/mdcvj.1201. PMID: 37213878; PMCID: PMC10198228.



Otto C, Nishimura R, et al. 2020 ACC/AHA Guideline for the Management of Patients With Valvular Heart Disease. J Am Coll Cardiol. 2021 Feb, 77 (4) e25–e197

ESC and ACC/AHA Guidelines for Management of Aortic Valve Stenosis

Clinical setting	ESC guidelines	ACC/AHA guidelines
Severe symptomatic AS		
With any symptoms	AVR recommended (IB)	AVR recommended (IB)
Haemodynamically unstable	AVR recommended	AVR recommended
	BAV may be considered as a bridge to surgery (IIbC)	BAV may be considered as a bridge to surgery (IIbC)
Surgery contraindicated due to severe co-morbidities	BAV may occasionally be considered for palliation (IIbC)	BAV may be considered (IIbC)
Severe asymptomatic AS		
With LV systolic dysfunction (EF < 50%) if no other cause identified	AVR recommended (IC)	AVR recommended (IC)
Undergoing CAGB, aortic surgery or mitral valve surgery	AVR recommended (IC)	AVR recommended (IC)
With symptoms on exercise testing	AVR recommended (IC)	AVR may be considered (IIbC)
With fall in BP to below baseline on exercise testing	AVR reasonable (IIaC)	AVR may be considered (IIbC)
With predictors of rapid progression	AVR reasonable (IIaC) with moderate to severe valve Ca^{2+} and a rate of V_{max} increase $\geq$0.3 m/s/year	AVR may be considered (IIbC) when rapid progression is likely (age, Ca^{2+}, CAD) or if surgery might be delayed at symptom onset

Continued

ESC and ACC/AHA Guidelines for Management of Aortic Valve Stenosis

Clinical setting	ESC guidelines	ACC/AHA guidelines
With complex ventricular arrhythmias on exercise testing	AVR may be considered (IIbC)	
With exercise LV hypertrophy (unless due to hypertension)	AVR may be considered (IIbC)	
Extremely severe AS		AVR may be considered if AS is extremely severe (AVA < 0.6 cm^2, $V_{max} > 5$ m/s, $\Delta P_{mean} > 60$ mmHg) and operative risk is $<1\%$ (IIbC)
Moderate AS		
Undergoing CAGB, aortic surgery or mitral valve surgery	AVR reasonable (IIaC)	AVR reasonable (IIaB)
Indeterminate severity of AS		
Low-gradient AS with LV dysfunction and contractile reserve	AVR reasonable (IIaC)	
Low-gradient AS with LV dysfunction but no contractile reserve	AVR may be considered (IIbC)	
Bicuspid aortic valve disease		
Bicuspid valve present regardless of symptoms or haemodynamics	Aortic root replacement should be considered for diameters >5 cm or if rate of increase is ≥ 0.5 cm^2/year (IIaC)	Aortic root replacement is recommended for diameter >5 cm or if rate of increase is ≥ 0.5 cm^2/year (IC)
With severe AS undergoing AVR	Lower thresholds than above should be considered	Aortic root replacement is recommended for diameters >4.5 cm (IC)

AVR, aortic valve replacement; BAV, balloon aortic valvuloplasty; BP, blood pressure; Ca^{2+}, calcification; CABG, coronary artery bypass grafting; CAD, coronary artery disease; EF, ejection fraction; LV, left ventricular; ESC, European Society of Cardiology; ACC/AHA, American College of Cardiology/American Heart Association.

Mild vs Moderate vs Severe Aortic Valve Stenosis

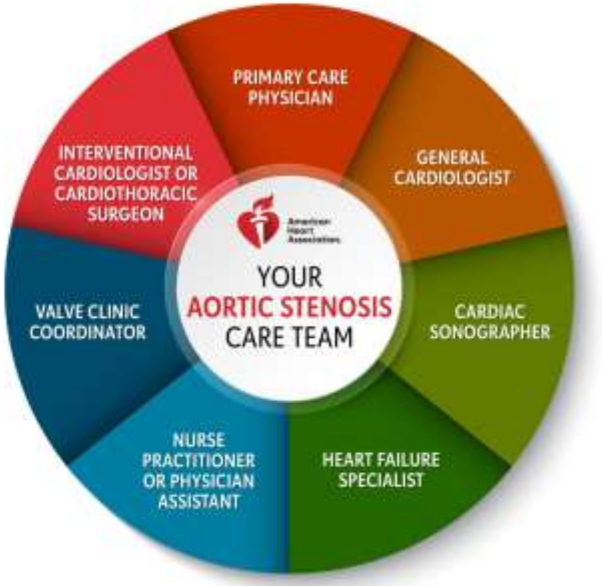
	Mild AS	Moderate AS	Severe AS
Clinical evaluation (review of symptoms and reported exercise levels)	1 year	1 year	6 months
Evaluation and treatment of cardiovascular risk factors	1 year	1 year	1 year
Echocardiography (AS jet velocity, mean gradient, valve area, AR severity, LV function)	3–5 years or any change in symptoms	1–2 years or any change in symptoms	6 months to 1 year or for any change in symptoms
Exercise test	Not needed	Not needed	If symptom status unclear and annual increase in jet velocity is <0.3 m/s/year
Serum BNP level	Not needed	Not needed	If symptom status unclear
Dobutamine stress echo	If LV dysfunction present and AS severity unclear	If LV dysfunction present and AS severity unclear	If LV dysfunction present and AS severity unclear
CT or CMR imaging	If bicuspid valve and aortic sinuses enlarged[b]	If bicuspid valve and aortic sinuses enlarged[b]	If bicuspid valve and aortic sinuses enlarged[b]
Cardiac catheterization	Not needed	Not needed	Coronary angiography at symptom onset

AS, aortic stenosis, BNP, brain natriuretic peptide, CT, computed tomography, CMR, cardiac magnetic resonance, LV, left ventricle.

[a]Once symptoms occur, intervention is recommended if symptoms are due to severe AS as shown in *Table 2*. Evaluation for other causes of symptoms is needed when AS is mild or moderate in severity.

[b]Interval for repeat CT or CMR depends on severity of aortic enlargement.

The Heart Team



The Heart Team in 2023 Has Gotten More Complicated!

- Treatment focus has now shifted from the first to the second aortic intervention (i.e., to the treatment of bioprosthetic failure), regardless of whether the first intervention is SAVR or TAVR.

- **Anatomy:**
  - Will redo TAVR be straightforward or complex (i.e., require leaflet modification)?
  - Will coronary access be an issue, both now and with future THV in THV?

- **Durability:**
  - Bioprosthetic vs mechanical valve
  - How long will a bioprosthetic valve last?

- **Hemodynamics:**
  - What size (ID) and type of SAVR will be used?
  - Will the SAVR be compatible with future VIV TAVR?

- **Other Considerations:**
  - Significant mitral or tricuspid valve disease
  - Multivessel or significant CAD
  - Patient preference

Hemodynamics, Prosthesis-Patient Mismatch

Classification of AS Severity

Classification of AS severity

([a]ESC & [b]AHA/ACC Guidelines)

	Aortic Sclerosis	Mild	Moderate	Severe
Aortic jet velocity (m/s)	≤ 2.5 m/s	2.6 -2.9	3.0 - 4	> 4
Mean gradient (mm Hg)		< 20[b] (<30[a])	20 – 40[b] (30 -50[a])	> 40
AVA (cm^2)		> 1.5	1.0 - 1.5	< 1.0
Indexed AVA (cm^2/m^2)		> 0.85	0.60 – 0.85	< 0.6
Velocity ratio		> 0.50	0.25 – 0.50	< 0.25

Invasive vs Echo-Derived Valve Function

Heart Valve Collaboratory 2022

Echocardiographic

-Simplified Bernoulli equation fails to account for:

- Laminar/average flow with lower velocity adjacent to the vessel
- Proximal LV velocity
- Variability of contraction coefficient
- Non-convective forces of flow acceleration, viscosity, and convective acceleration

Not corrected for pressure recovery

Invasive hemodynamic

-Inaccuracies introduced by:

- Fluid-filled catheters
- Use of pigtail instead of end-hole catheters
- Improper positioning within LV and aorta

Timing of measurements immediately post-TAVR

Herrmann HC, Pibarot P, Wu C, Hahn RT, Tang GHL, Abbas AE, Playford D, Ruel M, Jilaihawi H, Sathananthan J, Wood DA, De Paulis R, Bax JJ, Rodes-Cabau J, Cameron DE, Chen T, Del Nido PJ, Dweck MR, Kaneko T, Latib A, Moat N, Modine T, Popma JJ, Raben J, Smith RL, Tchetche D, Thomas MR, Vincent F, Yoganathan A, Zuckerman B, Mack MJ, Leon MB; Heart Valve Collaboratory. Bioprosthetic Aortic Valve Hemodynamics: Definitions, Outcomes, and Evidence Gaps: JACC State-of-the-Art Review. J Am Coll Cardiol. 2022 Aug 2;80(5):527-544. doi: 10.1016/j.jacc.2022.06.001. PMID: 35902177.

Prosthesis-Patient mismatch – Definition and Variability

TABLE 3 Definitions for Prosthesis-Patient Mismatch

	Severe, cm^2/m^2	Moderate, cm^2/m^2
ASE guidelines[26]	<0.65	0.65-0.85
VARC-2[105]	<0.65	0.65-0.85
BMI ≥30 kg/m^2	<0.60	0.60-0.70
EACVI recommendations[80]	<0.65	0.65-0.85
BMI ≥30 kg/m^2	<0.55	0.55-0.70
VARC 3[6]	≤0.65	0.66-0.85
BMI ≥30 kg/m^2	<0.55	0.55-0.70

ASE = American Society of Echocardiography; BMI = body mass index; EACVI = European Association of Cardiovascular Imaging; VARC = Valve Academic Research Consortium.

TABLE 4 Summary of Reasons for Discrepancy in Effects of Severe PPM on Outcomes

- Reasons why the reported incidence of PPM varies after AVR
  - Method of EOA calculation (measured vs predicted)
  - Correction or not for obesity
  - Timing of measurement (immediate vs later)
  - Effect of underlying flow state
  - Method of gradient determination (echocardiographic vs hemodynamic)
- Reasons why the effects of severe PPM on outcomes are conflicting
  - Measurements and calculations differ as above
  - Incomplete correction for confounding and competing outcome variables
    - Paravalvular aortic regurgitation
    - Low flow state
    - Older patients or other survival limitations
  - Underpowered analyses
  - Limited follow-up (1 year may not be sufficient)

AVR = aortic valve replacement; EOA = effective orifice area; PPM = prosthesis-patient mismatch.

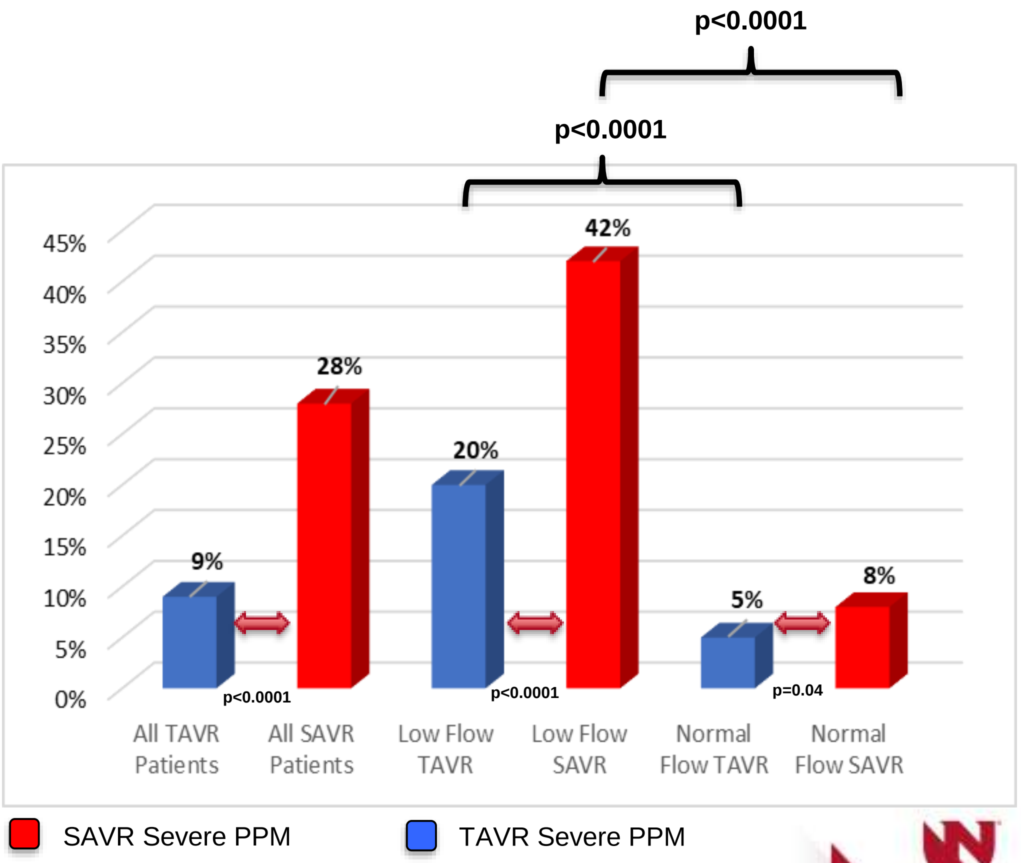
Herrmann HC, Pibarot P, Wu C, Hahn RT, Tang GHL, Abbas AE, Playford D, Ruel M, Jilaihawi H, Sathananthan J, Wood DA, De Paulis R, Bax JJ, Rodes-Cabau J, Cameron DE, Chen T, Del Nido PJ, Dweck MR, Kaneko T, Latib A, Moat N, Modine T, Popma JJ, Raben J, Smith RL, Tchetche D, Thomas MR, Vincent F, Yoganathan A, Zuckerman B, Mack MJ, Leon MB; Heart Valve Collaboratory. Bioprosthetic Aortic Valve Hemodynamics: Definitions, Outcomes, and Evidence Gaps: JACC State-of-the-Art Review. J Am Coll Cardiol. 2022 Aug 2;80(5):527-544. doi: 10.1016/j.jacc.2022.06.001. PMID: 35902177.

Severe Prosthesis Patient Mismatch: TAVR vs SAVR

Severe PPM following TAVR was significantly lower (9%) than SAVR (28%) in all patients.

- Independently predicted by stroke volume index and small valve size
- Associated with rehospitalization in all
- Associated with all cause mortality, all cause mortality or rehospitalization, cardiac death or rehospitalization in SAVR

PARTNER 2A/S3i registries: TAVR: n=954 and SAVR: n=726



Abbas AE, Ternacle J, Pibarot P, Xu K, Alu M, Rogers E, Hahn RT, Leon M, Thourani VH. Impact of Flow on Prosthesis-Patient Mismatch Following Transcatheter and Surgical Aortic Valve Replacement. Circ Cardiovasc Imaging. 2021 Aug;14(8):e012364. doi: 10.1161/CIRCIMAGING.120.012364. Epub 2021 Aug 13. PMID: 34387097.

What We Know and Don’t Know

What we know

- Echo and invasive hemodynamics can be and in most cases are complimentary.
- Small annuli – concern for PPM.
- TAVR vs SAVR – valve selection in small annulus matters - annular enlargement may be necessary. Inner diameter to match patients’ annuli (19-25 mm).
- PPM is associated with worse outcomes more often in SAVR than TAVR patients.

What we don’t know

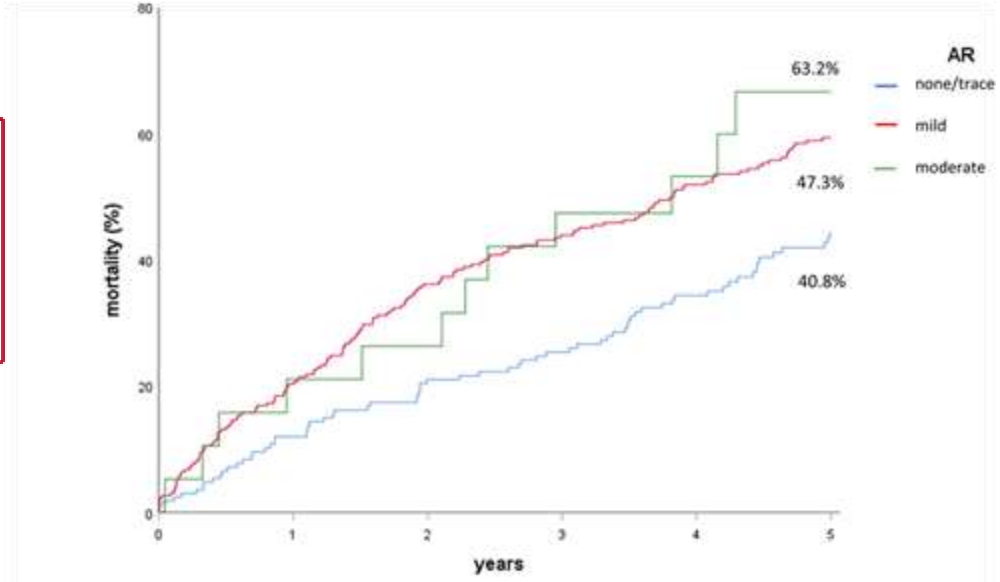
- Surgical vs Transcatheter – definition and measurement of PPM
- Impact of invasive gradients on valve durability and clinical outcomes
- Prospective Trials: Proposal to add on hemodynamics in studies

Paravalvular Leak, Left Ventricular Outflow Tract Calcification

5-year Mortality and Stages of PVL

- Minor degrees of PVL are independently associated with long-term mortality
- Hemodynamic measurements did not aid in identifying PVLs relevant to 5-year survival

Cumulative incidence of 5-year mortality for echocardiographic graduation of PVL, PVL, paravalvular leakage

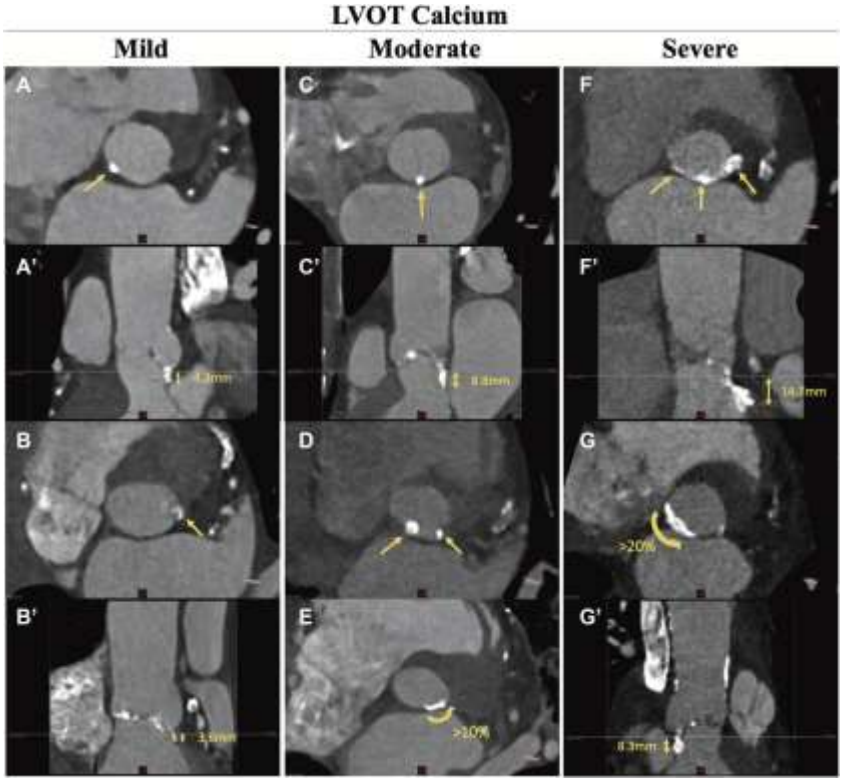


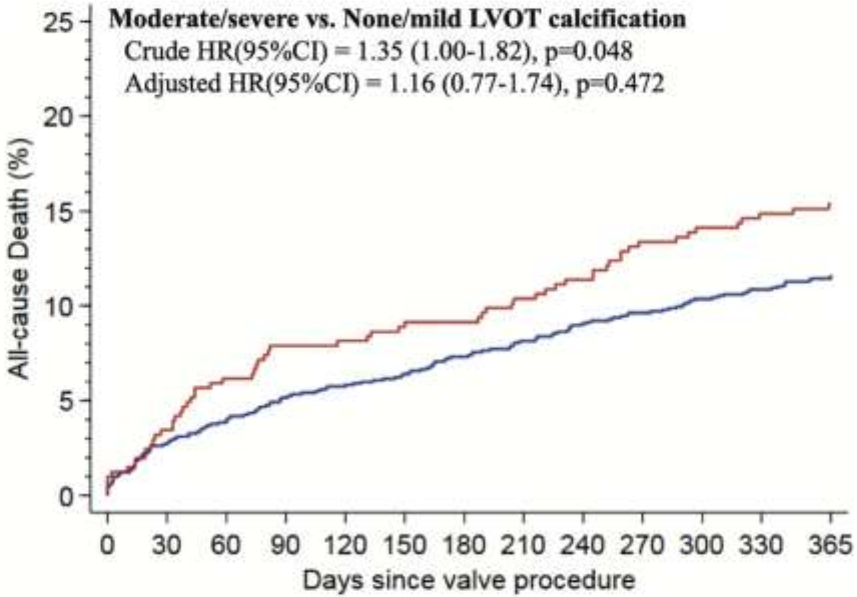
No. at risk						
none/trace	169	147	131	120	102	71
mild	267	212	169	145	119	87
moderate	19	15	14	10	8	5

Retrospective single center study, n=464

Schoechlin S, Hein M, Brennemann T, Eichenlaub M, Schulz U, Jander N, Neumann FJ. 5-Year outcomes after transcatheter aortic valve implantation: Focus on paravalvular leakage assessed by echocardiography and hemodynamic parameters. Catheter Cardiovasc Interv. 2022 Apr;99(5):1582-1589. doi: 10.1002/ccd.30083. Epub 2022 Jan 18. PMID: 35043554.

LVOT Calcium Grading and Outcomes



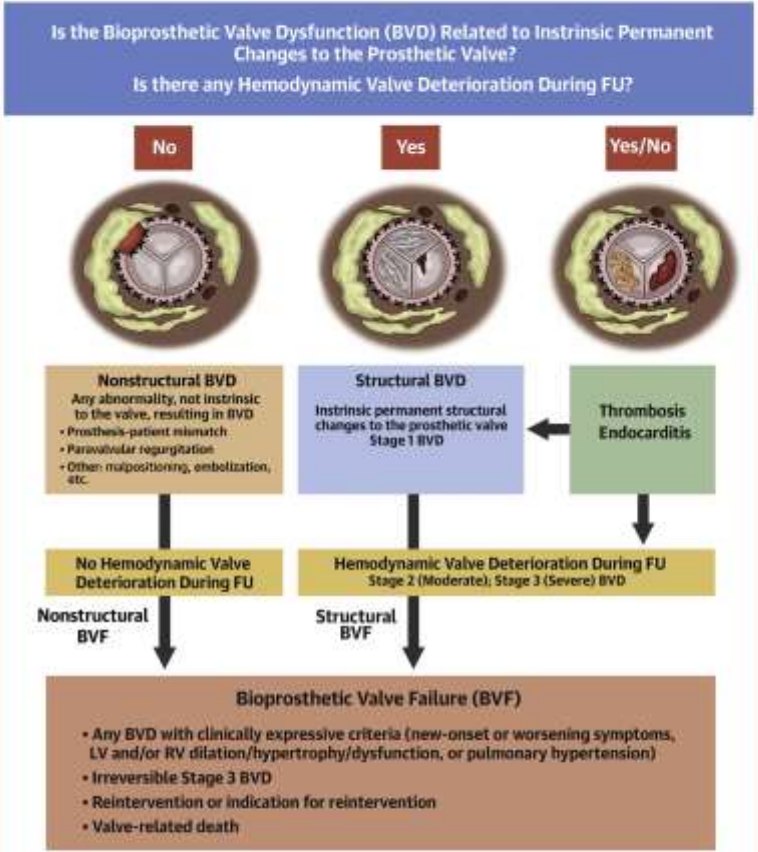


Number at risk													
none/mild	1228	1186	1167	1150	1142	1134	1123	1113	1102	1095	1086	1079	931
moderate/severe	407	392	379	372	371	367	366	360	356	348	345	342	309

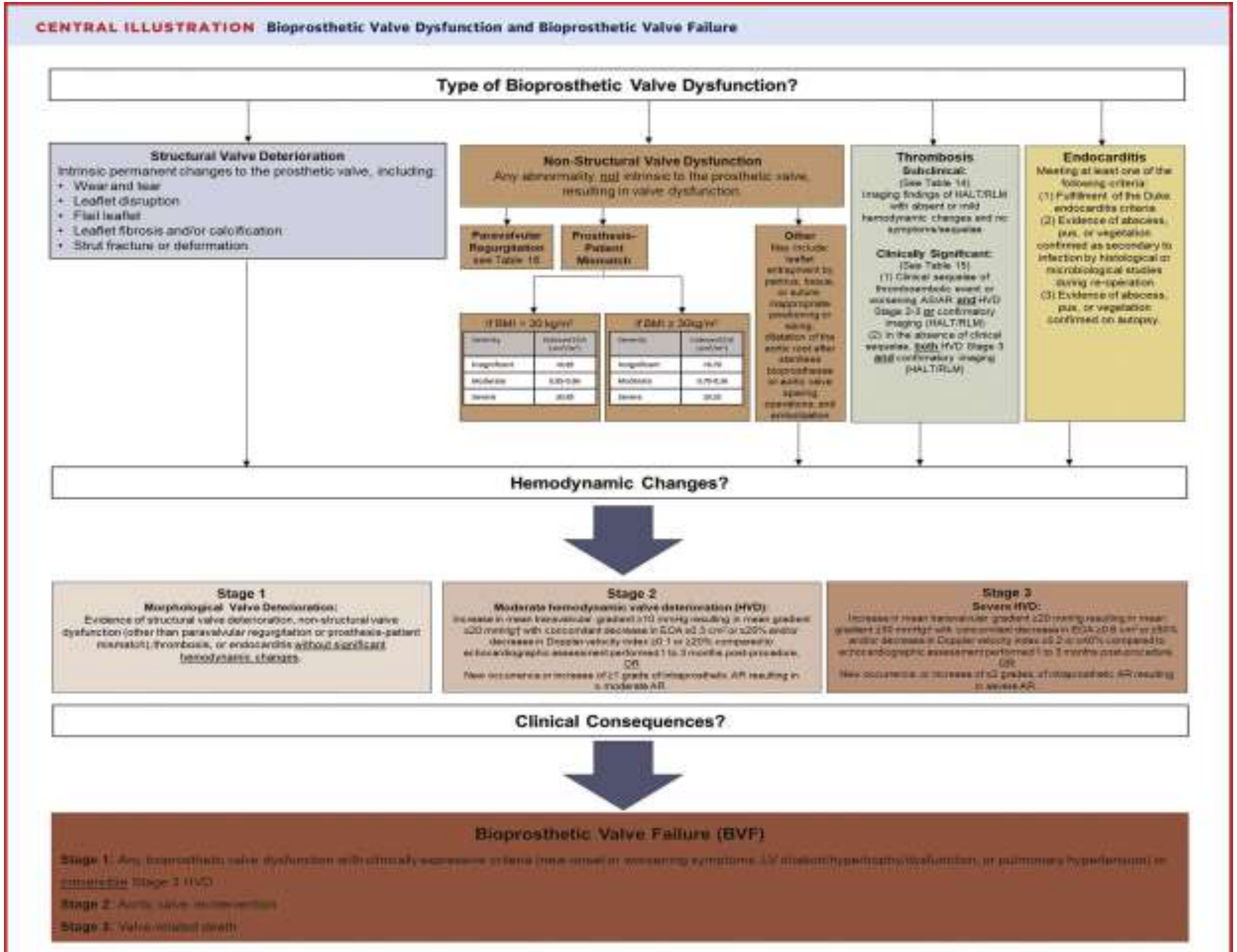
Okuno T, Asami M, Heg D, Lanz J, Praz F, Hagemeyer D, Brugger N, Gräni C, Huber A, Spirito A, Räber L, Stortecky S, Windecker S, Pilgrim T. Impact of Left Ventricular Outflow Tract Calcification on Procedural Outcomes After Transcatheter Aortic Valve Replacement. JACC Cardiovasc Interv. 2020 Aug 10;13(15):1789-1799. doi: 10.1016/j.jcin.2020.04.015. PMID: 32763071.

Bioprosthetic Valve Failure

CENTRAL ILLUSTRATION: Classification and Definitions of Bioprosthetic Valve Dysfunction and Failure



Pibarot P, et al. J Am Coll Cardiol. 2022;80(5):545-561.



Généreux, et al. J Am Coll Cardiol. 2021;77(21):.

Stages of Structural Valve Deterioration

TABLE 4 Standardized Definitions of the Stages of BVD Following Biological Aortic Valve Replacement

Stage 1: Morphological Valve Deterioration

- Evidence of structural valve deterioration, nonstructural valve dysfunction (other than paravalvular regurgitation or prosthesis-patient mismatch), thrombosis, or endocarditis without significant hemodynamic changes (see Table 3)

Stage 2: Moderate Hemodynamic Valve Deterioration[a]

- Morphological valve deterioration (Stage 1)

AND

- Increase in mean transvalvular gradient ≥10 mm Hg resulting in mean gradient ≥20 mm Hg[b] with concomitant decrease in AVA ≥0.3 cm^2 or ≥25% and/or decrease in DVI ≥0.1 or ≥20% compared with echocardiographic assessment performed 1 to 3 mo postprocedure (or discharge if not available)

OR

New occurrence or increase of ≥1 grade of intraprosthetic AR resulting in ≥ moderate AR

Stage 3: Severe Hemodynamic Valve Deterioration[a]

- Morphological valve deterioration (Stage 1)

AND

- Increase in mean transvalvular gradient ≥20 mm Hg resulting in mean gradient ≥30 mm Hg[b] with concomitant decrease in AVA ≥0.6 cm^2 or ≥50% and/or decrease in DVI ≥0.2 or ≥40% compared with echocardiographic assessment performed 1 to 3 mo postprocedure (or discharge if not available)

OR

New occurrence, or increase of ≥2 grades, of transvalvular AR resulting in severe AR

[a]When assessing the presence and severity of hemodynamic valve deterioration, it is important to differentiate true hemodynamic changes vs interechocardiography variability in the measurement of gradient, AVA, DVI, or AR (see Table 1). In particular, one should use the same window for continuous-wave Doppler interrogation when comparing gradients in early (1 to 3 months) postprocedural echocardiography vs follow-up echocardiography. Each case with potential hemodynamic valve deterioration should be individually adjudicated to confirm presence, stage, and etiology. Hemodynamic valve deterioration may be caused by structural valve deterioration but also by nonstructural dysfunction including valve thrombosis and endocarditis. The assessment of valve leaflet morphology and structure as well as clinical features (fever, blood culture, and so on) and change in valve and clinical status over time are key to make differential diagnosis between the different etiologies of hemodynamic valve deterioration: structural valve deterioration vs valve thrombosis or endocarditis vs nonstructural dysfunction (prosthesis-patient mismatch or paravalvular regurgitation) (see Table 3). [b]This criteria for hemodynamic dysfunction assumes normal flow. Adapted with permission from Généreux et al.[4]

BVD = bioprosthetic valve dysfunction; other abbreviations as in Table 1.

Pibarot P, Herrmann HC, Wu C, Hahn RT, Otto CM, Abbas AE, Chambers J, Dweck MR, Leipsic JA, Simonato M, Rogers T, Sathananthan J, Guerrero M, Ternacle J, Wijeysundera HC, Sondergaard L, Barbanti M, Salaun E, Généreux P, Kaneko T, Landes U, Wood DA, Deeb GM, Sellers SL, Lewis J, Madhavan M, Gillam L, Reardon M, Bleiziffer S, O'Gara PT, Rodés-Cabau J, Grayburn PA, Lancellotti P, Thourani VH, Bax JJ, Mack MJ, Leon MB; Heart Valve Collaboratory. Standardized Definitions for Bioprosthetic Valve Dysfunction Following Aortic or Mitral Valve Replacement: JACC State-of-the-Art Review. J Am Coll Cardiol. 2022 Aug 2;80(5):545-561. doi: 10.1016/j.jacc.2022.06.002. PMID: 35902178.

Clinically Relevant Durability Definition

To be clinically relevant, bioprosthetic valve durability should include measures of valve deterioration or dysfunctions AND the clinical consequence of valve dysfunction (i.e., reintervention or valve-related death)

Measures of valve deterioration or dysfunction

- ✓ Abnormal leaflets on CT or TEE

AND

- ✓ Stage 2 SVD by VARC 3 with mean gradient at least 20 mmHg by invasive measurements

Bioprosthetic Valve Failure

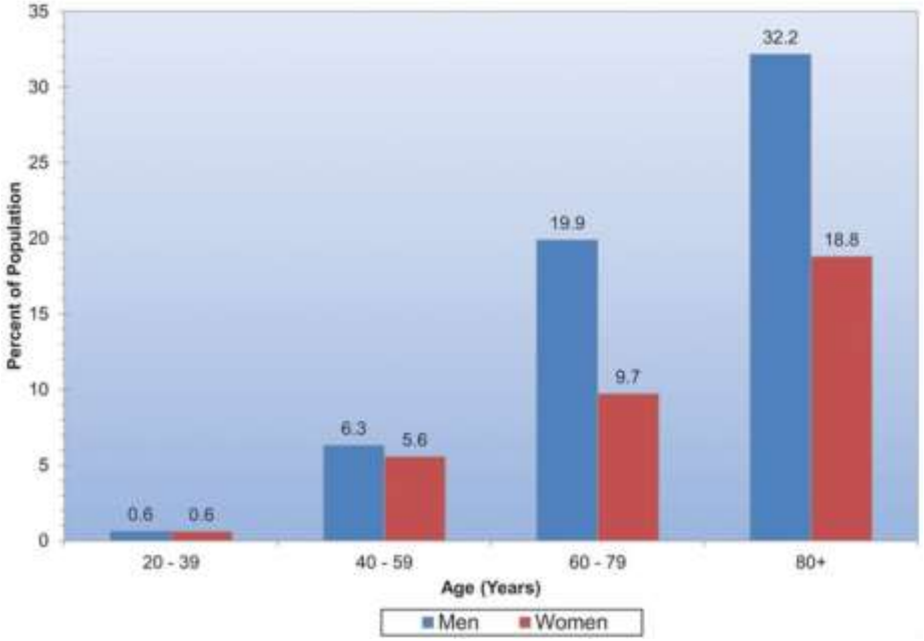
- Reintervention

OR

- Valve-related death

Valve-in-Valve TAVR

The Presence and Progression of Coronary Heart Disease Needs to be Considered When Assessing TAVR Patients



Prevalence of coronary heart disease by age and sex (National Health and Nutrition Examination Survey: 2009–2012).
Source: National Center for Health Statistics and National Heart, Lung, and Blood Institute.

~20% of men and ~10% of women aged 60-79 years have frank CHD

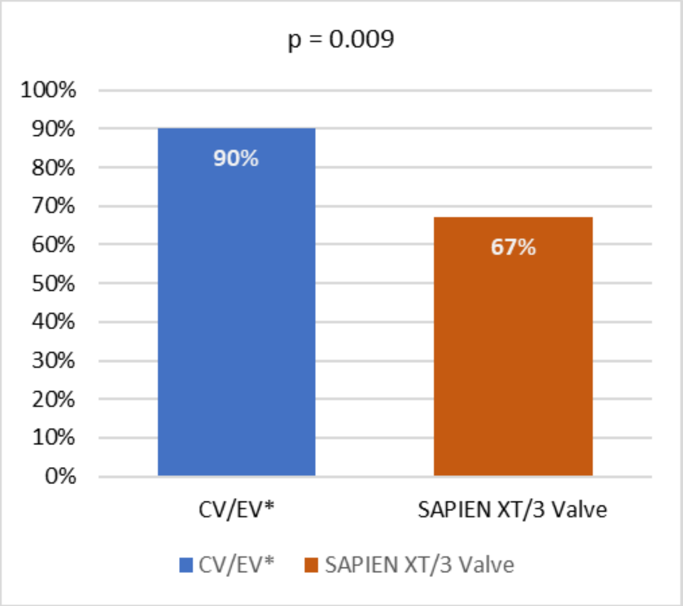
- **Lifetime CHD burden needs to be assessed in TAVR patients**
- **CHD makes up more than half of all CV events in those <75 years of age**

Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, de Ferranti S, Després JP, Fullerton HJ, Howard VJ, Huffman MD, Judd SE, Kissela BM, Lackland DT, Lichtman JH, Lisabeth LD, Liu S, Mackey RH, Matchar DB, McGuire DK, Mohler ER 3rd, Moy CS, Muntner P, Mussolino ME, Nasir K, Neumar RW, Nichol G, Palaniappan L, Pandey DK, Reeves MJ, Rodriguez CJ, Sorlie PD, Stein J, Towfighi A, Turan TN, Virani SS, Willey JZ, Woo D, Yeh RW, Turner MB; American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics--2015 update: a report from the American Heart Association. Circulation. 2015 Jan 27;131(4):e29-322. doi: 10.1161/CIR.0000000000000152. Epub 2014 Dec 17. Erratum in: Circulation. 2015 Jun 16;131(24):e535. Erratum in: Circulation. 2016 Feb 23;133(8):e417. PMID: 25520374.

Coronary Access Interference: Factors to Consider

Interfering Factors

1. Ostium of the coronary artery below the top of the neo-skirt
2. Distance between the THV stent frame and aortic wall <3 mm (in case the coronary artery originates below the top of the neo-skirt)
3. Distance between the stent struts of the first and second THV <3 mm at the "crossing zone" at the same longitudinal level as the coronary ostium
4. A coronary ostium below the top of the neo-skirt and <2 mm distance between the THV stent frame and aortic wall
5. Distance <2 mm between the stent struts of the first and second THVs at the "crossing zone" for CV/EV-in-CV/EV cases



*CV/EV = CoreValve/Evolut; TAV/THV: transcatheter aortic/heart valve; n = 45

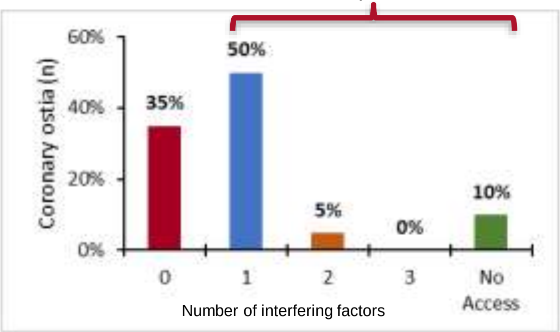
De Backer O, Landes U, Fuchs A, Yoon SH, Mathiassen ON, Sedaghat A, Kim WK, Pilgrim T, Buzzatti N, Ruile P, El Sabbagh A, Barbanti M, Fiorina C, Nombela-Franco L, Steinvil A, Finkelstein A, Montorfano M, Maurovich-Horvat P, Kofoed KF, Blanke P, Bunc M, Neumann FJ, Latib A, Windecker S, Sinning JM, Norgaard BL, Makkar R, Webb JG, Søndergaard L. Coronary Access After TAVR-in-TAVR as Evaluated by Multidetector Computed Tomography. JACC Cardiovasc Interv. 2020 Nov 9;13(21):2528-2538. doi: 10.1016/j.jcin.2020.06.016. PMID: 33153567.

Does THV design and sequence affect coronary access in TAV-in-TAV?

SAPIEN 1st

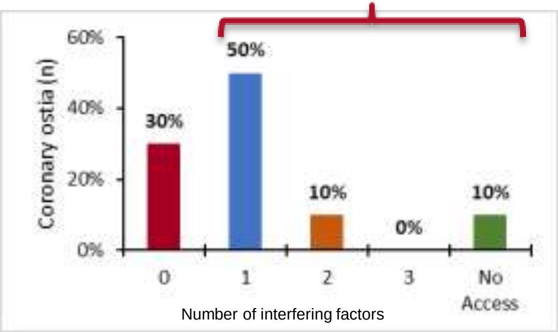
SAPIEN in SAPIEN (n=20)

Interference with coronary access



CV/EV in SAPIEN (n=10)

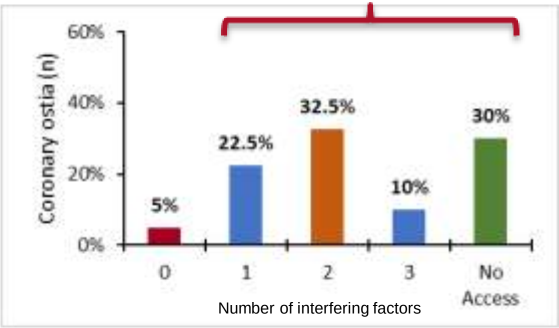
Interference with coronary access



CV/EV 1st

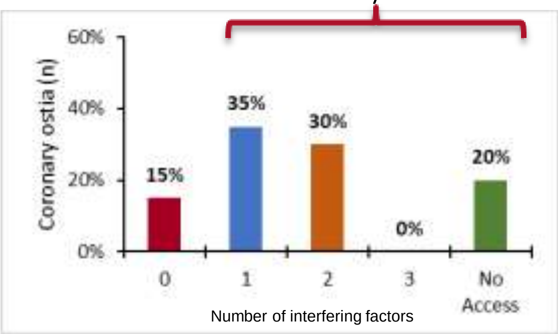
CV/EV in CV/EV (n=40)

Interference with coronary access



SAPIEN in CV/EV (n=20)

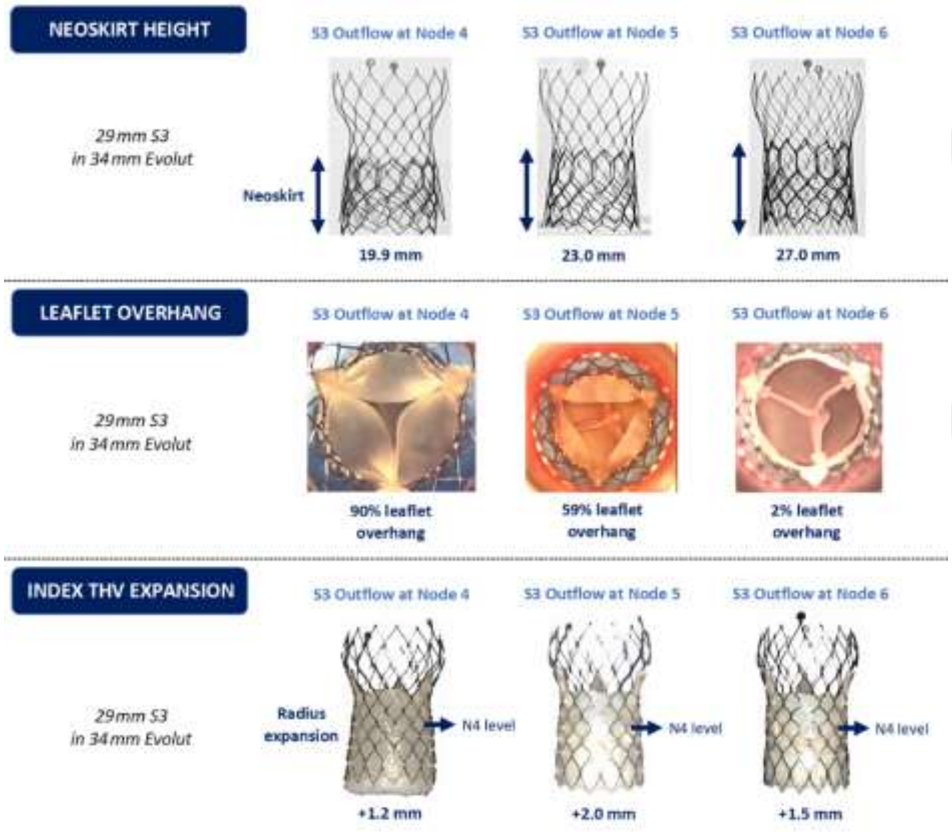
Interference with coronary access



Coronary access may be further complicated by THV-THV stent frame strut misalignment in 53% of CV/EV-in-CV/EV cases

De Backer O, Landes U, Fuchs A, Yoon SH, Mathiassen ON, Sedaghat A, Kim WK, Pilgrim T, Buzzatti N, Ruile P, El Sabbagh A, Barbanti M, Fiorina C, Nombela-Franco L, Steinvil A, Finkelstein A, Montorfano M, Maurovich-Horvat P, Kofoed KF, Blanke P, Bunc M, Neumann FJ, Latib A, Windecker S, Sinning JM, Norgaard BL, Makkar R, Webb JG, Søndergaard L. Coronary Access After TAVR-in-TAVR as Evaluated by Multidetector Computed Tomography. JACC Cardiovasc Interv. 2020 Nov 9;13(21):2528-2538. doi: 10.1016/j.jcin.2020.06.016. PMID: 33153567.

Important Considerations and Concepts for Future THV-in-THV



- Coronary access
- Coronary obstruction risk with future THV-in-THV

- Hemodynamics
- Durability concerns
- Residual gradient

Tarantini G, Delgado V, de Backer O, Sathananthan J, Treede H, Saia F, Blackman D, Parma R. Redo-Transcatheter Aortic Valve Implantation Using the SAPIEN 3/Ultra Transcatheter Heart Valves-Expert Consensus on Procedural Planning and Techniques. Am J Cardiol. 2023 Apr 1;192:228-244. doi: 10.1016/j.amjcard.2023.01.010. Epub 2023 Jan 27. PMID: 36710143.

Manufacturer/ Brand	Valve Size	Bard TRU Balloon Fracture/Pressure	Bard Atlas Gold Balloon Fracture/Pressure	Appearance After Fracture
St. Jude Trifecta	19 mm	NO	NO	
	21 mm	NO	NO	
St. Jude Biocor Epic	21 mm	YES / 8 ATM	YES / 8 ATM	
Medtronic Mosaic	19 mm	YES / 10 ATM	YES / 10 ATM	
	21 mm	YES / 10 ATM	YES / 10 ATM	
Medtronic Hancock II	21 mm	NO	NO	
Sorin Mitroflow	19 mm	YES / 12 ATM	YES / 12 ATM	
	21 mm	YES / 12 ATM	YES / 12 ATM	
Edwards MagnaEase	19 mm	YES / 18 ATM	YES / 18 ATM	
	21 mm	YES / 18 ATM	YES / 18 ATM	
Edwards Magna	19 mm	YES / 24 ATM	YES / 24 ATM	
	21 mm	YES / 24 ATM	YES / 24 ATM	

1. Balloons sized 1 mm larger than valve size.
2. Medtronic Mosaic and Sorin Mitroflow have no metal in ring therefore appearance after fracture unchanged.

Selection of Surgical Valves

If the Heart Team decides on SAVR, it is important that the best SAVR be chosen:

- Biggest ID possible
- Suitable for ViV TAVR
- Fracturable (especially if smaller size)
- Avoidance of surgical valves without stent frames (i.e., NO homografts or stentless valves)

Allen KB, Chhatriwalla AK, Cohen DJ, Saxon JT, Aggarwal S, Hart A, Baron S, Davis JR, Pak AF, Dvir D, Borkon AM. Bioprosthetic Valve Fracture to Facilitate Transcatheter Valve-in-Valve Implantation. Ann Thorac Surg. 2017 Nov;104(5):1501-1508. doi: 10.1016/j.athoracsur.2017.04.007. Epub 2017 Jun 29. PMID: 28669505.

What We Know and Don’t Know

What we know

- In younger patients, bioprosthetic valves are increasingly used over mechanical valves
- Patients may need multiple valves over their lifetime and need is expected to increase
- TAV-in-SAV is safe and effective

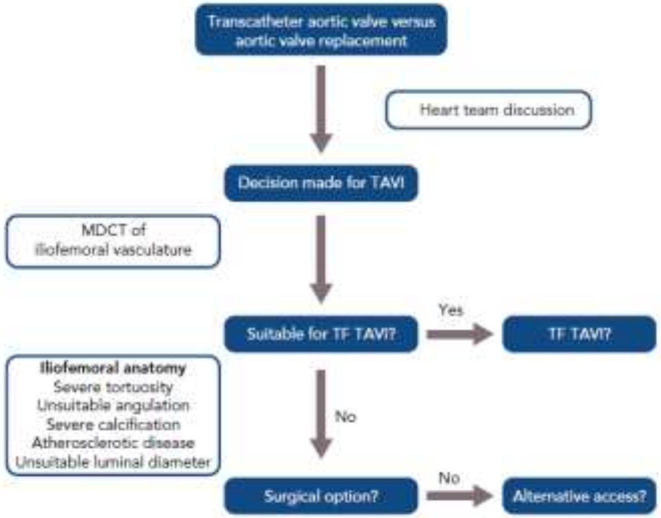
What we don’t know

- Procedure safety, patient selection, and best practices for THV-in-THV and THV explant
- Long-term durability and outcomes of THV-in-THV
- Anti-coagulation strategy after THV-in-THV
- The effect of PPM/host valve under expansion (especially small valves) on long-term outcomes

Alternative Access TAVR

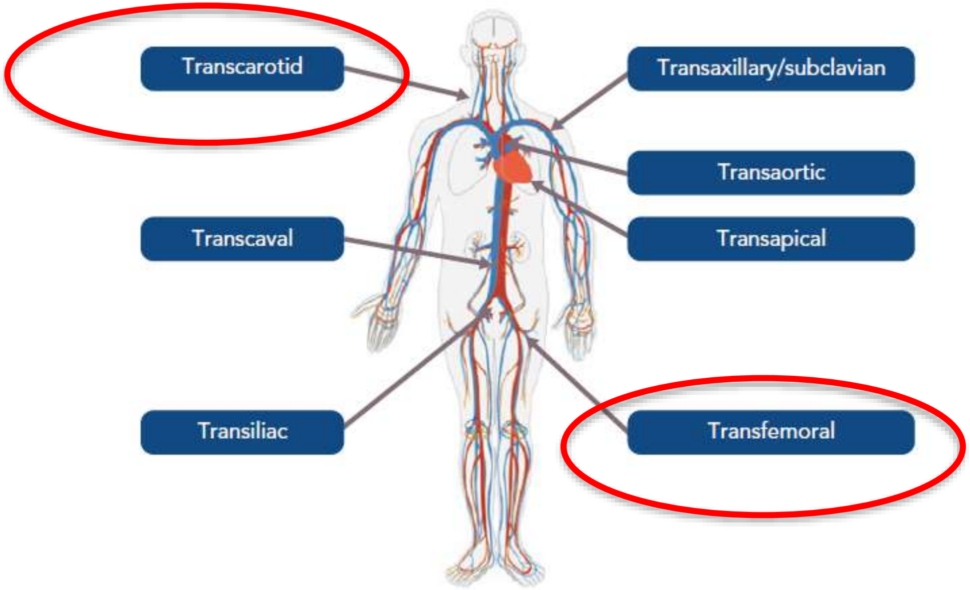
Access Sites for TAVR

Figure 1: Algorithm for Deciding if Patient is a Candidate for Alternative Access Transcatheter Aortic Valve Implantation



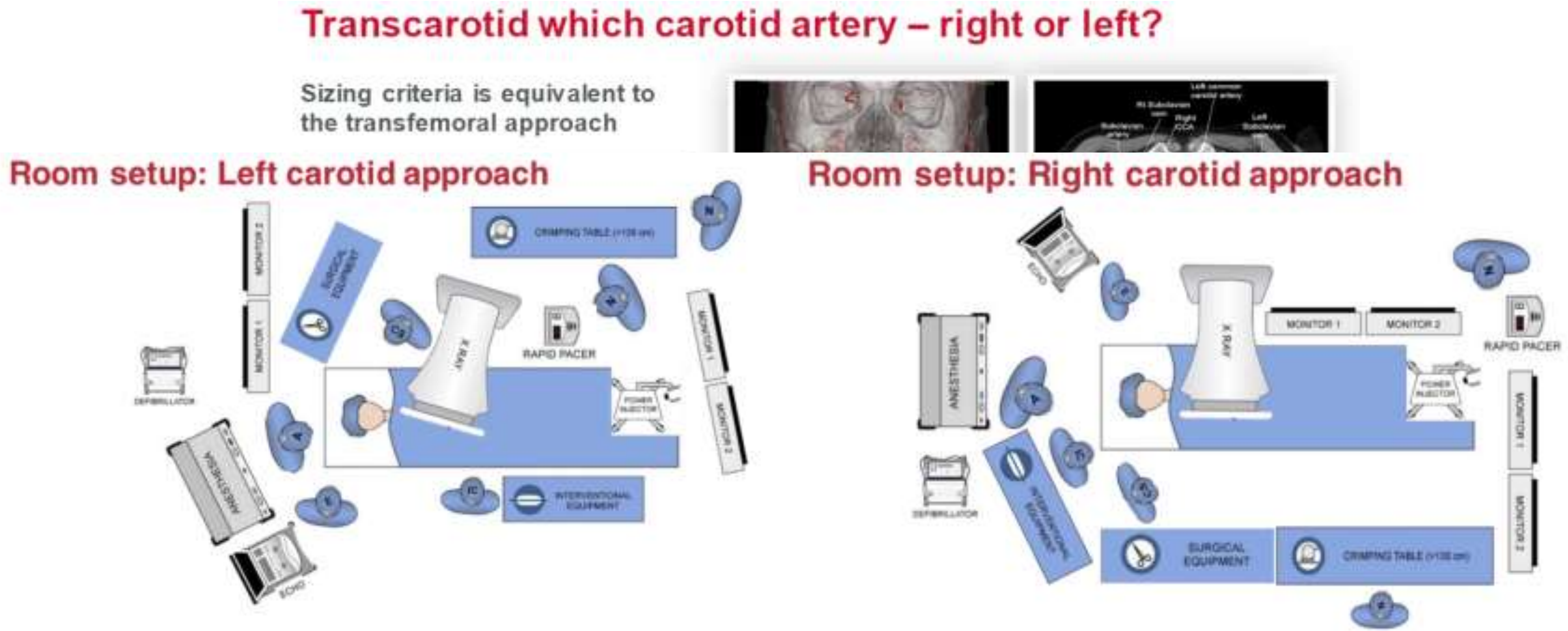
MDCT = multiple detector CT; SAVR = surgical aortic valve replacement; TAVI = transcatheter aortic valve implantation; TF = transfemoral

Figure 2: Access Options in Modern Transcatheter Aortic Valve Implantation



Coughlan J et al. Vascular & Endovascular Review 2019;2(1):23–7

Room Setup – Alternative Access TAVR via the Carotid Artery



SAVR vs TAVR – Which One First?

- 59-year-old male with no co-morbidities
- Severe AS, 0.8
- High-level VP of medical technology company
- 2 daughters in college, near graduation
- High-stress job with significant travel, including international
- Prefers TAVR due to job demands and upcoming daughters' graduations

SAVR vs TAVR First: My Approach

Potentially Favors SAVR

- Younger Patient
- Unfavorable anatomy
  - Eccentric bulky leaflets
  - Type 0 Bicuspid
  - Severe LVOT calcium
  - Very large annulus
- Poor access for TAVR
- Aortopathy (especially if bicuspid)
- Other important valvular disease
- Multivessel CAD
- Redo TAVR won't be straightforward

Potentially Favors TAVR

- Older Patient
- Favorable anatomy
  - No eccentric bulky calcium
  - Favorable bicuspid
  - No or minimal LVOT calcium
  - Annular size in treatment range
- Favorable access for TAVR
- No aortopathy meeting surgical criteria
- No other important valvular disease
- Minimal CAD or CAD easily managed by PCI
- Redo TAVR will be straightforward

Thank You

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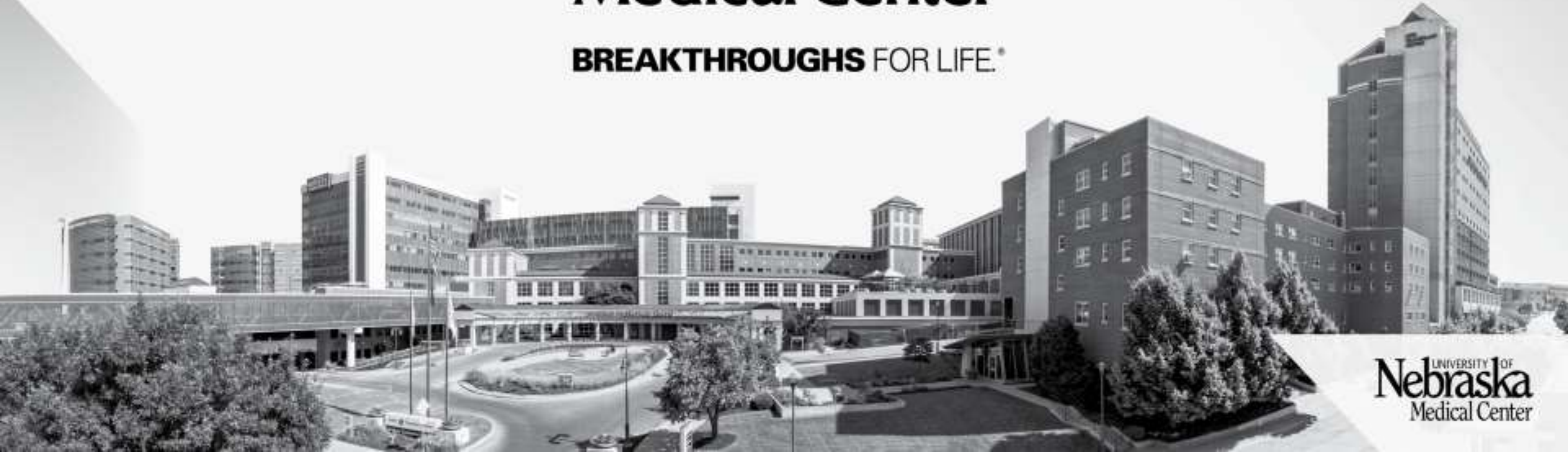

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