EUROVALVE
& STRUCTURAL CARDIOMYOPATHIES
NH PALERMO

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Coronary Artery Disease In TAVI Patients

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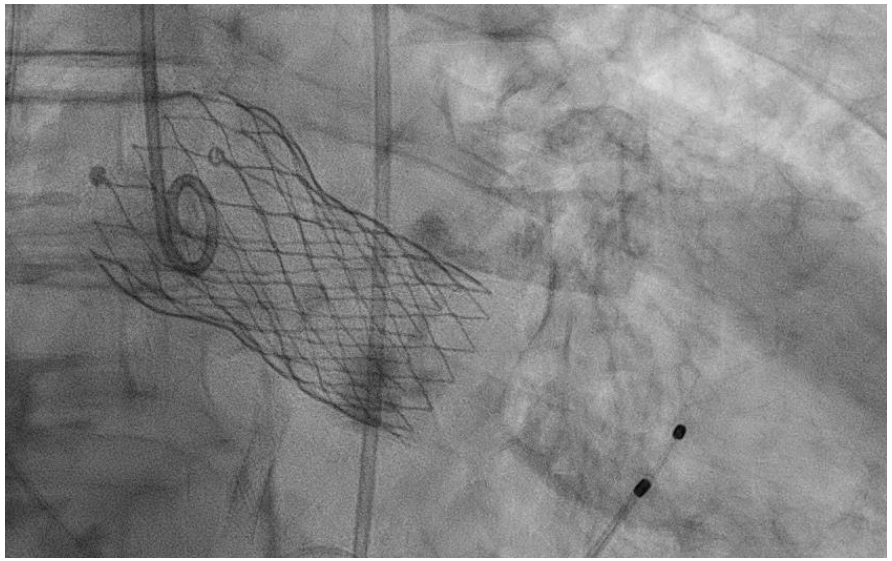
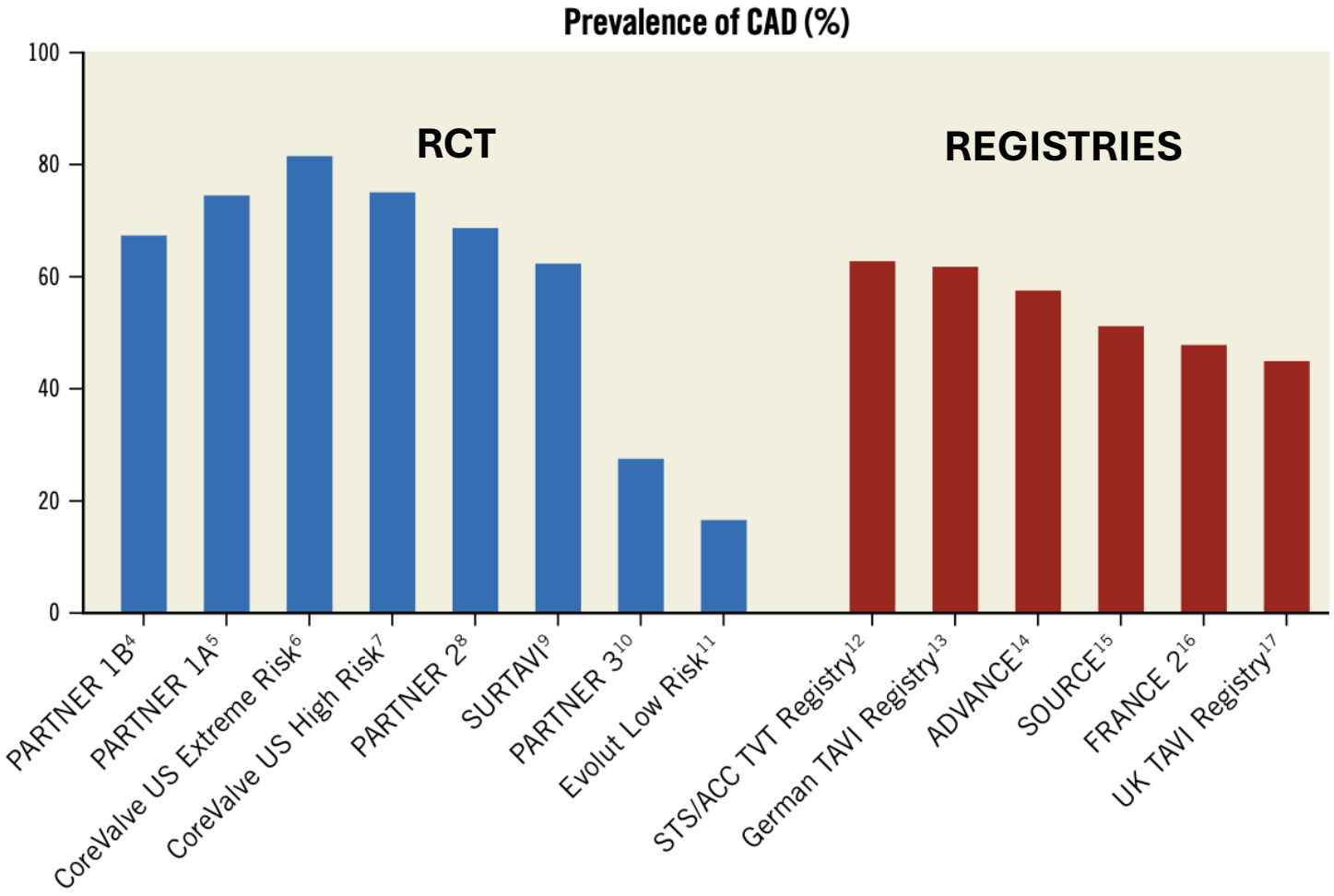
- No Conflict of Interest to declare

Prevalence of CAD in TAVI population

- CAD in ~ 50% of TAVI patients
- Prior PCI in ~ 20%
- Prevalence decreases with reduction in age and surgical risk





Tarantini G. et al. EuroIntervention. 2023 May 15;19(1):37-52.

Management of CAD in TAVI patients

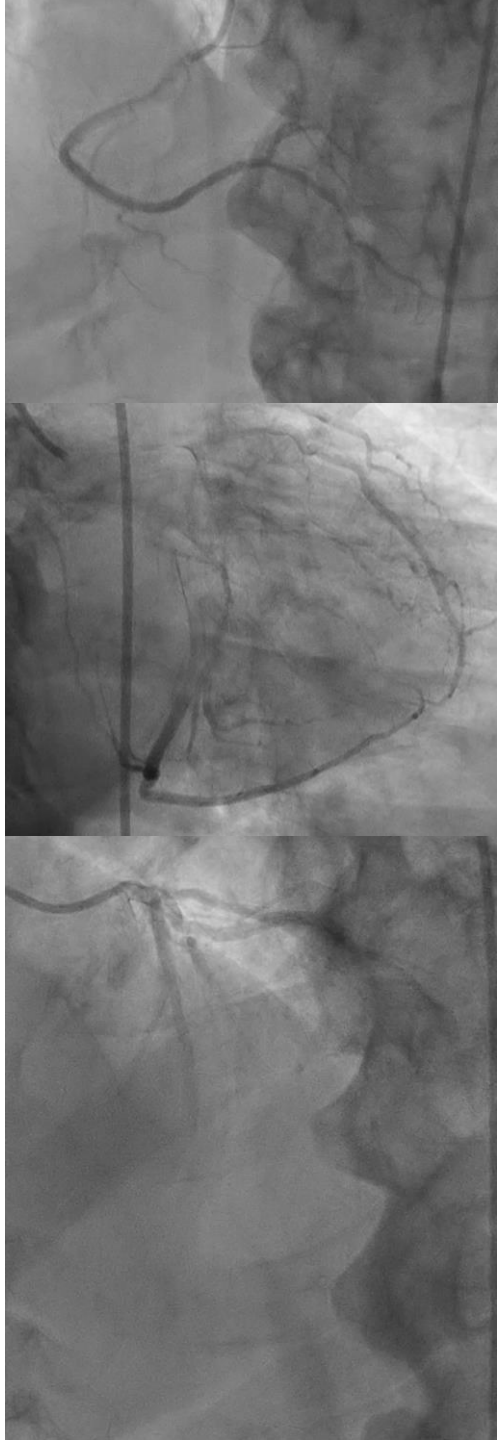
Under-Diagnosis/Treatment	**Over**-Diagnosis/Treatment
• **Symptoms (angina, dyspnea)** • **Altered Quality of Life** • **Acute Coronary Syndrome** *CAD progression* *Plaques destabilization*	• **Symptoms (angina, dyspnea)** • **Altered Quality of Life** • **Acute Coronary Syndrome** *CAD progression* *Plaques destabilization* *In-stent restenosis, Stent Thrombosis*
• Ischemia-induced **hemodynamic instability** during TAVI procedure • More difficult **coronary access after TAVI** if needed	• Contrast-induced **nephropathy** • **Bleeding** (<DAPT) • **Time** • **Cost**

In any case, if PCI, aim for optimal results and keep it simple to limit risk of related events

Diagnostic CAD evaluation

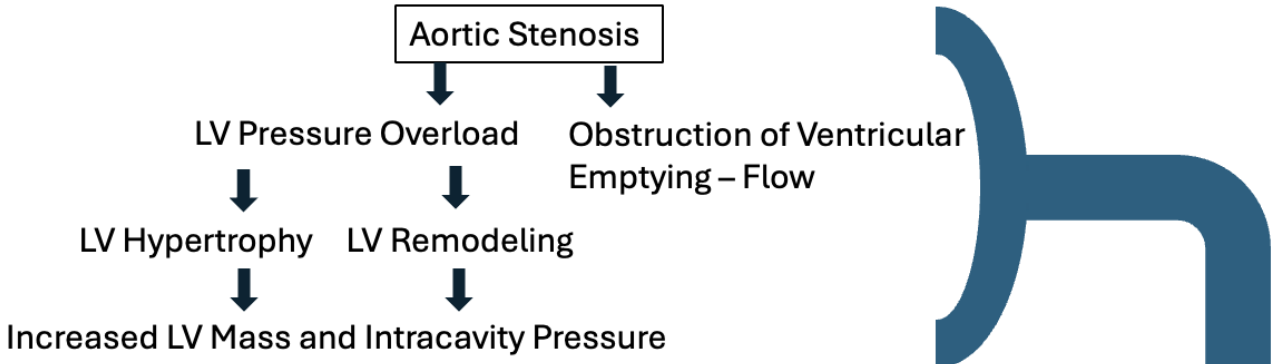
1. Invasive Coronary Angiography

- Standard assessment
- Benefits:
    1. Good performance even with significant burden of Ca >< CT
    2. Guidelines
    3. Concomitant functional/imaging assessment or PCI
- Timing:
    - Before: minimize contrast volume and procedure duration of TAVI
    - Concomitant: non-surgical candidate or low probability of CAD
- Disadvantages
    - Risk of vascular complications
    - Risk of contrast nephropathy
    - Burden of healthcare system
    - Delay in AS treatment
- Remains the mainstay of CAD assessment in most TAVI candidates

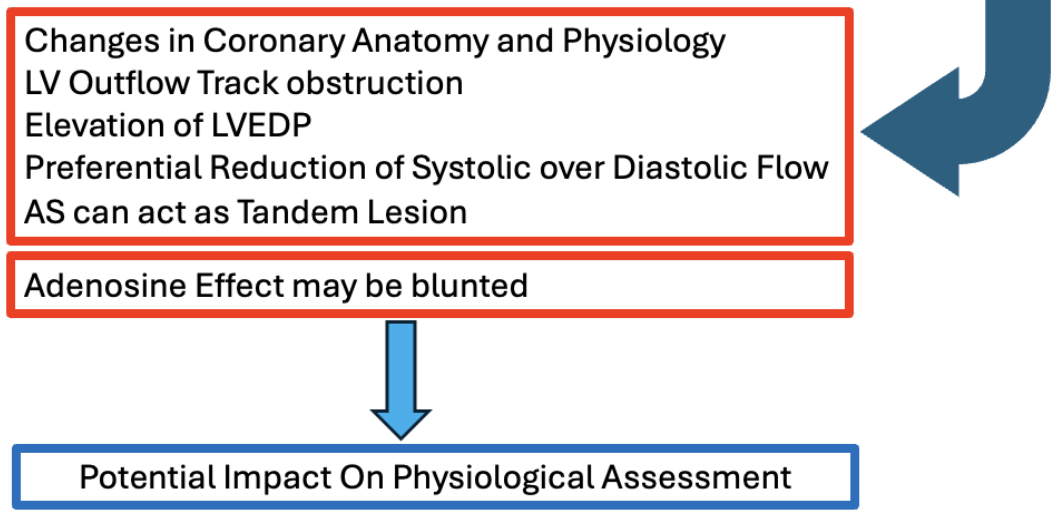


2. Invasive Coronary Physiology Assessment

1. Reliability of Invasive Physiology Assessment



Effects of AS on coronary artery anatomy and physiology
Reduction in stroke volume, systolic and mean arterial pressure, which may cause reduced coronary perfusion pressure
Decreased density of coronary microvasculature
Attenuated and delayed systolic forward compression wave of coronary blood flow
Increased resting diastolic backward expansion wave
Reduction in resting microvascular resistance, with inability to reduce further in response to hyperaemia
Upregulation of vasoactive factors, leading to increased resting blood flow
Microvascular dysfunction impairing hyperaemic response
Reversal of normal endocardial-epicardial blood flow ratio at rest
Reduced diastolic coronary perfusion phase
Attenuated coronary flow reserve



Ahmad Y et al. JACC Cardiovasc Interv. 2018 Oct 22;11(20):2019-2031.
Tarantini G. et al. EuroIntervention. 2023 May 15;19(1):37-52.

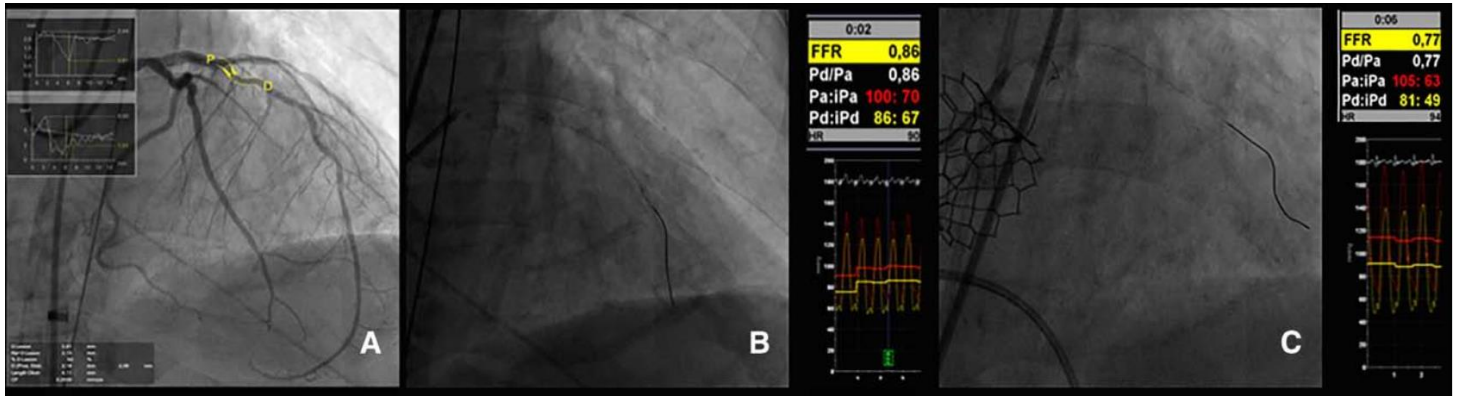
2. Invasive Coronary Physiology Assessment

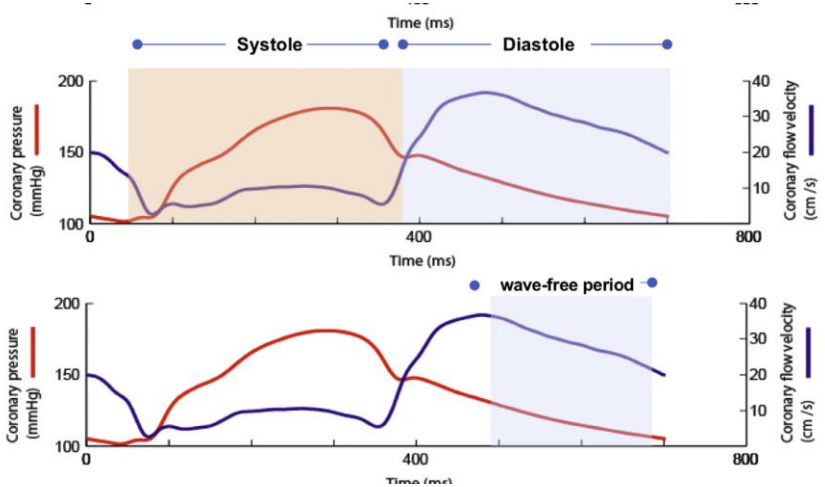
2. Data

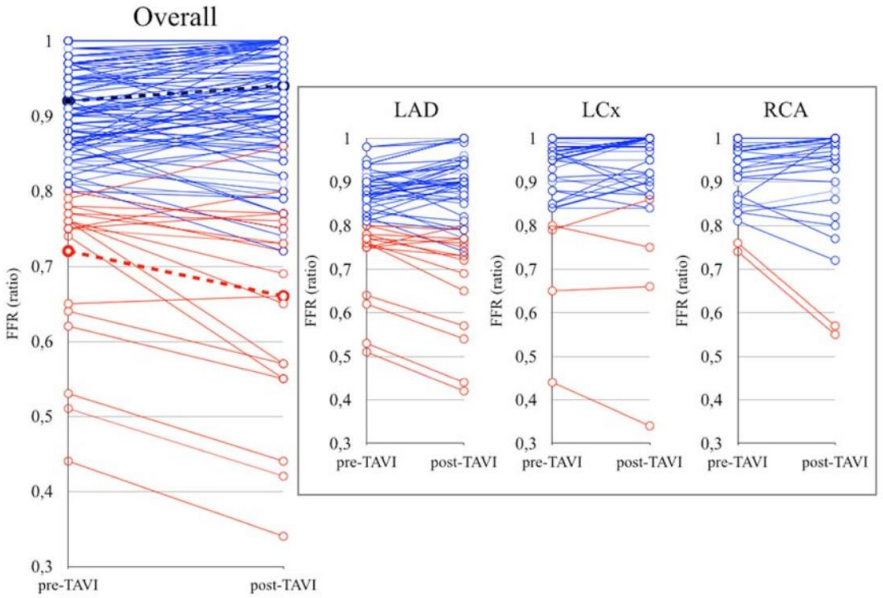
- No RCT data
- Limited observational studies

- Studies evaluating FFR/iFR before/after TAVI
- Conflicting findings

- Correlation with clinical outcomes
- Is iFR a better option?
- Validation of other (non-) Hyperemic cutoffs?



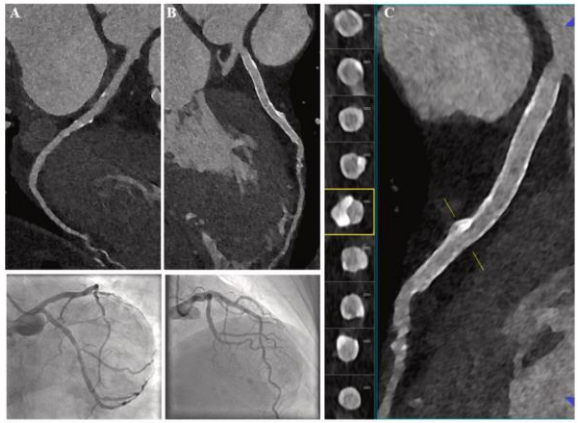


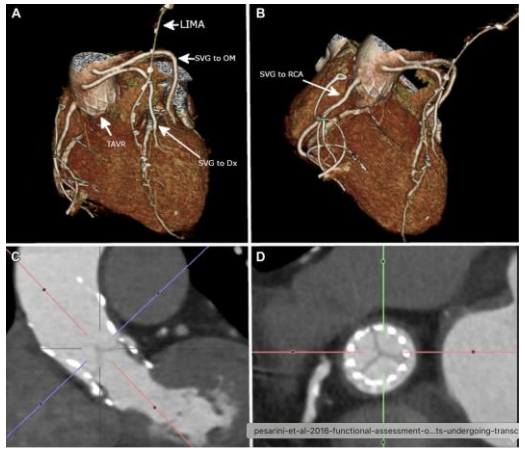


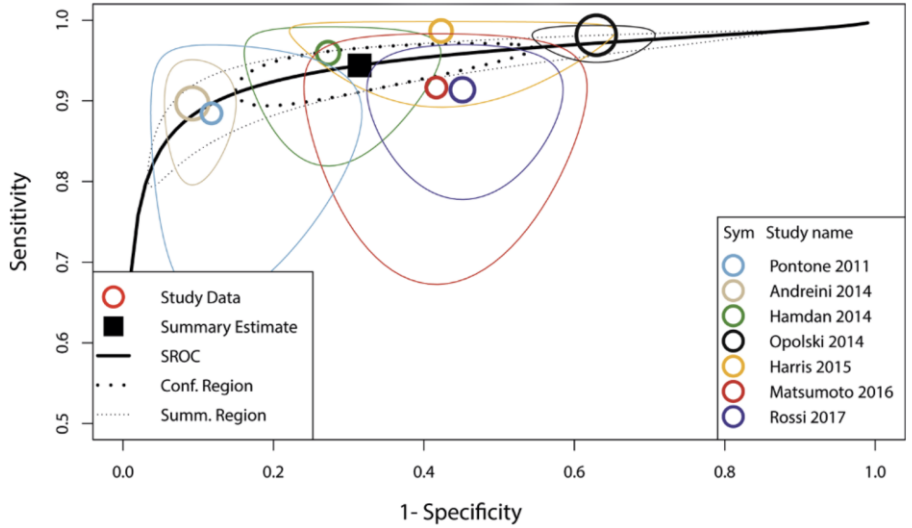
Patel K et al. JACC Cardiovasc Interv. 2021 Oct 11;14(19):2083-2096
Pesarini G et al. Circ Cardiovasc Interv. 2016 Nov;9(11):e004088

3. Non-Invasive CAD Assessment

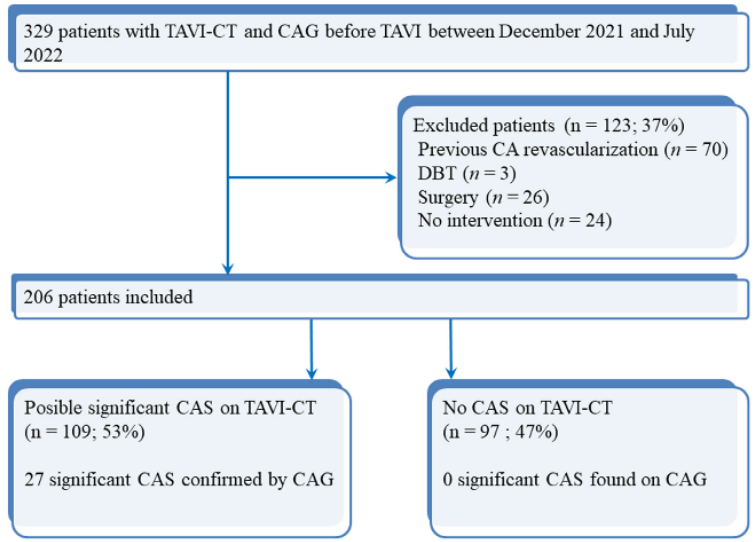
- MSCT for preprocedural planning
  - ➔ May be used for concomitant CTCA
- Advantages
  1. Lower risk of complications
  2. Lower burden on Healthcare system
  3. Decreased delay to AS treatment
- To consider in **patients** with low pretest probability of CAD and expected good image quality (young patients with low CV profile)
- Evolution with techniques (IA)







Pooled sensitivity: 95%, NPV: 94%
Pooled specificity: 65%, PPV: 71%



CA avoided in 47% of selected patients

Lecomte A et alDiagn Interv Imaging. 2023 Nov;104(11):547-551.
van den Boogert TPW et al. Neth Heart J. 2018 Dec;26(12):591-599.
Widmer R. et al. JSCAI, Volume 3, Issue 3, 101301
van der Bie J. et al. Eur J of Radiol, Volume 163, 110829

Management of CAD

- PCI in patients with stable CAD
  - PCI should be performed in case of severe CAD (>70%, >50% in LM) in proximal segments (Class IIa, C)
    - Particularly if ACS, angina, subocclusive lesions
- Optimal **timing** based on clinical presentation, anatomical characteristics, coronary lesions complexity, THV choice

PCI before TAVI	PCI after TAVI	Combined PCI and TAVI
- **Easier coronary access** (especially for self-expanding THV with a supra-annular leaflet position) - **Lower risk of ischaemia-induced haemodynamic instability** (i.e., during rapid pacing) - **Reduced contrast use** compared with concomitant PCI and TAVI	- **More reliable FFR/iFR of intermediate lesions** - **Lower risk of haemodynamic instability during complex PCI** (i.e., with rotational atherectomy and impaired LV function) - **Reduced contrast use** compared with concomitant PCI and TAVI	- Use of the **same arterial access** - **Lower cost**
- Less reliable FFR/iFR assessments of borderline lesions - Higher risk of haemodynamic instability due to AS	- **More challenging and potentially compromised coronary access** - **Less stability and support of the coronary guiding catheter** - **Potential THV dislodgement**	- Larger amount of contrast and higher risk of AKI - **Prolonged procedure** - Need for DAPT at the time of TAVI, hence increased **bleeding risk**

A TAVR procedural safety with obstructive CAD

Definition of CAD Risk/Severity

- **Non-obstructive**: All lesions in LAD, LCx and RCA <70%, LM <50%
- **Intermediate**: LCX or RCA or non-prox LAD ≥70%
- **High**: LCX and LAD ≥70% or RCA and either LAD or LCX ≥70% or prox LAD ≥70% or 50%≤ LM <70%
- **Extreme**: Triple vessel disease (all lesions ≥70%) or LM ≥70%

SEV 9%

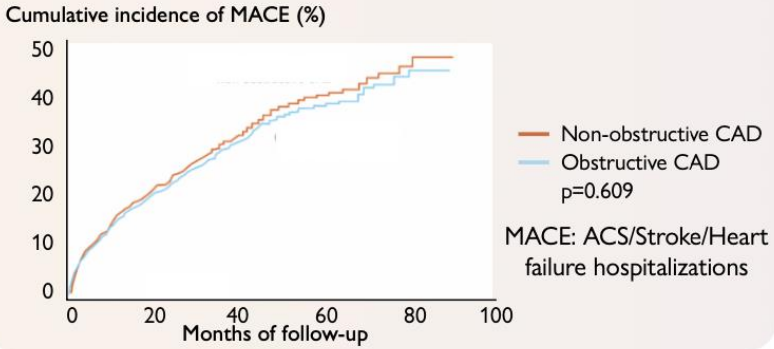
BEV 91%

1911 included for analysis

	Non-obstructive CAD:1432	Intermediate CAD:116	High CAD:199	Extreme CAD:199
Intra-aortic balloon pump	0.1%	0.0%	0.0%	0.0%
Ventricular arrhythmia requiring shock	0.1%	0.0%	0.0%	0.0%
ECMO	0.1%	0.0%	0.0%	0.6%
Shock	0.0%	0.0%	0.0%	0.6%
Death	0.4%	0.0%	0.5%	0.6%

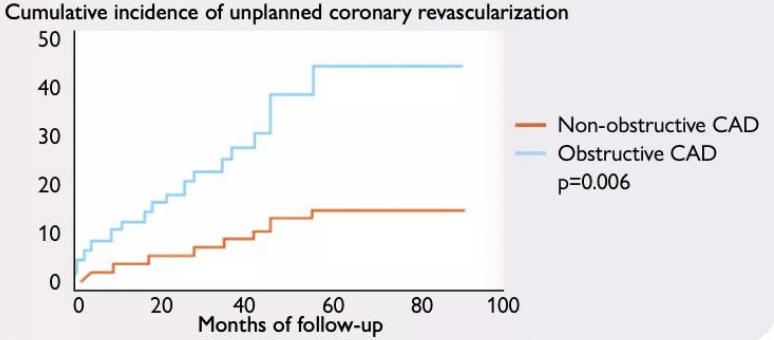
Overall procedural complications: p=0.60 (across groups)

B Cumulative incidence of MACE



MACE: ACS/Stroke/Heart failure hospitalizations

C Cumulative incidence of unplanned coronary revascularization



D Multivariable analyses for all-cause mortality and MACE

	Unadjusted		Multivariable adjusted	
Group	HR (95% CI)	P	HR (95% CI)	P
All-cause mortality				
Non-obstructive CAD	Ref	N/A	Ref	N/A
Intermediate CAD	1.32 (0.89, 1.94)	0.17	1.17 (0.70, 1.95)	0.55
High CAD	1.17 (0.83, 1.65)	0.36	0.93 (0.57, 1.51)	0.77
Extreme CAD	0.80 (0.53, 1.20)	0.28	0.74 (0.45, 1.23)	0.25
Major adverse cardiovascular events				
Non-obstructive CAD	Ref	N/A	Ref	N/A
Intermediate CAD	1.03 (0.71, 1.49)	0.87	1.05 (0.68, 1.63)	0.83
High CAD	1.20 (0.91, 1.56)	0.19	1.07 (0.77, 1.48)	0.69
Extreme CAD	0.79 (0.57, 1.10)	0.16	0.76 (0.52, 1.11)	0.16

Persits I et al. European Heart Journal (2024) 45, 1890–1900

Antithrombotic Therapy Post-TAVI +/- PCI

Procedure	No pre-existing indication for OAC	Concurrent indications for OAC
TAVI alone	Aspirin long-term	(D)OAC long-term
+ PCI for chronic coronary syndrome	DAPT 1-6 months (HBR: 1-3, LBR: 6) ASA long-term	Triple therapy (AAS-Clopidogrel-(D)OAC) ≤1 week (D)OAC + Clopidogrel for 1-6 months (HBR: 1-3, LBR: 6) (D)OAC long-term
+ PCI for acute coronary syndrome	DAPT for 6-12 months (HBR:6, LBR: 12) ASA long-term	Triple therapy (AAS-Clopidogrel-(D)OAC) ≤1 week (D)OAC + Clopidogrel for 6-12 months (HBR: 6, LBR: 12) (D)OAC long-term

Individual Risk Assessment:
Bleeding vs. Ischemic

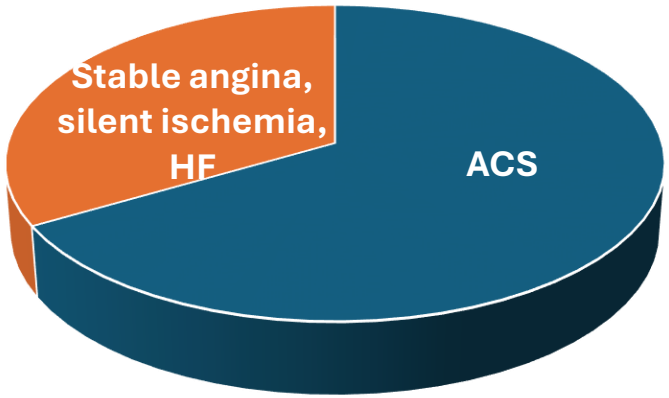
Most current TAVI patients: HBR

Hindricks G et al. Eur Heart J. 2021 Oct 21;42(40):4194
Van Gelder I. et al. European Heart Journal (2024) 45, 3314–3414
Vahanian A. et al. European Heart Journal (2022) 43, 561–632
Neumann F. European Heart Journal (2019) 40, 87–165

Coronary Access and TAVI

The younger the patient we treat with TAVI, the higher the risk of future PCI indication given the longer life expectancy

- ICA and/or PCI
  - 2% within 1 year
  - 16% within 5 years
    - 5% of PCI



- Evolution of CAD
  - Progression of CAD
  - Occurrence of ACS
  - Delayed coronary occlusion
- Rate may increase
  - Younger patients with longer life expectancy
  - More conservative strategy for asymptomatic lesions

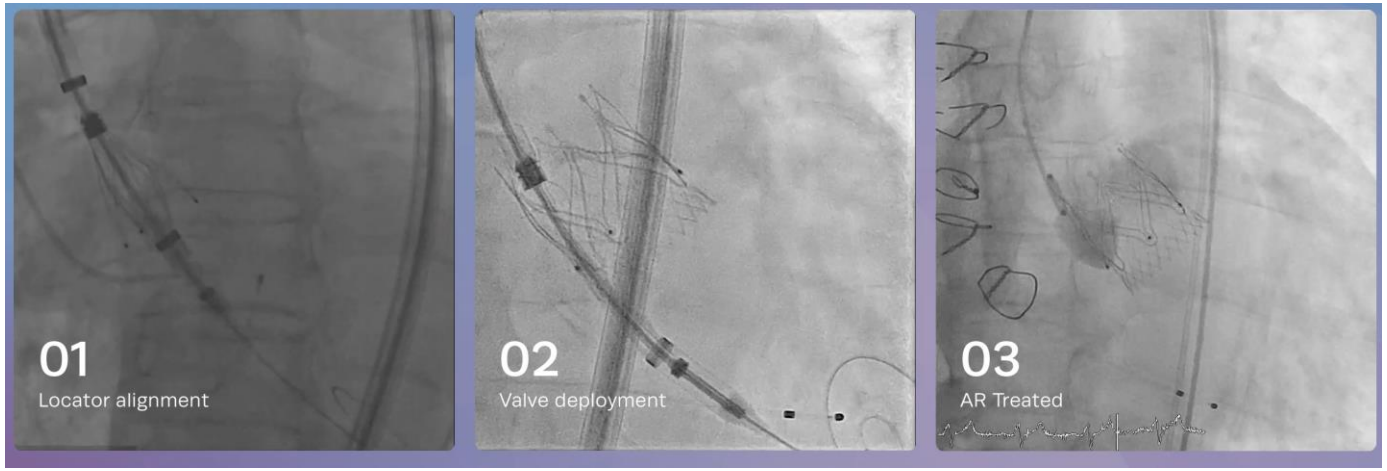
- Access to coronary arteries after TAVI
  - Related to risk of coronary artery occlusion per-TAVI

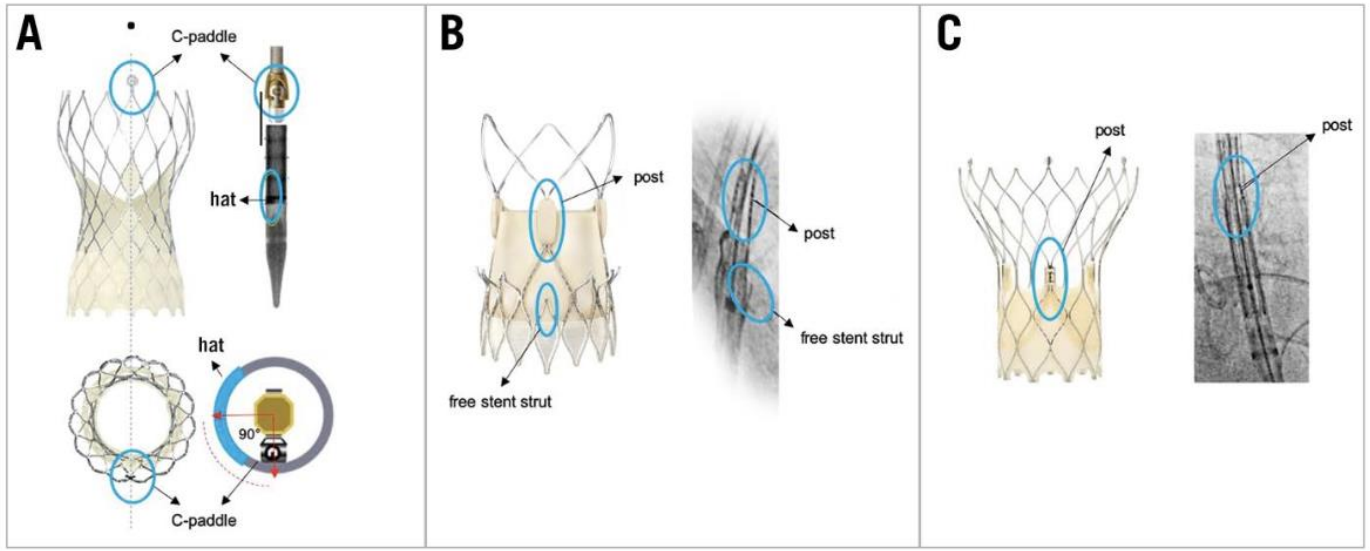
PATIENT CHARACTERISTICS
- LCA and RCA Height
- Sinus Sizes
- Height and width of STJ
- Calcifications
- Aortic Root Dilatation
- Aberrant Coronary Arteries

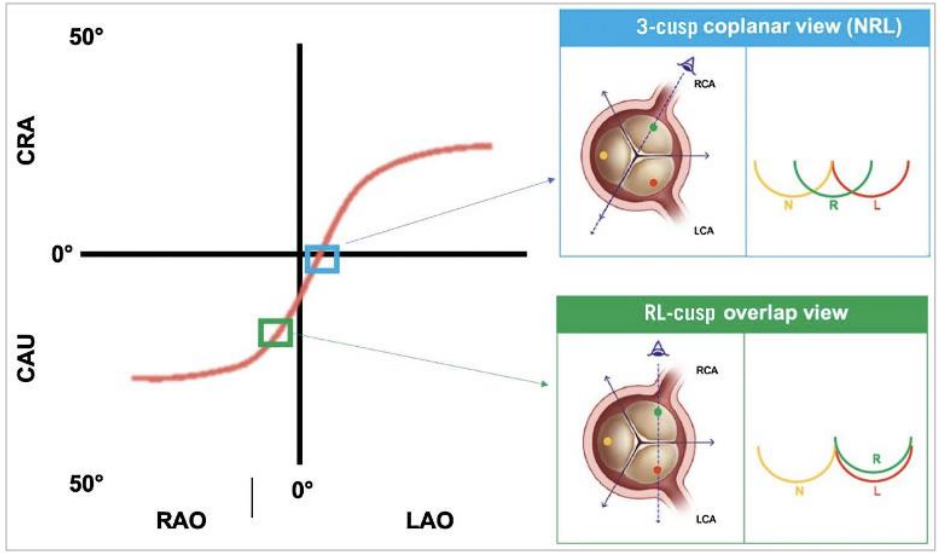
TECHNICAL CHARACTERISTICS
- Devices
  - BEV – SEB
  - Frame/stent Design
  - Cusp Alignment Markers
- Technique
  - Implant Height
  - Cusp Alignment

THV Design/Position And Coronary Access: Possible Actions

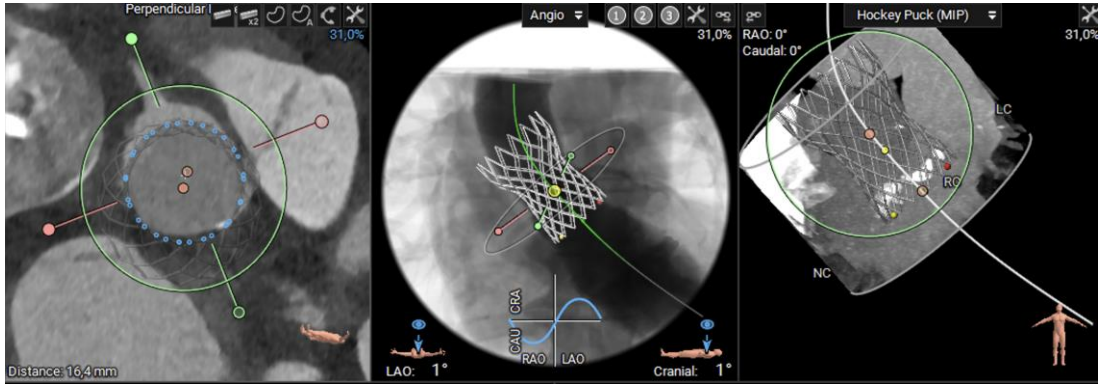
- **THV Design**
  - Stent frame height
  - Leaflet position (annular/supra-annular)
  - Leaflet height with respect to recommended annular positioning
  - Size of cells
- **Implant position**
- **Commissural Alignment**



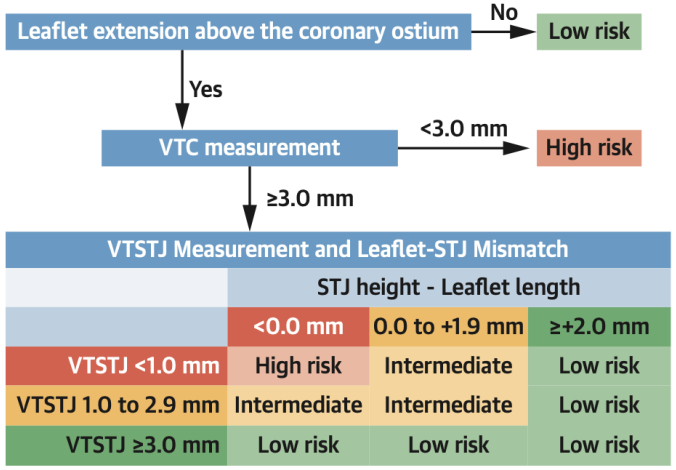




TAVI And Coronary Access: Evaluation

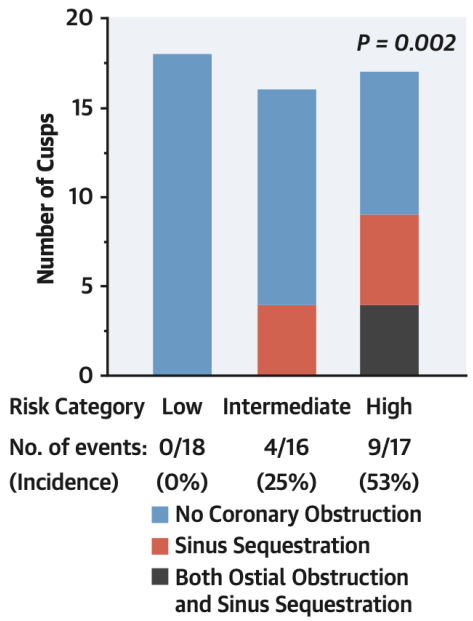


Risk Stratification on Pre-TAVR CT, N = 51



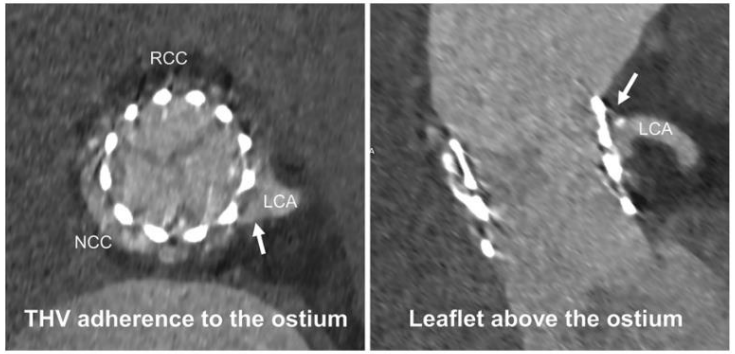
VTSTJ Measurement and Leaflet-STJ Mismatch

	STJ height - Leaflet length		
	<0.0 mm	0.0 to +1.9 mm	≥+2.0 mm
VTSTJ <1.0 mm	High risk	Intermediate	Low risk
VTSTJ 1.0 to 2.9 mm	Intermediate	Intermediate	Low risk
VTSTJ ≥3.0 mm	Low risk	Low risk	Low risk

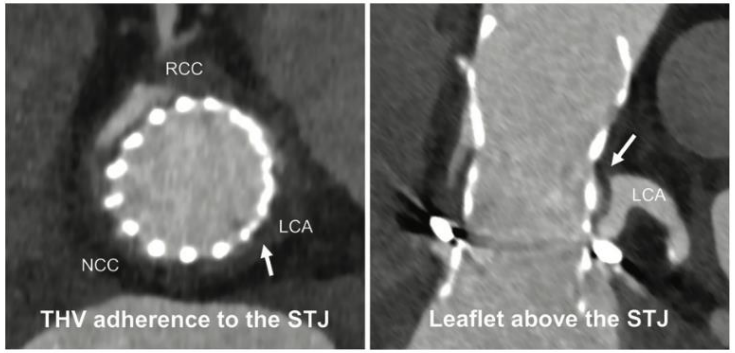


Threatened Coronary Obstruction After TAVR

Ostial Obstruction



Sinus Sequestration



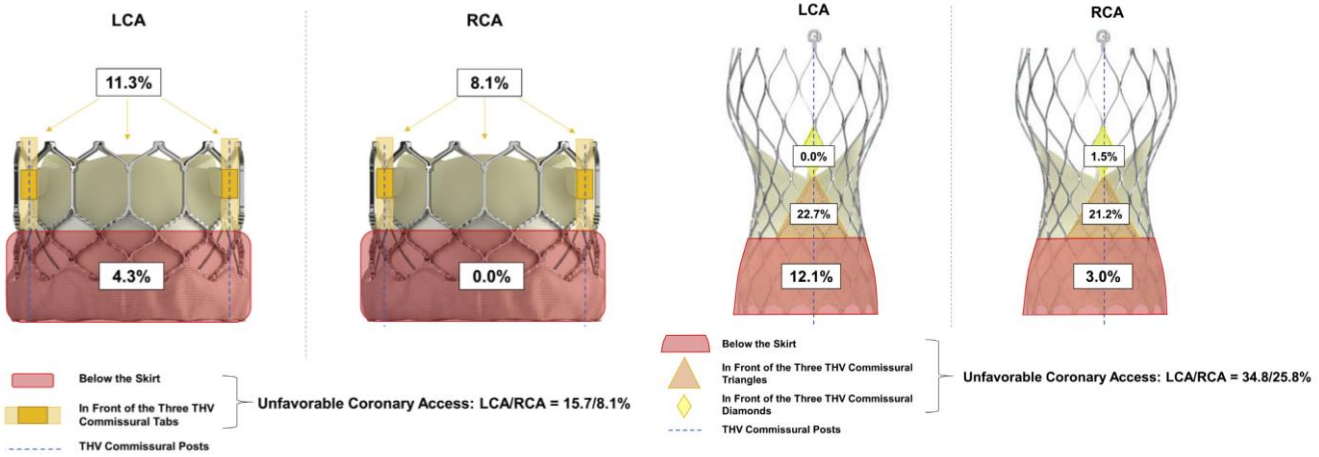
Kitamura M et al. J Am Coll Cardiol Intv. 2022 Mar, 15 (5) 496–507.

Table 3. Feasibility of coronary access with different THV in available studies.

Study author, year	Valve type (n)	ACS	RCA CA success	RCA CA selective	LCA CA success	LCA CA selective	PCI, n; success, %
Blumenstein et al. 2015[55]	SAPIEN XT (n=19) CoreValve (n=10) ACURATE (n=4) Other (n=2)	13.3%	94.3%	77.1%	97.1%	79.4%	n=8; 100%
Boukantar et al. 2017[66]	CoreValve (n=16)	43.8%	58%	16%	75%	44%	n=7; 85.7%
Htun et al. 2017[67]	CoreValve (n=28)	90.0%	100%	90%	100%	97%	n=29; 100%
Zivelonghi et al. 2017[54]	Evolut R (n=25) SAPIEN 3 (n=41)	0%	100%	94%	98%	97%	n=17; 100%
Tanaka et al. 2019[61]	CoreValve/Evolut (n=41)	56.5%	50%	31.3%	87.5%	57.1%	n=30; 93.3%
Ferreira-Neto et al. 2019[53]	SAPIEN XT (n=28)	64.3%	100%	81.5%	100%	82.6%	n=13; 100%
Couture et al. 2020[97]	Evolut R/PRO (n=10)	10.0%	NA	60%	NA	40%	n=2; 50%
Nai Fovino et al. 2020[52]	SAPIEN XT/3 (n=36) CoreValve/Evolut R/Pro (n=8) Jena (n=2) Lotus (n=2)	35.0%	100% IA vs 75% SA	94% IA vs 25% SA	100% IA vs 100% SA	97% IA vs 50% SA	n=26; 96.2%
Barbanti et al. 2020[51]	SAPIEN (n=96) Evolut (n=123) ACURATE (n=72) Portico (n=9)	0%	96.0%	88.0%	95.3%	68.3%	n=0; 0%
Kim et al. 2021[98]	SAPIEN (n=201) ACURATE (n=62) CoreValve/Evolut (n=140) Portico (n=16) Other (n=30)	100%	98.3%	71.6%	99.3%	79.3%	n=243; 91.4%

ACS: acute coronary syndrome; IA: intra-annular; CA: coronary access; LCA: left coronary artery; PCI: percutaneous coronary intervention; RCA: right coronary artery; SA: supra-annular; TAVI: transcatheter aortic valve implantation; THV: transcatheter heart valve

Tarantini G. et al. EuroIntervention. 2023 May 15;19(1):37-52.

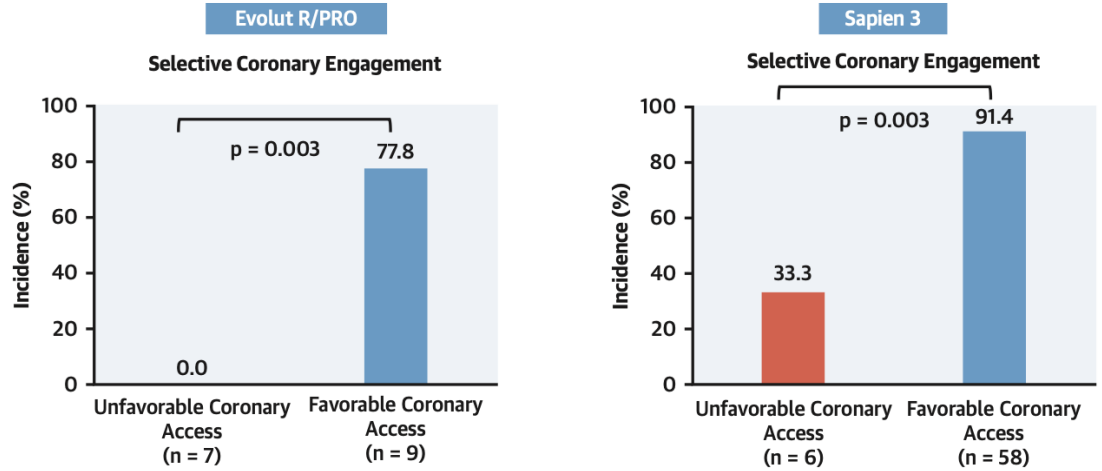


CENTRAL ILLUSTRATION Summary of the ALIGN TAVR Study on Transcatheter Valve Orientation and its Impact on Commissural Alignment and Coronary Artery Overlap

	Sapien 3	Evolut	ACURATE-neo
			
Method of Transcatheter Valve Orientation	1 commissure crimped at 3, 6, 9 and 12 o'clock	"Hat" marker position at initial deployment	Commissure position at initial deployment
Impact of Initial Deployment Orientation on Commissural Alignment	None	• Insert catheter with flush port facing 3 o'clock • Alignment improves when "Hat" at outer curve (OC)/ center front (CF)	• Insert catheter with flush port facing 12 o'clock • Alignment improves when commissure at center back (CB)/ inner curve (IC)
Severe Overlap With Left Main	32.7%-39.7%	15.7% (OC/CF) vs. 66.0%	0-7.1% (CB/IC) vs. 14.8%-75.9%
Severe Overlap With Right Coronary Artery	28.8%-51.6%	7.1% (OC/CF) vs. 51.1%	7.1%-12.5% (CB/IC) vs. 62.1%-74.1%

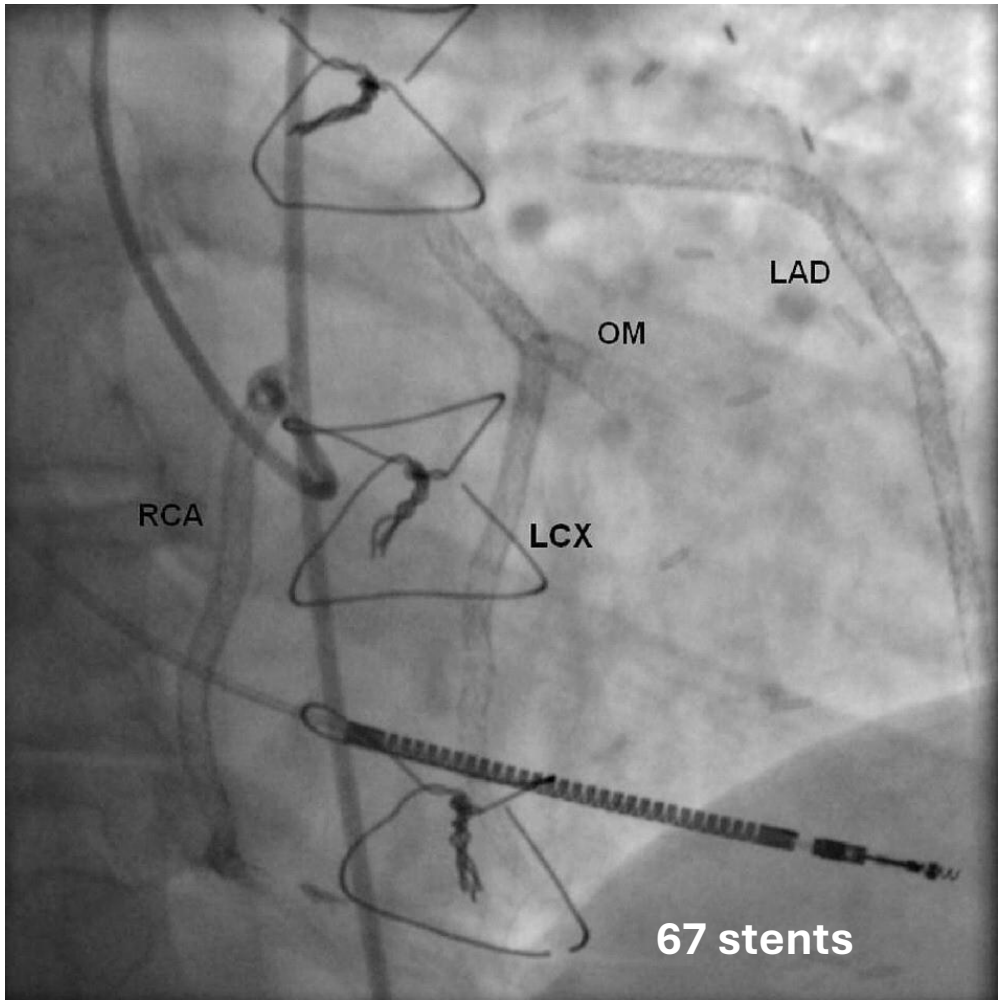
Tang, G.H.L. et al. J Am Coll Cardiol Intv. 2020;13(9):1030–42.

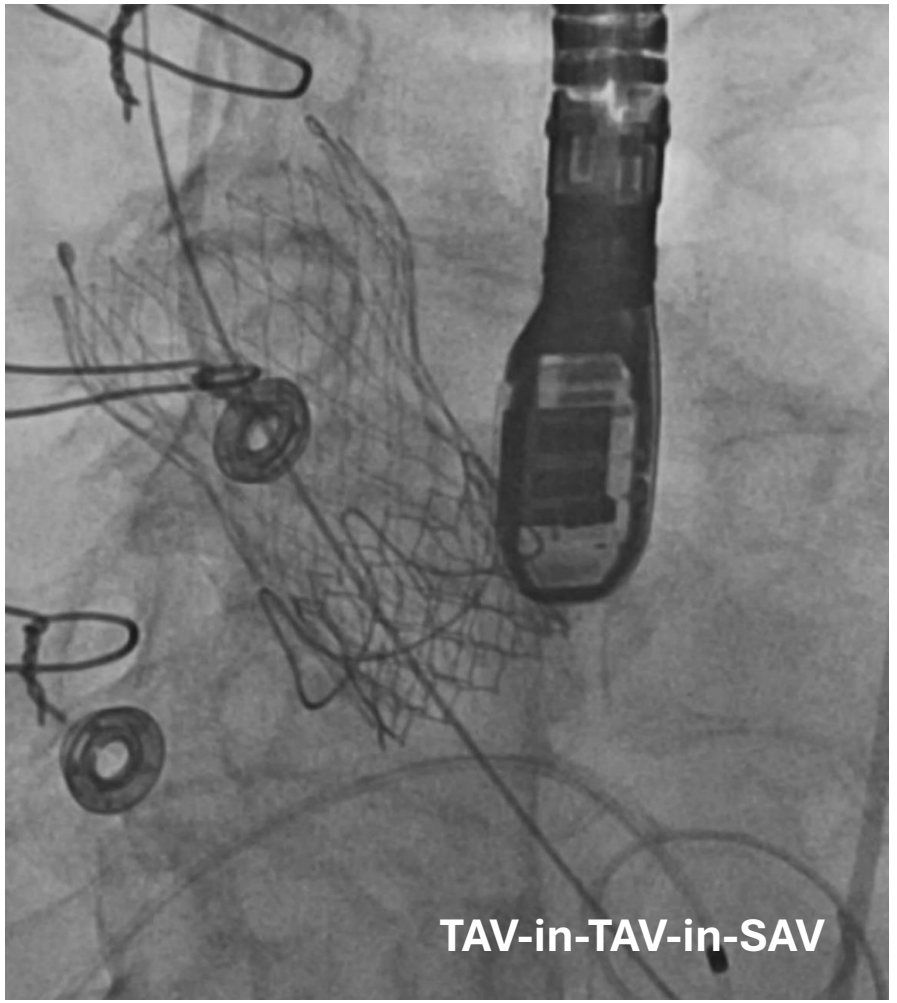
Success Rates of Selective Coronary Engagement in Evolut R/PRO and Sapien 3



T. et al. J Am Coll Cardiol Intv. 2020;13(6):693-705.

Conclusions



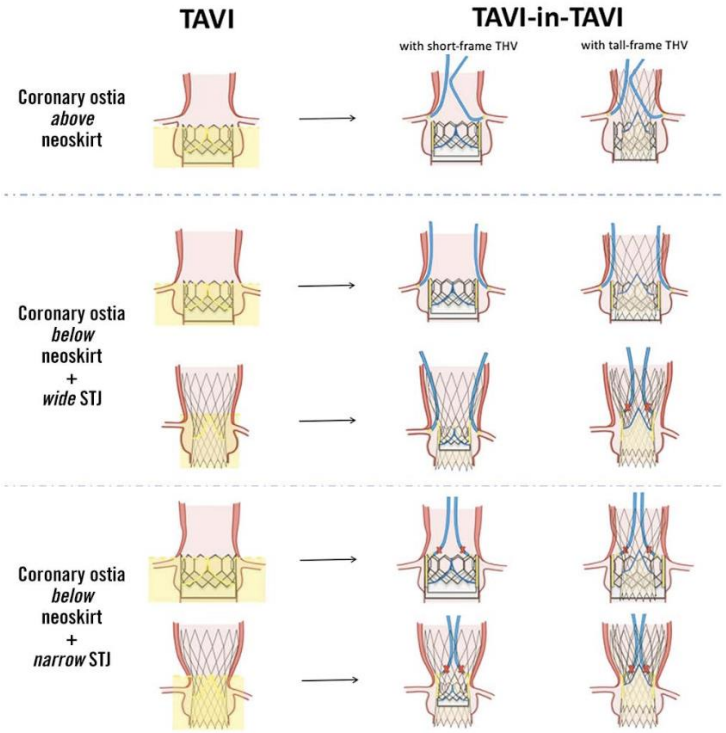


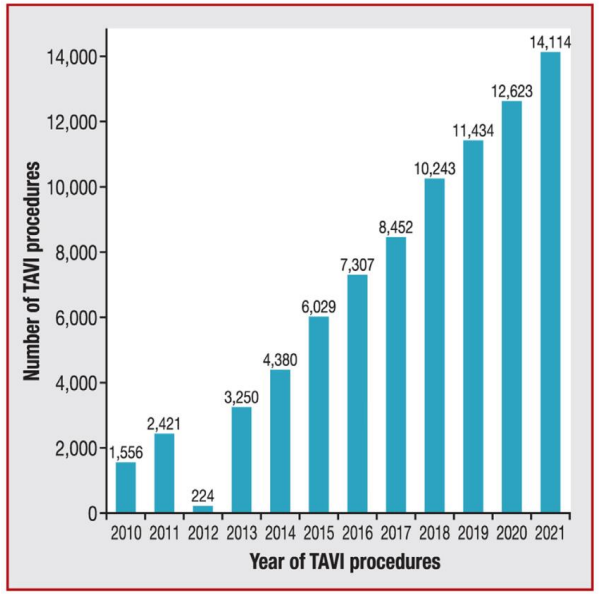
Khouzam, R et al. *JACC*. 2010 Nov, 56 (19) 1605

Haroian N, NY Valves 2024, https://www.tctmd.com/slide/tav-tav-sav-how-plan-and-execute

Conclusions

- Selective CA remains the main diagnostic modality
- Role of invasive HD assessment and CT to be defined
- CT pre-planning before CA?
- Many factors can influence timing of PCI
- Antithrombotic treatment related to bleeding risk
- Coronary access important to consider
  - Role THV design and position – Role of imaging - Screening
- Matter of debate… for years to come!





Tarantini G. et al. EuroIntervention. 2023 May 15;19(1):37-52.

Didier R. et al. Archives of Cardiovascular Disease 115 (2022) 206—213

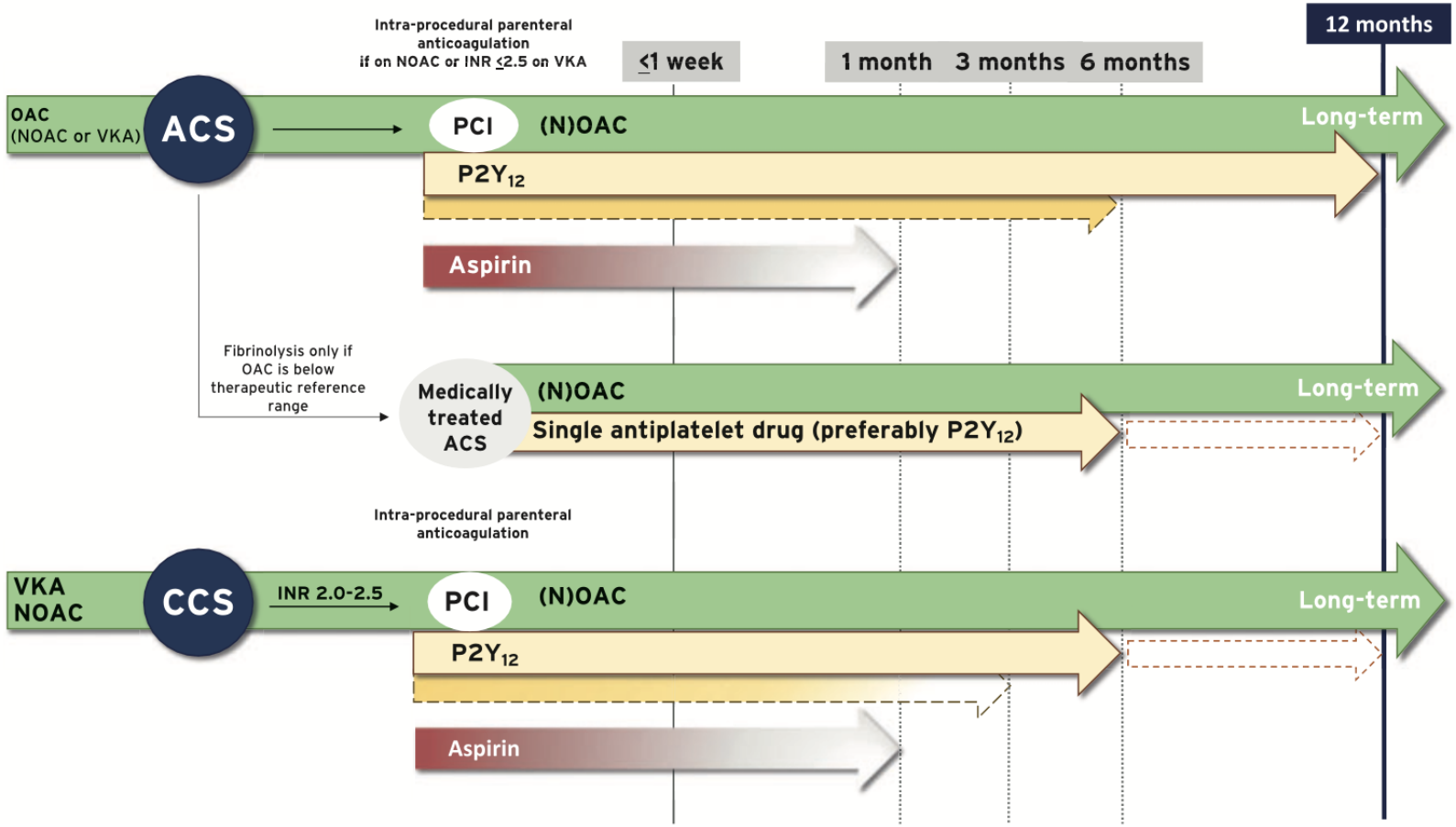
Thank you!

CHU de Liège

LIÈGE université

Antithrombotic Therapy Post-TAVI and PCI

- Post-TAVI:
  - Single Antiplatelet Therapy (SAPT): Aspirin
  - OAC if indicated
- **Post-PCI**
  - **Chronic vs. Acute**
  - **Indication for OAC vs. no indication**
  - **Bleeding risk vs. Ischemic risk**
  - Bleeding risks: >75 years-old, other risk factors
  - DAPT for 3 months
  - If OAC indicated: Triple thearpy 1 week, OAC + SAPT 6 months, then OAC
  - If very high bleeding risk: SAPT + OAC 1-3 months, then OAC



Hindricks G et al. Eur Heart J. 2021 Oct 21;42(40):4194

FIGURE 2 **Proposed Algorithm for Revascularization Among Patients Undergoing Valve Replacement**

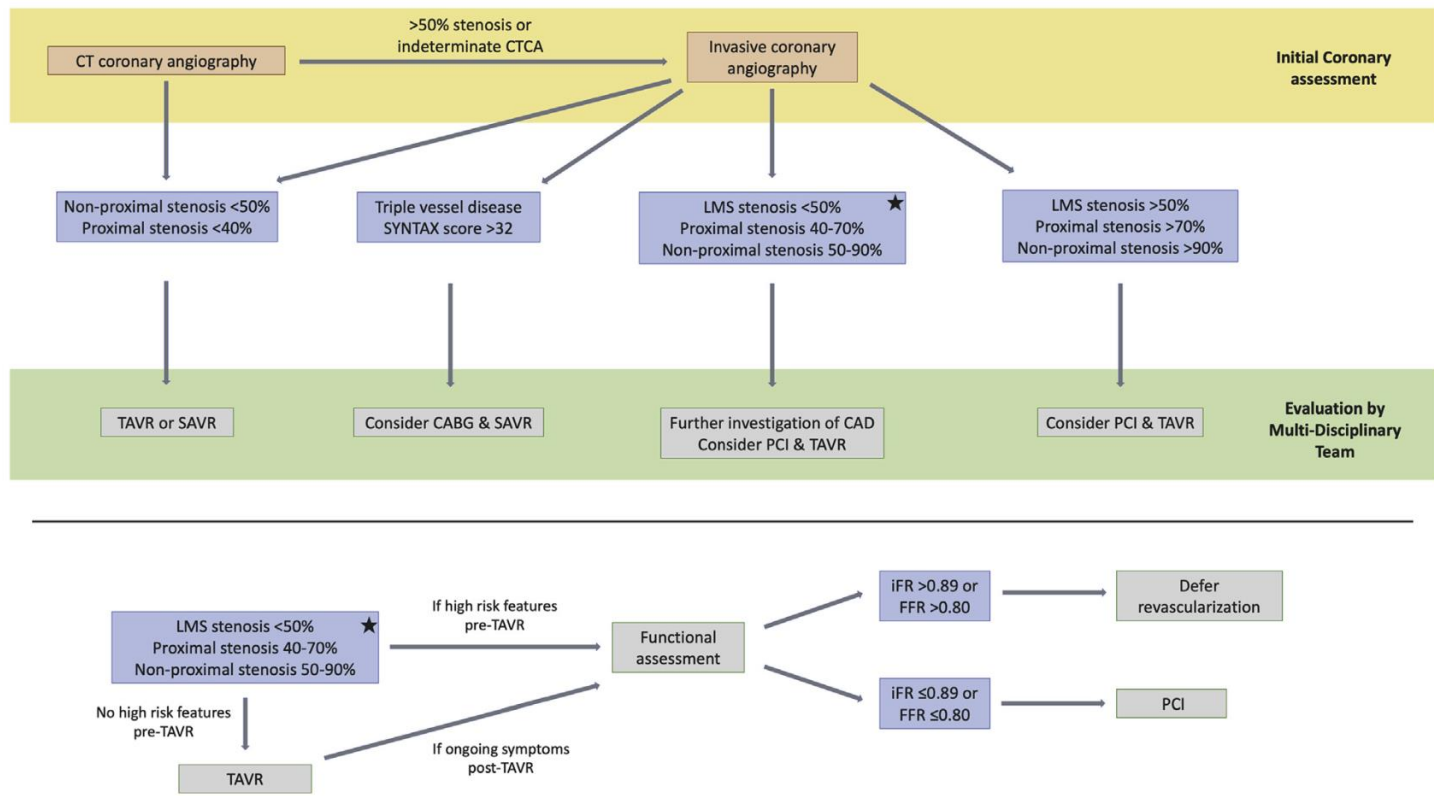
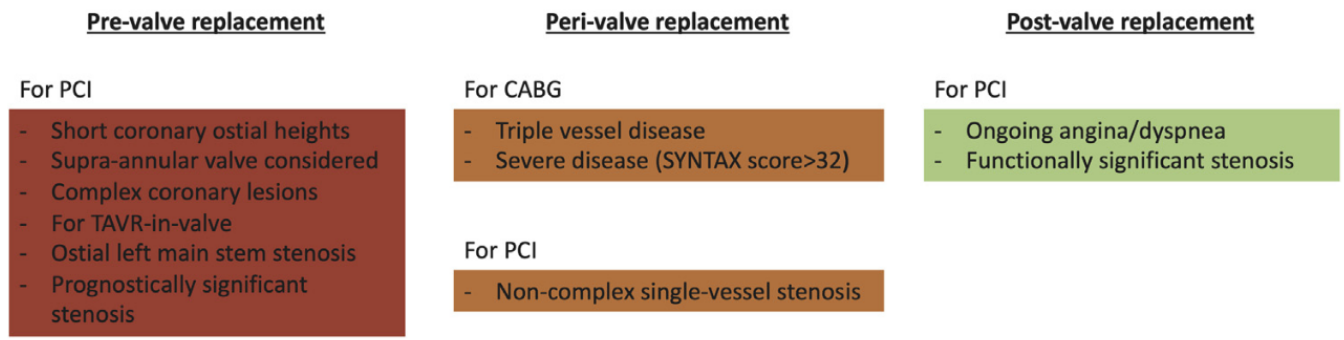


FIGURE 1 **Timing of Revascularization**



On the basis of coronary, transcatheter aortic valve replacement (TAVR), surgical aortic valve replacement, and anatomical factors, the heart team can decide on the timing of revascularization: before, during, or after aortic valve replacement. CABG = coronary artery bypass grafting; PCI = percutaneous coronary intervention; SYNTAX = Synergy Between PCI With Taxus and Cardiac Surgery.

Difficulty with re-Do

- More and more complex
- CT, imaging, neo-sinus,..;
- More frequent
- TAV-in-SAV, TAVI-in-TAVI

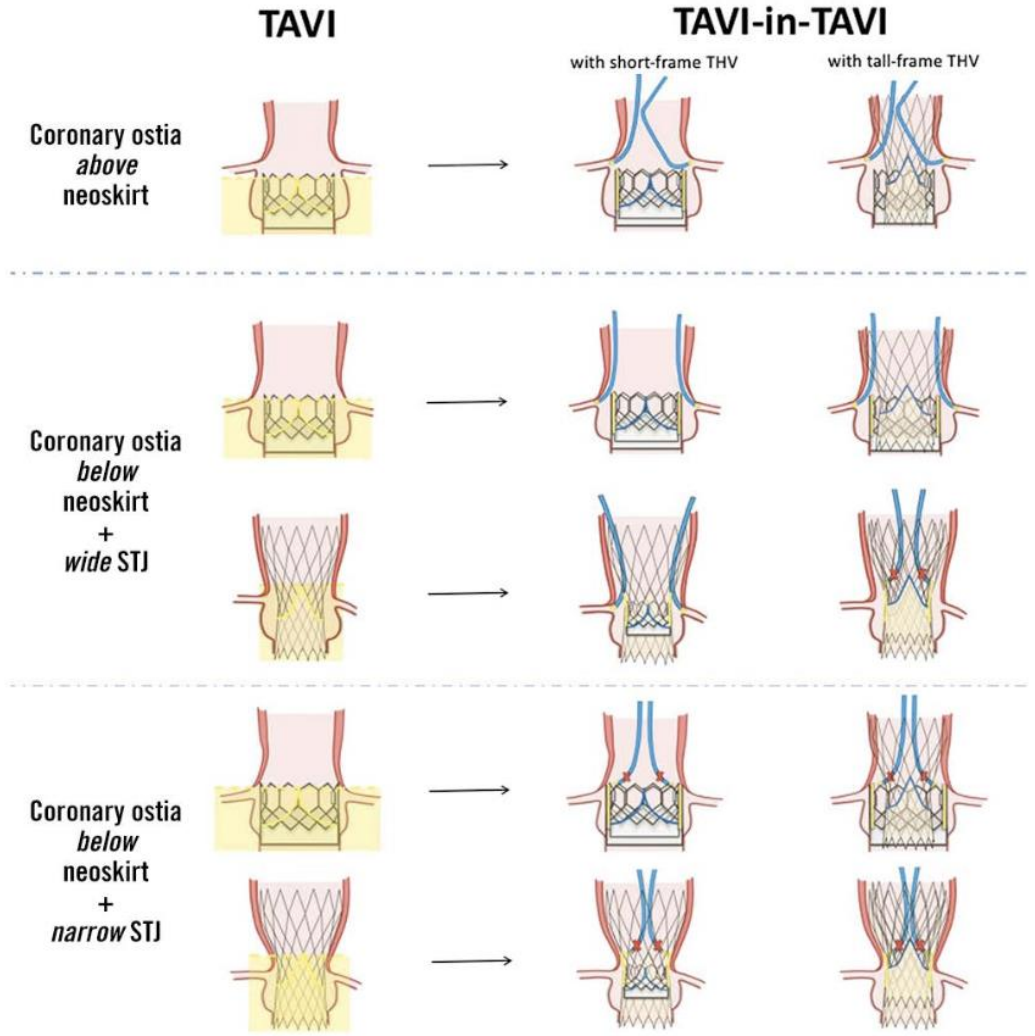
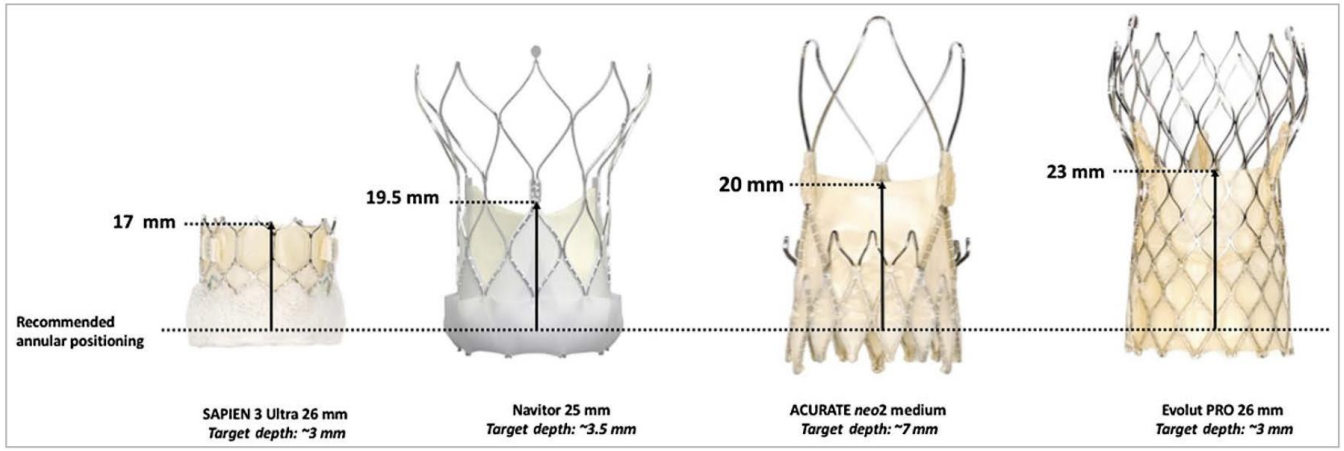


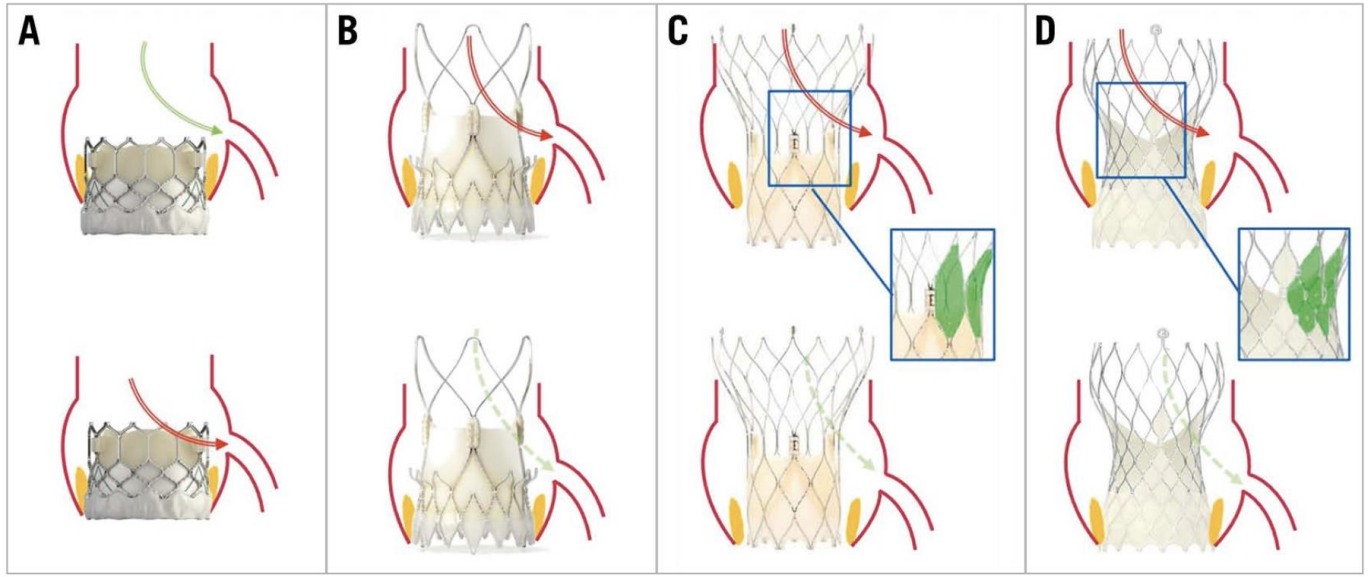
Figure 8. *Coronary access after TAVI-in-TAVI with different combinations of SAPIEN and CoreValve/Evolut transcatheter heart valves, depending on aortic root anatomy. STJ: sinotubular junction; TAVI: transcatheter aortic valve implantation. Adapted with permission from*[90].

THV Design /Position And Coronary Access

- **THV Design**
  - Stent frame height
  - Leaflet position (annular/supra-annular)
  - Leaflet height with respect to recommended annular positioning
  - Size of cells
- **Implant position**
- **Commissural Alignment**

TAV-in-SAV
TAVI-in-TAVI





- Cas stent before
- Cas stent after

Plan risk of difficult access

- Scan: neo sinus

- Simulation ? IA?

Risk of occlusion

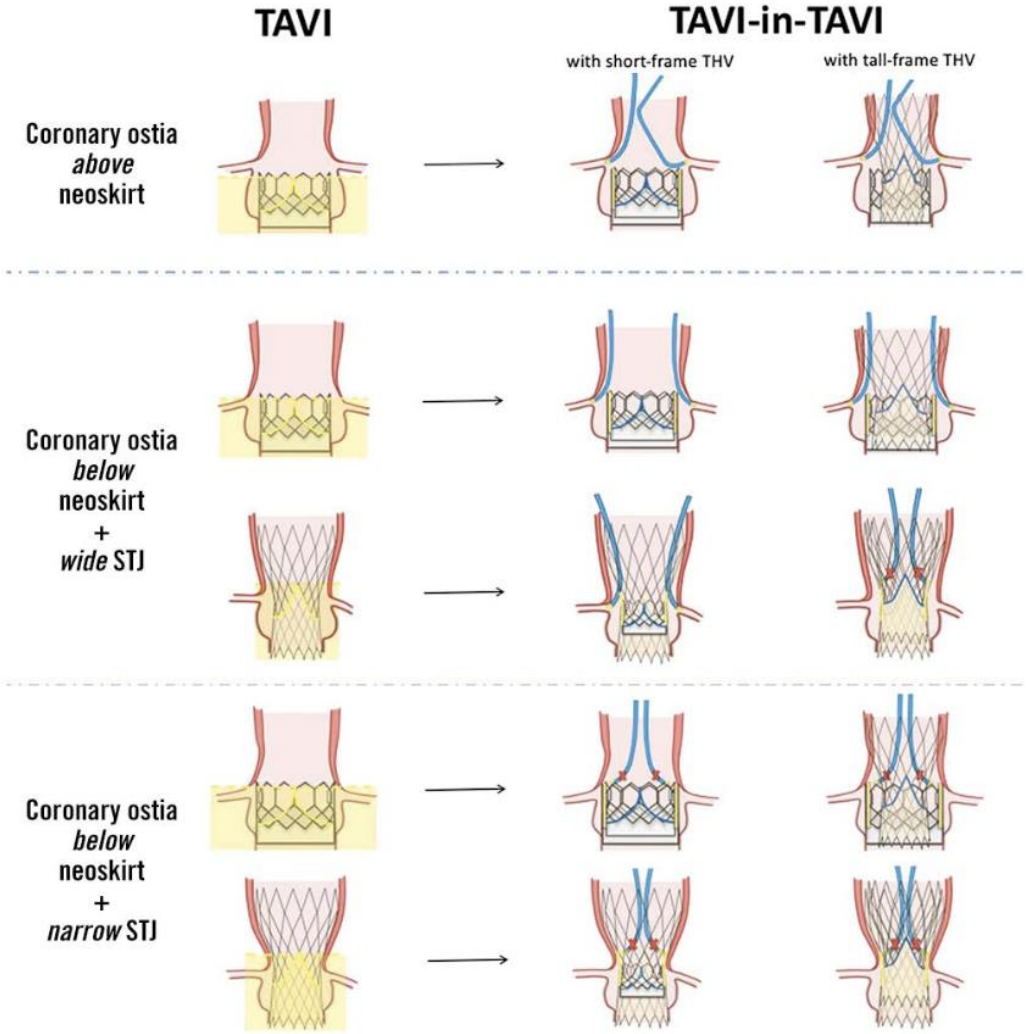
- Chimney etc
- basilica

How to assess before

- access
- Risk of occlusion

- Stents 1-3 mois ok

- Pas besoin de coro dans 20-30% des



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Conclusions

guidelines

- If risk of occlusion
  - Techniques
    - Chimney
    - Stent in place

Anticipated complex access after TAVI : favors PCI before???

Coronary re-access after TAVI and re-do TAVI

Commissural alignment

Tarantini G. et al. EuroIntervention. 2023 May 15;19(1):37-52.

Conclusion

- Matter of debate

- Favours PCI

- Difficulty of reintervention
- Prognosis:
- Symptoms of angina: valve or artery?
- Lesion characteristic: if high grade risk of restenosis, thrombosis
- Keep it simple!
- Hemodynamic assessment

- Favours Medical
- Symp

Timing of PCI

PCI before TAVI	PCI after TAVI	Combined PCI and TAVI
- **Easier coronary access** (especially for self-expanding THV with a supra-annular leaflet position) - **Lower risk of ischaemia-induced haemodynamic instability** (i.e., during rapid pacing) - **Reduced contrast use** compared with concomitant PCI and TAVI	- **More reliable FFR/iFR of intermediate lesions** - **Lower risk of haemodynamic instability during complex PCI** (i.e., with rotational atherectomy and impaired LV function) - **Reduced contrast use** compared with concomitant PCI and TAVI	- Use of the **same arterial access** - **Lower cost**
- Less reliable FFR/iFR assessments of borderline lesions - Higher risk of haemodynamic instability due to AS	- **More challenging and potentially compromised coronary access** - **Less stability and support of the coronary guiding catheter** - **Potential THV dislodgement**	- Larger amount of contrast and higher risk of AKI - **Prolonged procedure** - Need for DAPT at the time of TAVI, hence increased **bleeding risk**

- Impact prognosis
  - Procedural risk
    - Occlusion, plaque destabilization, acute ischemia
  - Post-procedural prognosis
    - ACS, symptoms, reinterventions

    - What we want to achieve:

    - Show a case: difficult canulation
    - Show a case complex pci
    - Show a case