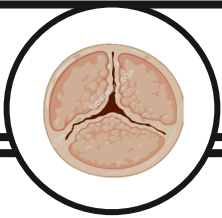


# **TAVI-in-TAVI: dal planning pre-procedurale all'ottimizzazione**



**Giuseppe Tarantini,  
Professore Ordinario  
Direttore Cardiologia Interventistica  
Università di Padova  
Presidente fondazione GISE**



# AORTIC VALVE replacement



**TAVI** in patients  $\geq 70$  years with tricuspid AV, if the anatomy is suitable



**SAVR** in patients  $< 70$  years AND at low risk



*Integrated regional Heart Valve Network,  
linking outpatient clinics with Heart Valve centres.*



# The TAVI Journey:

## Treating Today, Planning Tomorrow

### 1 First intervention

*The starting point of the lifetime strategy*



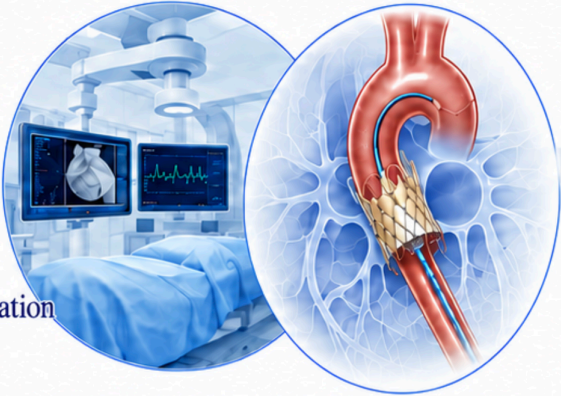
Planning



Valve choice



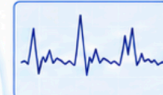
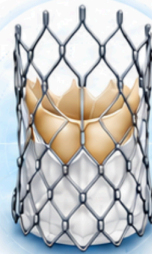
Assessment and optimization



### 2 Durability

**Durability**

*Long-term valve performance depends on the first intervention*



Life-expectancy



Valve durability



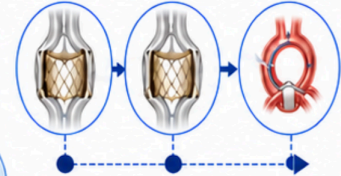
Hemodynamic performance



### 3 Repeatability

**Repeatability**

*Future treatment options are influenced by the first intervention*



Coronary access



Coronary obstruction

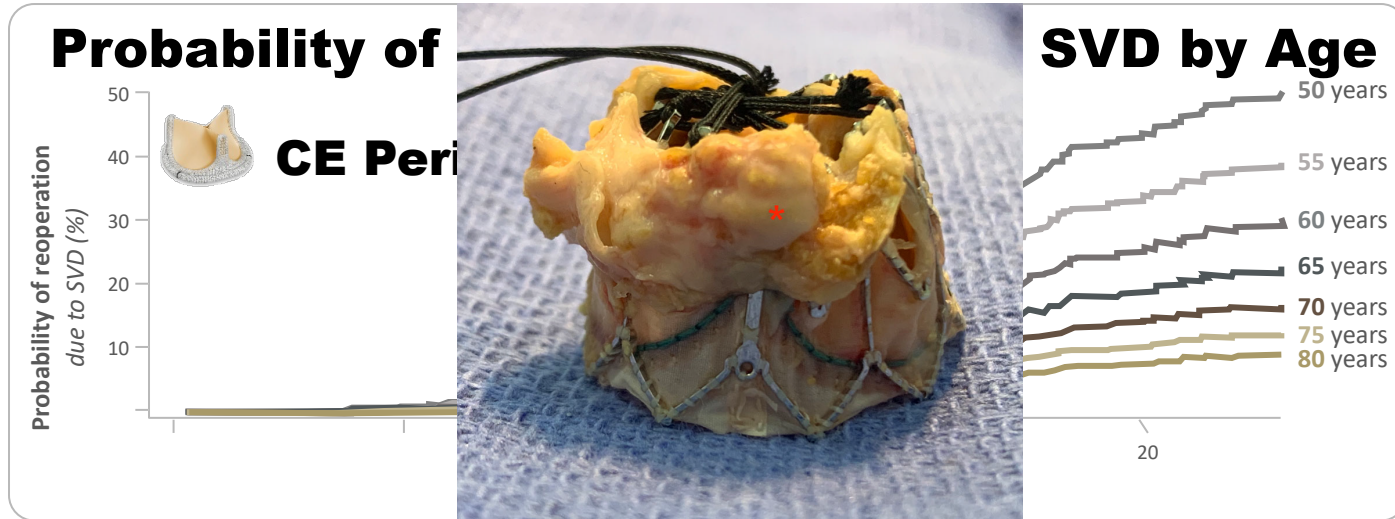


TAVR-in-TAVR



*The first intervention conditions the lifetime strategy*

# Durability is inversely related with Pts Age



The primary mode of failure for bioprosthetic valves is **CALCIFICATION**.

**Calcification** is accelerated by young recipient age.

Bourguignon T, et al. Ann Thorac Surg. 2015;99:831-7.



# Longest Durability Follow-up of **TAVI** RCT



10 years

5-10 years

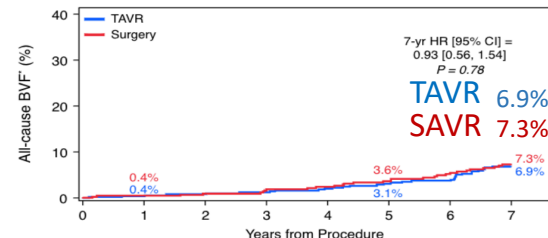
1 year

- **Notion (Low risk)**
- **PARTNER 1A**
- **Corevalve High risk**
- **PARTNER 2**
- **PARTNER 3 (low risk)**
- **AVR-TAVI Low-Risk**
- **UK-TAVI (all THVs)**
- **DEDICATE-DZHK6 Trial (All THVs)**

## PARTNER 3 Trial

Leon MB N Engl J Med. 2025

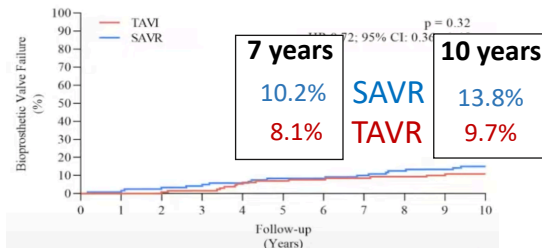
BVF 7 years -  $p = 0.8$



## Notion Trial

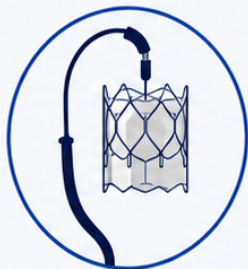
Thyregod EHJ, 45-13, 2024

BVF 10 years -  $p = 0.3$



# Redo TAVR or Explant? A Snapshot of the Evidence

## Redo TAVR (TAVR-in-TAVR)



- ✓ Lower early mortality
- ✓ 30-day mortality:
- ✓ 1-year mortality:
- ✓ Less invasive
- ✓ Most likely future strategy in many SVD cases

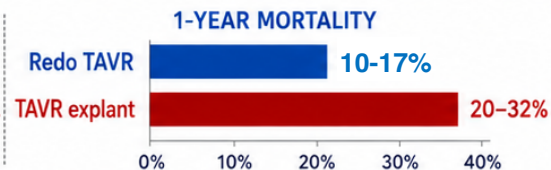
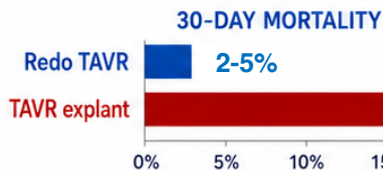
## TAVR explant



- ⚠ Higher risk profile
- ⚠ 30-day mortality:
- ⚠ 1-year mortality:
- ⚠ More invasive surgery
- ⚠ Patients are often older at the second procedure



Across observational studies, redo TAVR is consistently associated with **lower mortality**.



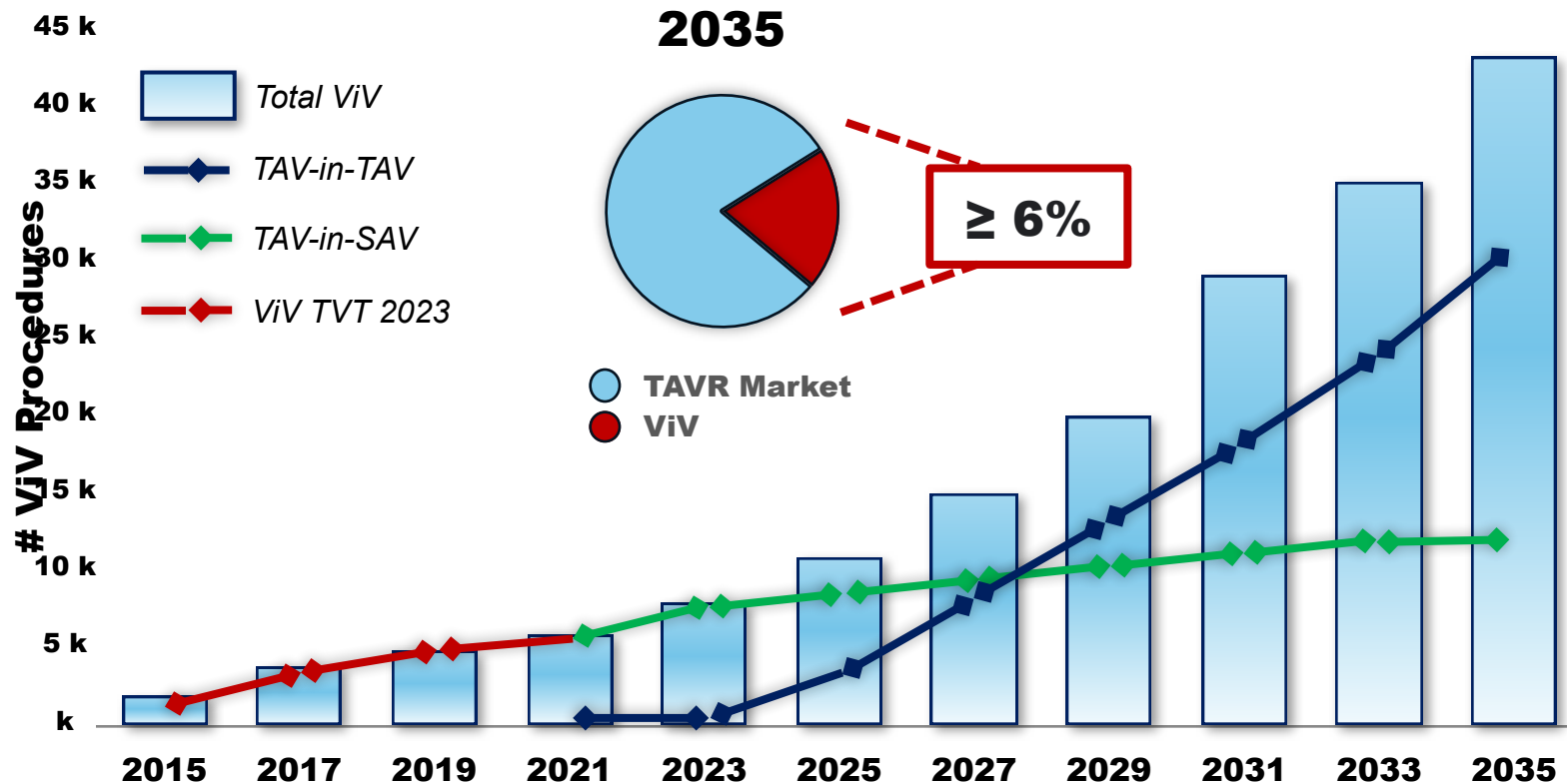
■ Redo TAVR (TAVR-in-TAVR)  
■ TAVR explant



## TAKE-HOME MESSAGE

In many patients with SVD, redo TAVR will most likely be the preferred second-valve strategy.

# US ViV Market Forecast



Adapted from: Génèreux P et al.

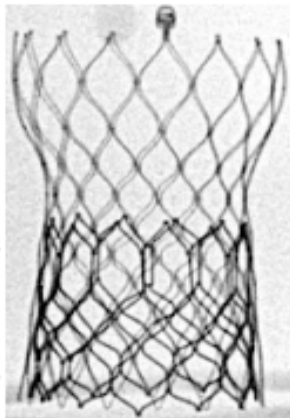




# NEW TERMINOLOGIES FOR THV-in-THV

## RISK PLANE/ NEOSKIRT

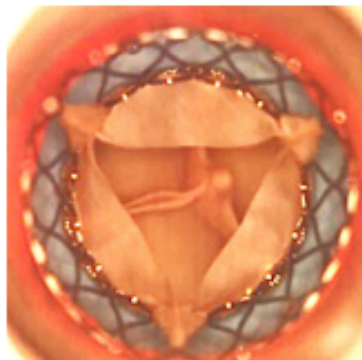
S3 Outflow at Node 5



23.0 mm

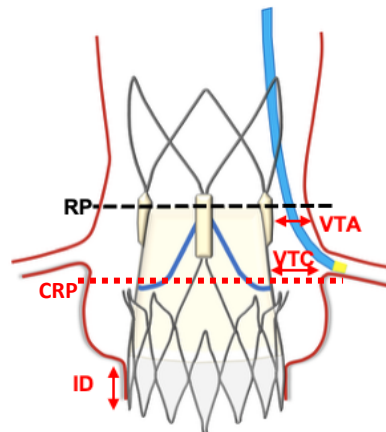
## LEAFLET OVERHANG

S3 Outflow at Node 5



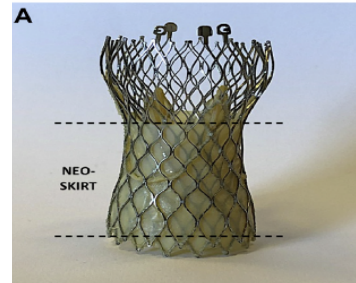
59% leaflet  
overhang

## VTA VTC

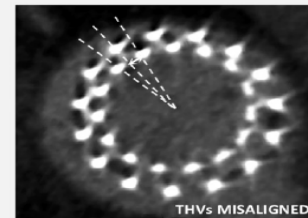


## COMMISSURE ALIGNMENT

CV/EV-in-CV/EV



DISTANCE BETWEEN STRUTS < 3 MM





# Translating New **CONCEPTS** into **PROCEDURAL STRATEGY** in TAV-TAV



## 2° THV



**THV Type**



**Sizing # 2 THV**



**Positioning #2 THV**



*As applied in the Re-TAVI registry*

## Redo-Transcatheter Aortic Valve Implantation Using the SAPIEN 3/Ultra Transcatheter Heart Valves—Expert Consensus on Procedural Planning and Techniques

*Tarantini et al. American Journal of Cardiology 2023*

### THV in THV: CHECK LIST FOR PRE-PROCEDURAL PLANNING

Site: \_\_\_\_\_

Patient: \_\_\_\_\_

Index THV  
(with size): \_\_\_\_\_

#### A. PRE-INDEX TAVI CT

|                              | Yes                       | No |
|------------------------------|---------------------------|----|
| CT Available                 |                           |    |
| If Yes:                      |                           |    |
| Native bicuspid aortic valve |                           |    |
| If Yes: Type 0?              |                           |    |
|                              | Native Anatomy Dimensions |    |
| Annular area and perimeter   |                           |    |
| Annular diam (Min/max)       |                           |    |
| SOV diam                     |                           |    |
| STJ diam                     |                           |    |
| Coronary Height (LCR/RCA)    |                           |    |
|                              | Yes                       | No |
| Appropriate THV sizing?      |                           |    |

#### B. INDEX THV METRICS

|                                | Labeled Design Dimensions |
|--------------------------------|---------------------------|
| Frame Height                   |                           |
| Inflow diam                    |                           |
| Center/Waist diam              |                           |
| Outflow diam                   |                           |
| Max Skirt Height               |                           |
| Commissural Height (Neo-skirt) |                           |

#### C. THV FAILURE MECHANISM

|                        | Yes | No |
|------------------------|-----|----|
| Stenosis               |     |    |
| If Yes:                |     |    |
| Severe PPM Excluded    |     |    |
| Regurgitation          |     |    |
| If Yes:                |     |    |
| Prevalent PVL Excluded |     |    |
| Thrombosis             |     |    |
| Endocarditis           |     |    |

#### D. POST-INDEX TAVI CT

|                                         | Index THV Dimensions |    |
|-----------------------------------------|----------------------|----|
| Inflow diam                             |                      |    |
| Center/Waist diam                       |                      |    |
| Functional neo-skirt                    |                      |    |
| Outflow diam                            |                      |    |
| Implantation Depth                      |                      |    |
| Appropriate sizing/expansion            |                      |    |
| Presence of significant PVL             |                      |    |
| Coronary Ostia above the risk plane     |                      |    |
| If below:                               |                      |    |
| Coronary Ostia Height                   |                      |    |
| VTC                                     |                      |    |
| VTA (at or below risk plane)            |                      |    |
|                                         | Yes                  | No |
| Commissural post in front of LCA ostium |                      |    |
| Commissural post in front of RCA ostium |                      |    |



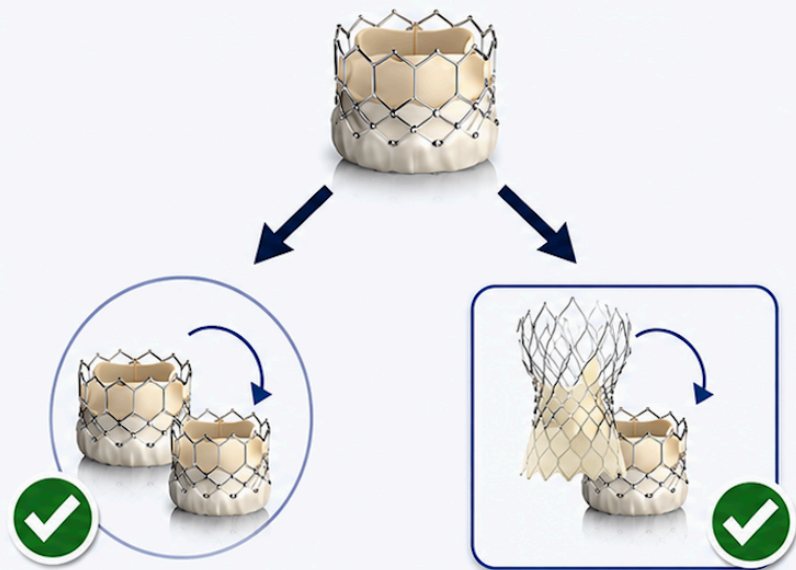
Size: \_\_\_\_\_

Positioning: \_\_\_\_\_



# *Translating* New **CONCEPTS** *into* **PROCEDURAL STRATEGY** in TAV-TAV

## 1° THV short frame

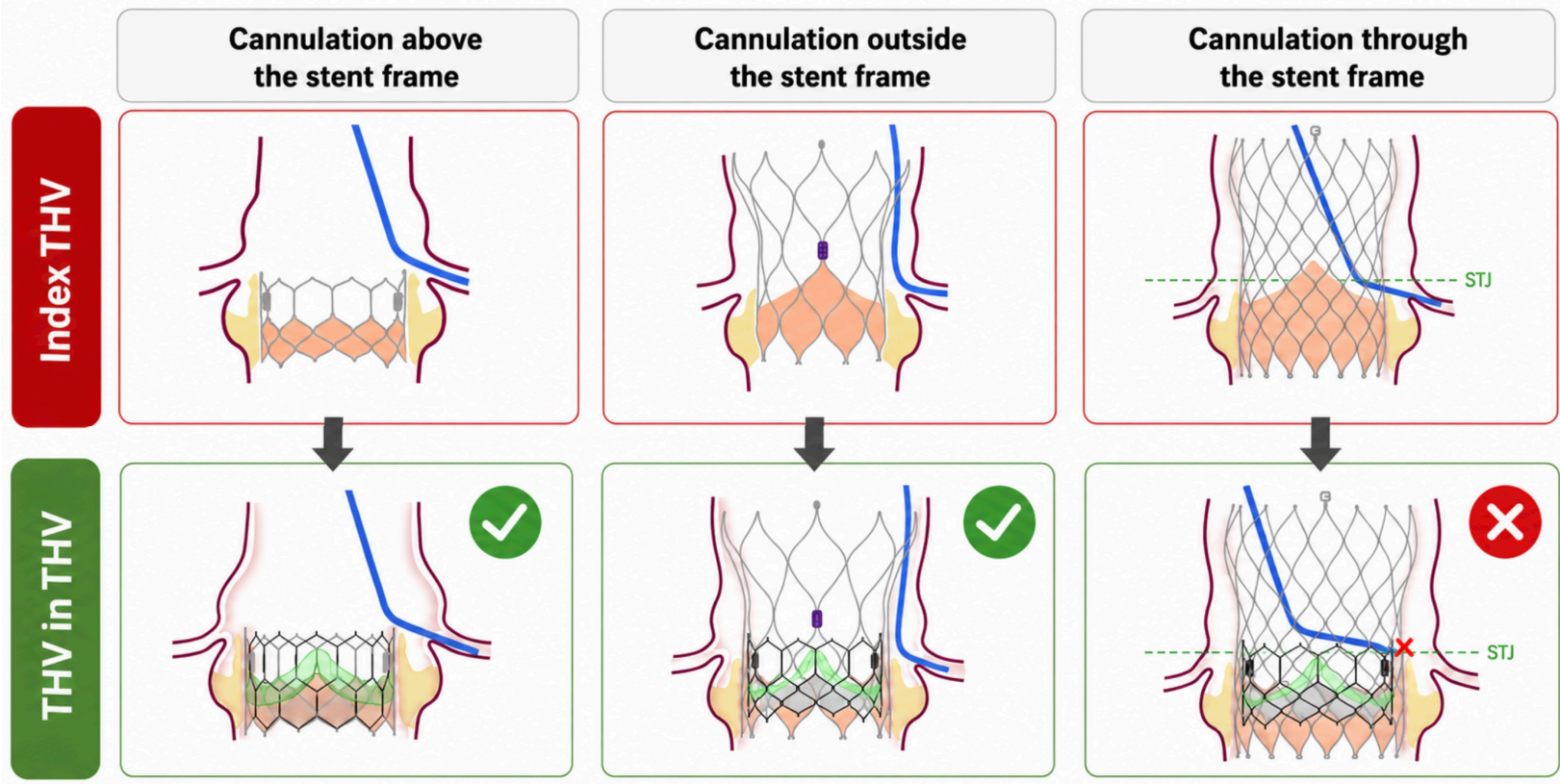


Bapat et al. *JACC INT* 2024, 17: 1631-1651

Tarantini G et al. *JACC Intv* 2022;15:1777-1793

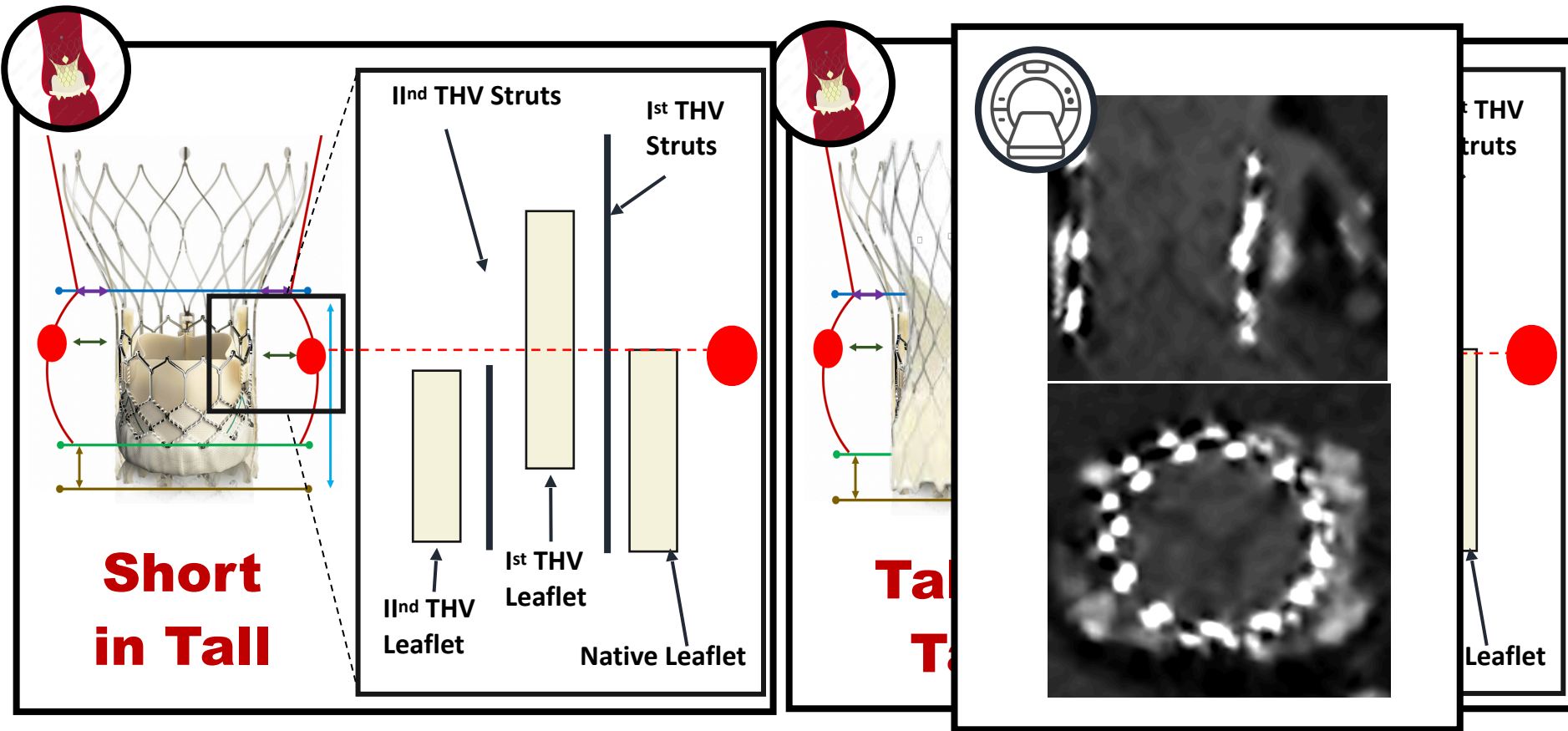


# CORONARY CANNULATION AFTER TAVI-in-TAVI



# 1<sup>st</sup> THV choice **MATTER : NEOSINUSES structures**

Tarantini, Circulation: Cardiovascular Interventions 2024



# 2<sup>nd</sup> THV POSITIONING

**MECHANISM OF FAILURE IS PIVOTAL**

## PREVALENT STENOSIS

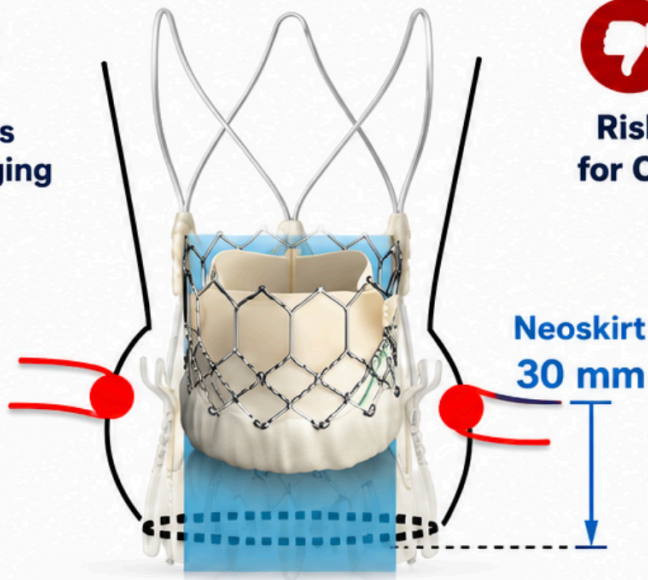
**HIGHER IMPLANTATION**



Leaflets  
overhanging



Risk  
for CO



Neoskirt  
30 mm

## PREVALENT REGURGITATION

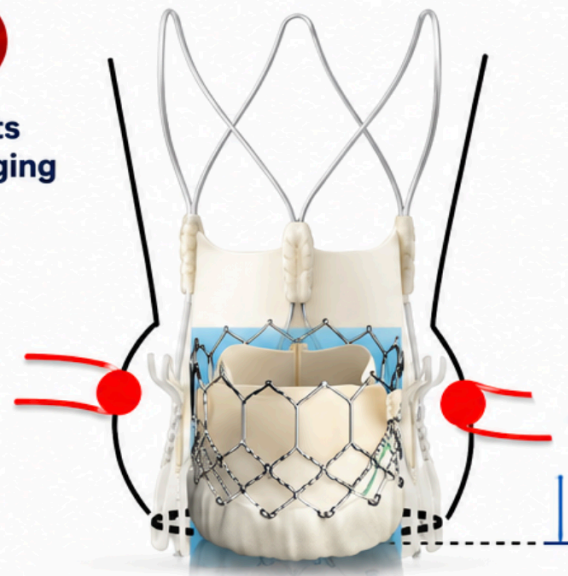
**LOWER IMPLANTATION**



Leaflets  
overhanging



Risk  
for CO



Neoskirt  
19 mm



# THV expansion assessment

## FLUOROSCOPIC

EVOLUT PRO THV

ACURATE Neo THV

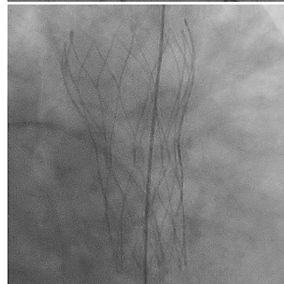
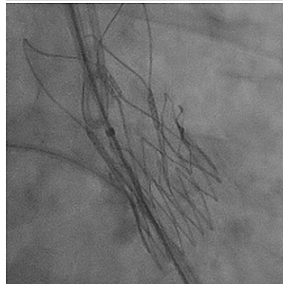
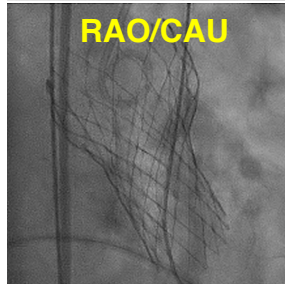
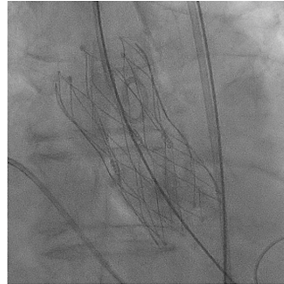
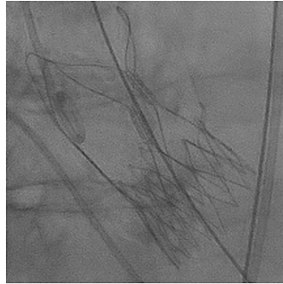
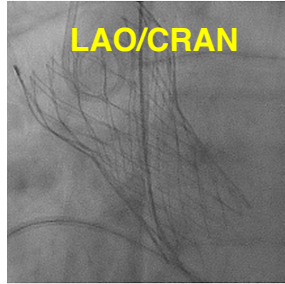
PORTICO THV

Co-planar view

LAO/CRAN

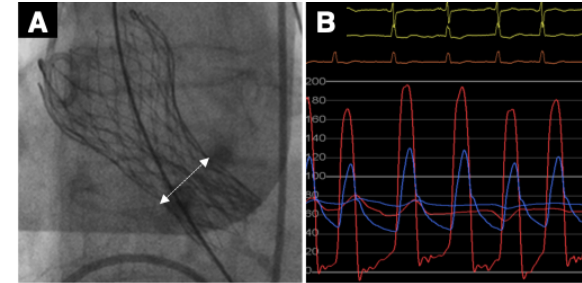
Orthogonal view

RAO/CAU

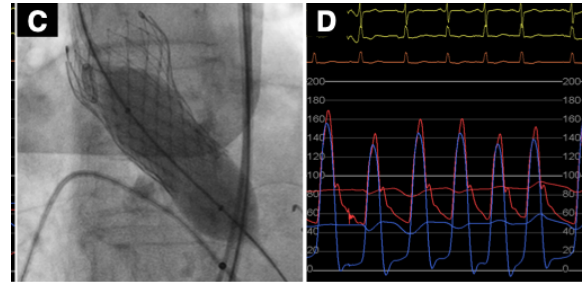


## INVASIVE

**EVOLUT 29-mm**  
**P-P Grad 40 mmHg**



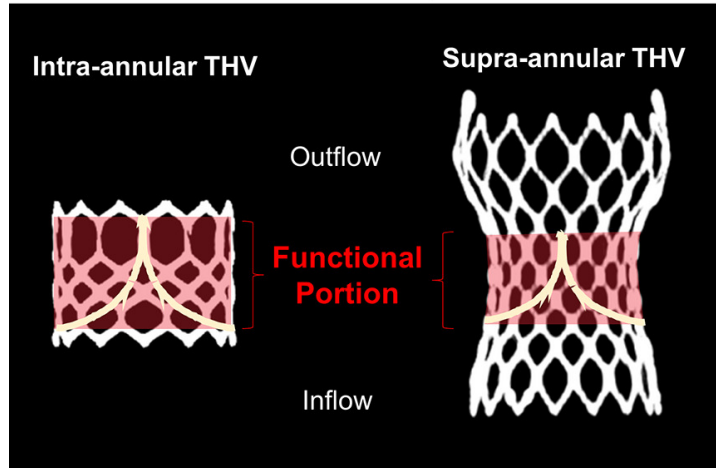
**Post-dilatation**  
**23-mm CB**  
**P-P Grad 10 mmHg**



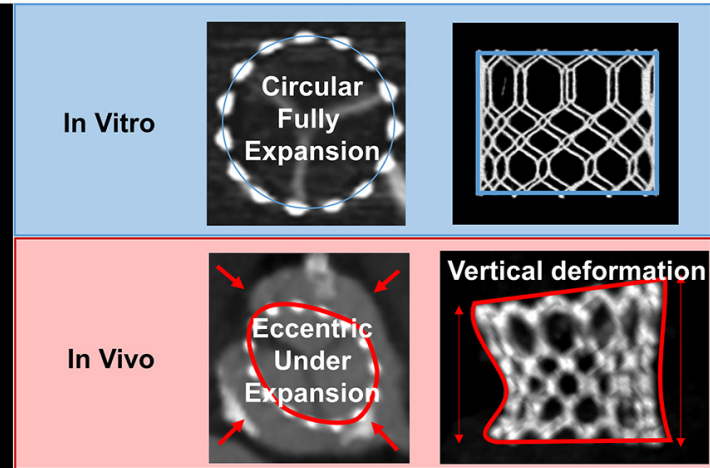


# TAVI DEFORMATION

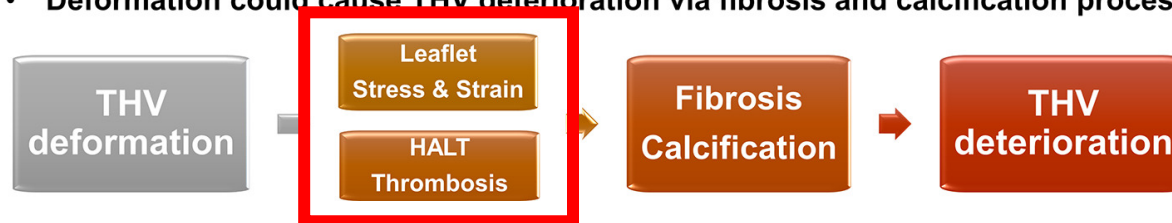
- Deformation at functional portion is crucial



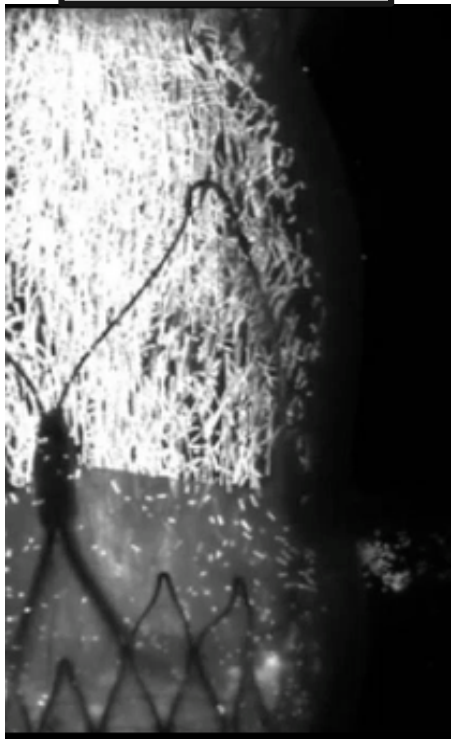
- Deformation is 3D phenomenon



- Deformation could cause THV deterioration via fibrosis and calcification process



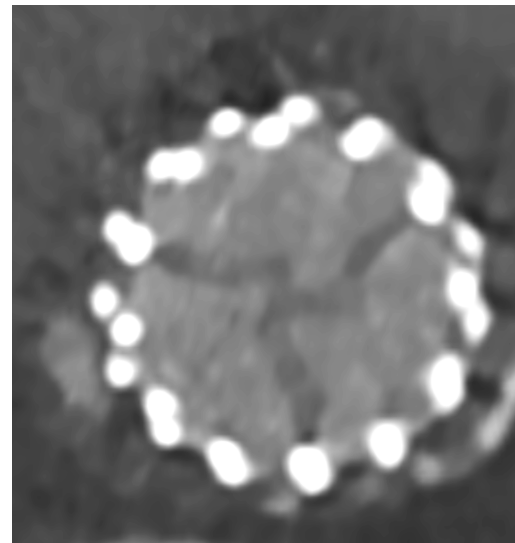
**Expanded**



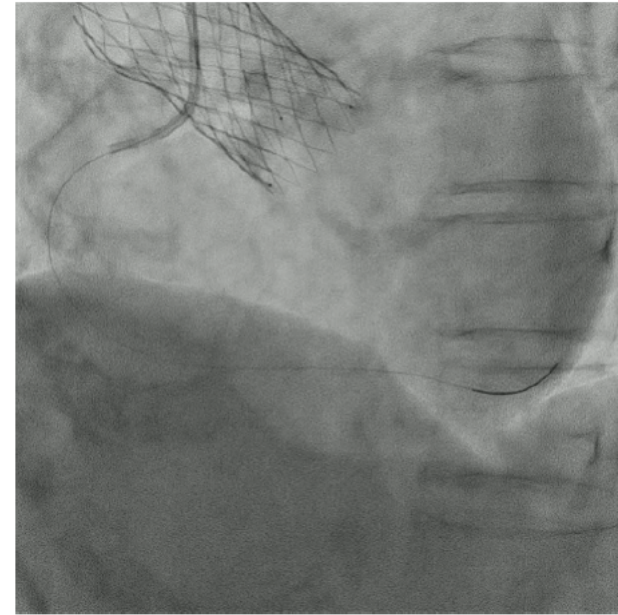
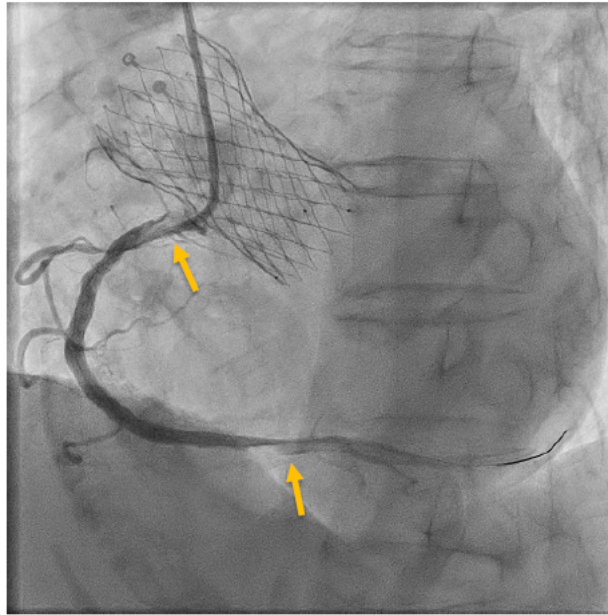
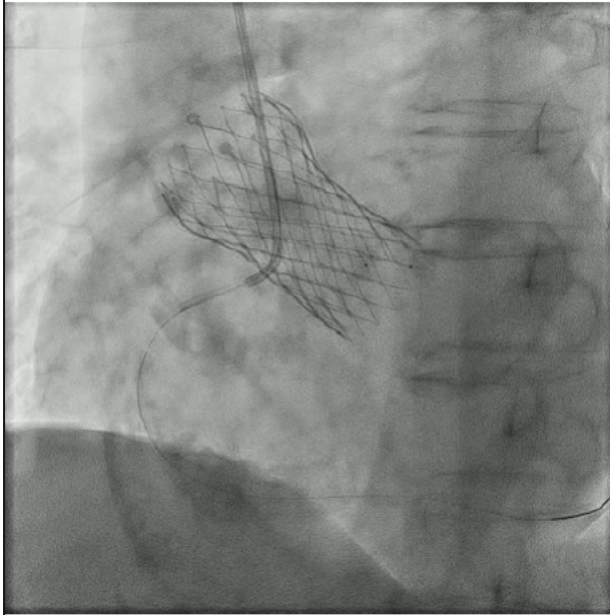
**Severely  
Under- Expanded**



**Pin-wheeling**

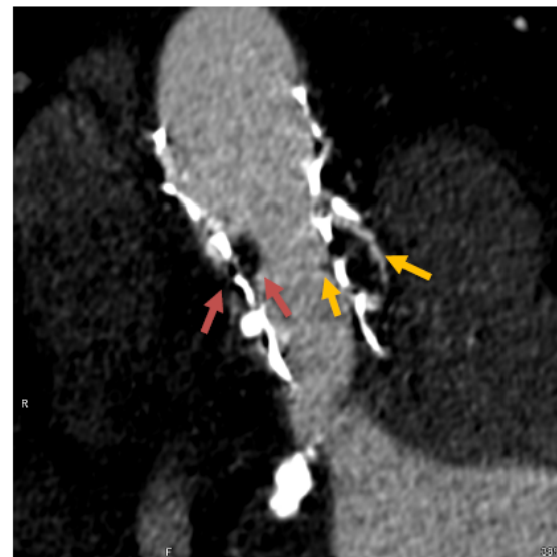
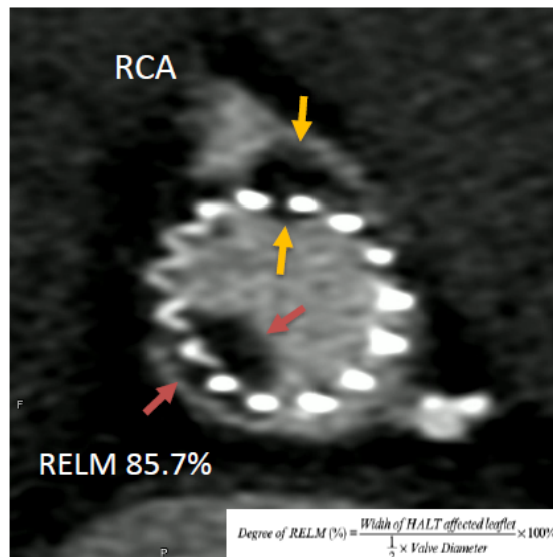
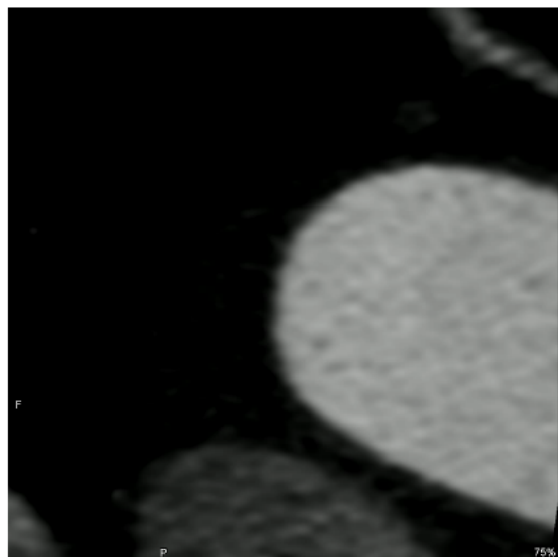


# AMI after TAVI



- Coronary angiography showed right coronary artery stenosis with thrombus.
- After PCI (percutaneous coronary intervention) with thrombus aspiration, angiography showed normal distal flow and no residual thrombus in right coronary artery.

# CT after PCI



RELM (reduced leaflet motion) Rashid HN et al. *Circ J.* 2018;82(7):1735-1742.

- CT showed **hypoattenuated leaflet thickening (HALT)** in Evolut valve.
- The leaflet immobility was graded as severe (>70% RELM).
- Hypoattenuation was extended into the sinus (in particular **large hypoattenuation in the right sinus**).



## TAVR in SAVR EVIDENCES



- ✓ **TRANSIT reg.**  
(Circ Card Interv 2019)
- ✓ **TVT Registry**  
(Lancet 2023)
- ✓ **German Registry**  
(EuroIntervention 2014)
- ✓ **Multicenter world**  
(Circ Card Interv 2019)
- ✓ **Redo TAVR Regis**  
(J Am Coll Cardiol 2019)
- ✓ **U.S.Medicare**  
(JACC Card Interv 2019)

## Early outcomes of redo-TAVI with the SAPIEN 3 platform: the prospective, multicentre ReTAVI registry

Giuseppe Tarantini<sup>1\*</sup>, MD, PhD; Luca Nai Fovino<sup>1</sup>, MD; Héctor Alfonso Alvarez Covarrubias<sup>2</sup>, MD, PhD, MSc; Rafał Wolny<sup>3</sup>, MD, PhD; Tommaso Fabris<sup>1</sup>, MD; Joanna Nawara Skipirzepa<sup>4</sup>, MD; Matthias Eden<sup>5</sup>, MD; Jose Luis Zamorano<sup>6</sup>, MD; Michael Joner<sup>7</sup>, MD; Thomas Cuisser<sup>7,8</sup>, MD, PhD; Victoria Delgado<sup>9</sup>, MD, PhD; Josep Rodés-Cabau<sup>10</sup>, MD; Francesco Saia<sup>11</sup>, MD, PhD; Gintautas Bieliauskas<sup>12</sup>, MD; Eric Van Belle<sup>13</sup>, MD; Thomas Modine<sup>14</sup>, MD; Tobias Rheude<sup>2</sup>, MD; Philippe Garot<sup>15</sup>, MD; Christian Jung<sup>16</sup>, MD, PhD; Tanja K. Rudolph<sup>17</sup>, MD; Lionel Leroux<sup>18</sup>, MD, PhD; Wolfgang Rottbauer<sup>19</sup>, MD; Thomas Nestelberger<sup>20</sup>, MD; Thibault Lhermusier<sup>21</sup>, MD, PhD; Mohammed Nejari<sup>22</sup>, MD; Ander Regueiro<sup>23</sup>, MD, PhD; David Meier<sup>24</sup>, MD; Chiara Fraccaro<sup>1</sup>, MD, PhD; Tau Hartikainen<sup>25</sup>, MD; Nicole Karam<sup>26</sup>, MD, PhD; Martin Swaans<sup>27</sup>, MD, PhD; Alberto Rodrigues<sup>28</sup>, MD; Henryk Dreger<sup>29,30</sup>, MD; Christian Hengstenberg<sup>31</sup>, MD; Thomas Schmitz<sup>32</sup>, MD; Sarah Mauler-Wittwer<sup>33</sup>, MD; Nicolo Piazza<sup>34</sup>, MD; Nicolas Combaret<sup>35</sup>, MD; Vincent Letocart<sup>36</sup>, MD; Vincent Auffret<sup>37</sup>, MD, PhD; Eric Durand<sup>38</sup>, MD, PhD; Marina Urena-Alcázar<sup>39</sup>, MD; Raquel del Valle-Fernández<sup>40</sup>, MD; Andrea Drago<sup>41</sup>, MD; Marco De Carlo<sup>42</sup>, MD, PhD; Victor Alfonso Jimenez Diaz<sup>43</sup>, MD; Maciej Dąbrowski<sup>3</sup>, MD, PhD; Julia Mascherbauer<sup>44</sup>, MD; Arnaud Sudre<sup>45</sup>, MD; Peter Ong<sup>46</sup>, MD; Birgid Gonska<sup>47</sup>, MD; Massimo Mancone<sup>48</sup>, MD, PhD; Enrico Fabris<sup>49</sup>, MD, PhD; Rui Campante Teles<sup>50,51</sup>, MD; Luis Nombela-Franco<sup>52</sup>, MD; Lluís Asmarats<sup>53</sup>, MD, PhD; Victoria Vilalta<sup>9</sup>, MD, PhD; Marcin Protasiewicz<sup>54</sup>, MD, PhD; John Graydon Webb<sup>55</sup>, MD; Gábor Tóth-Gayor<sup>56</sup>, MD; Andreas Zierer<sup>57,58,59</sup>, MD; Gilles Rioufol<sup>60</sup>, MD, PhD; Moritz Seiffert<sup>61</sup>, MD; Marianna Adamo<sup>62</sup>, MD, PhD; Francesco Meucci<sup>63</sup>, MD; Alfonso Ielasi<sup>64</sup>, MD; Francesco Burzotta<sup>65</sup>, MD; Maria Lopez Benito<sup>66</sup>, MD; Itamar Loewenstein<sup>67</sup>, MD; Paweł Kralisz<sup>68</sup>, PhD; Jacek Legutko<sup>69,70</sup>, MD, PhD; Zenon Huczek<sup>71</sup>, MD; Andrea Pavei<sup>72</sup>, MD, PhD; Radka Raková<sup>72</sup>, RND; Wilbert Wesselink<sup>72</sup>, PhD; Marie Zielinski<sup>73</sup>, BEng; Nataliya Trushina<sup>73</sup>, MSc; Peter Bramlage<sup>73</sup>, MD, PhD; Radosław Parma<sup>4</sup>, MD, PhD

\*Corresponding author: Department of Cardiac, Thoracic, Vascular Sciences and Public Health, University of Padua, Via Giustiniani 2, Padua, 35128, Italy. E-mail: giuseppe.tarantini.1@unipd.it

This paper also includes supplementary data published online at: <https://eurointervention.pcronline.com/doi/10.4244/EIJ-D-25-01268>

## TAVR in SAVR EVIDENCES



Tot Pts  
**> 10000**

- ✓ **INTER 2 ViV**  
(Circ Card Interv 2019)
- ✓ **Post-market Reg.**  
(Circ Card Interv 2019)
- ✓ **Registry**  
(Circ Card Interv 2014)
- ✓ **Center ViV Accurate**  
(Circ Card Interv 2019)
- ✓ **CC reg**  
(Circ Card Interv 2018)
- ✓ **Center US Reg.**  
(Circ Card Interv 2019)

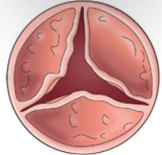
**more than 26 studies)**

## CLINICAL CASE #1 – From Re-Do TAVI Registry



**Woman, 83 y.o., BSA 1.78 m<sup>2</sup>**

**DM, paroxysmal AF**



**Native Tricuspid Aortic Valve Stenosis**



**2016 – NYHA III**

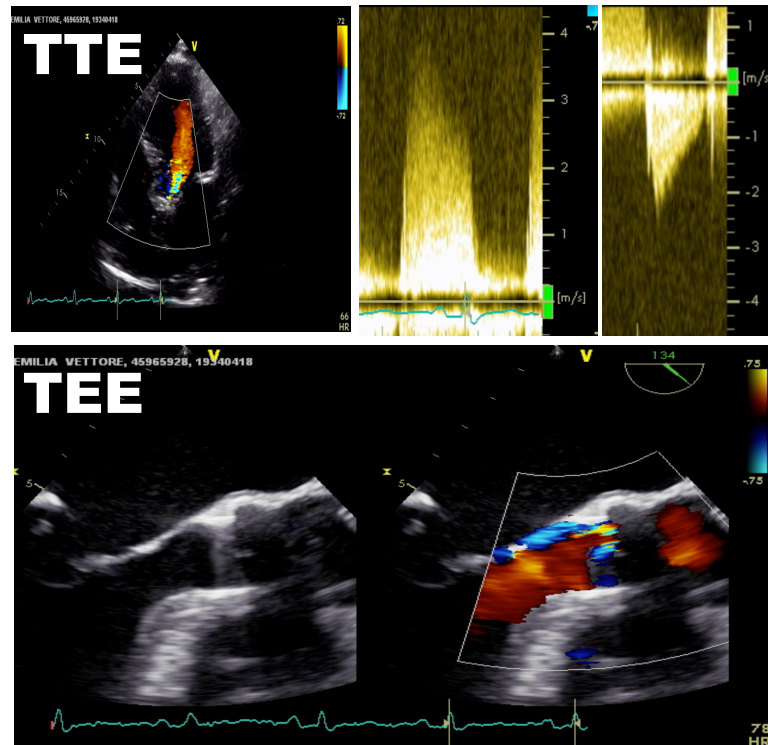
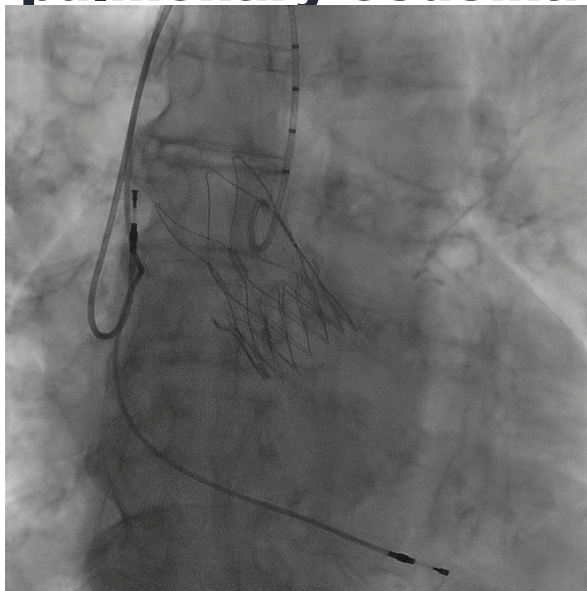
- **Severe AS - (grad 70/45 mmHg, AVA 0.8 cm<sup>2</sup>), 1+/4 AR**
- **Normal LVEF - No CAD**
- **Heart Team → TF TAVR Acurate Neo M + permanent PM**

2023

7-years later



## Hospital Admission for pulmonary oedema



**SVD - intra-prosthetic regurgitation.**  
**Prolapse of non-coronary leaflet.**

# Redo-TAVI Procedure – **Procedural Plan**

## PROBLEMS



**High risk for coronary obstruction**

because of tall neoskirt from tall-frame index THV and small VTC/VTA



**Mechanism of failure**

Aortic regurgitation



**Index THV appropriately sized**

ACURATE M

## OUR STRATEGY



RedoTAVR with  
**SAPIEN 3 ULTRA RESILIA**  
26 mm (nominal)



**Coronary protection**

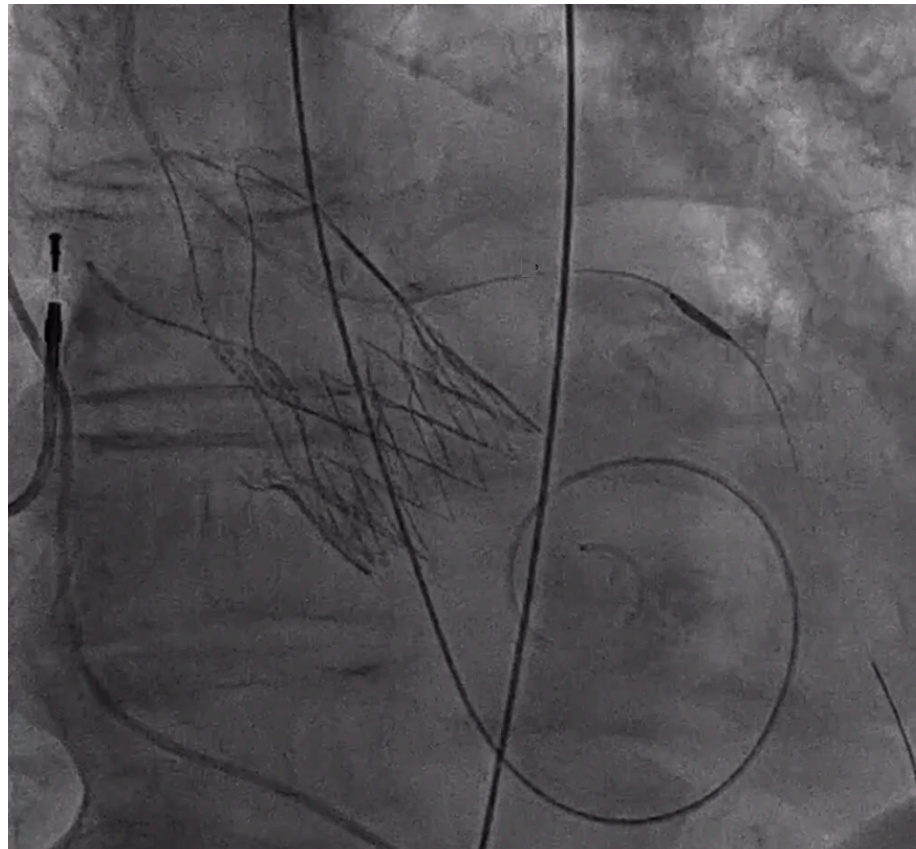
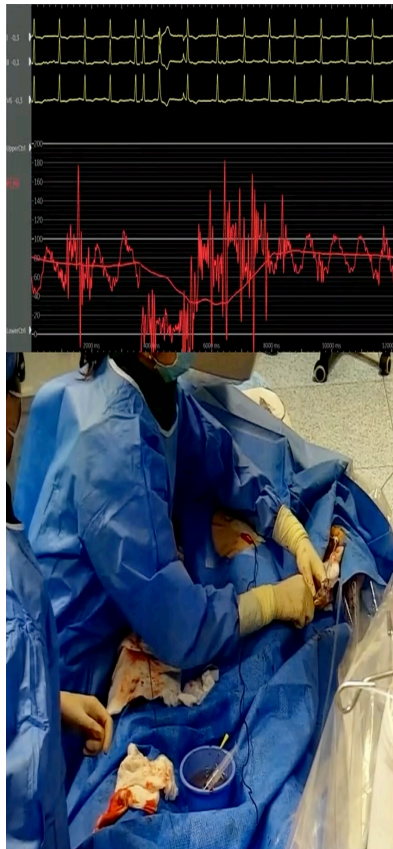


**Low implant**

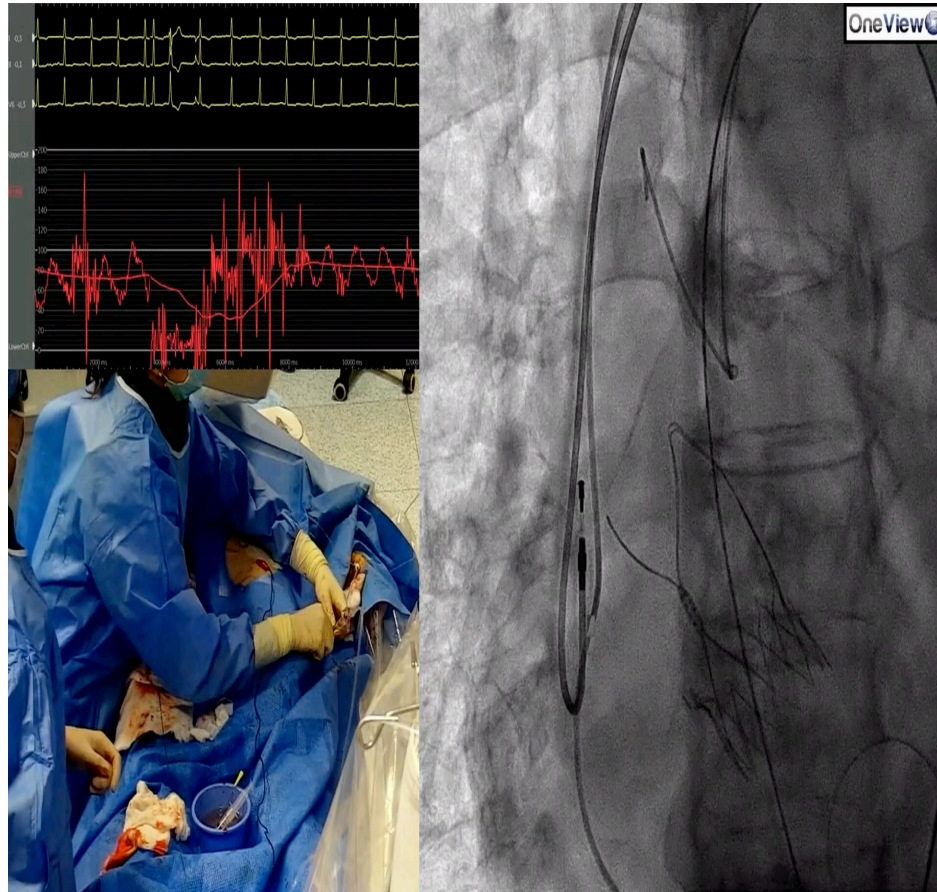
because the mechanism of failure of the index THV is aortic regurgitation



# Redo-TAVI Procedure – **Coronary protection**

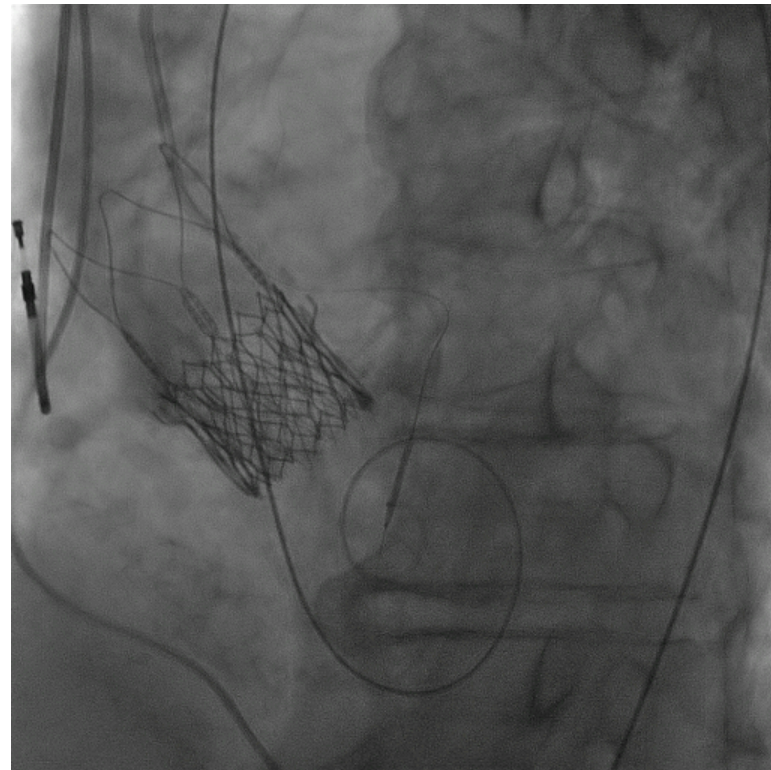
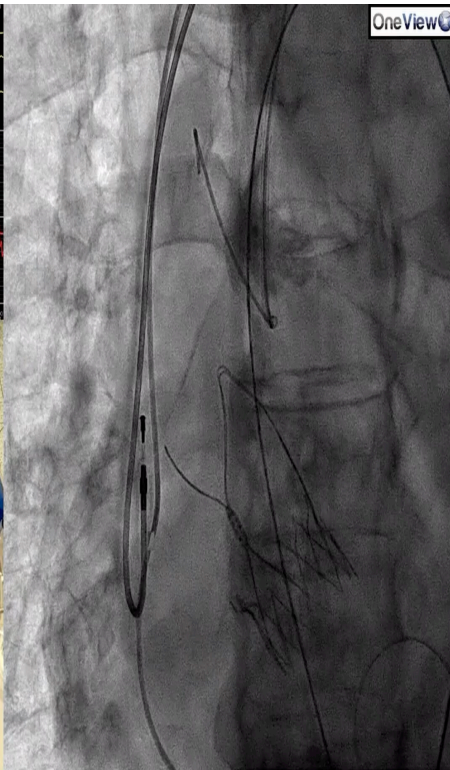
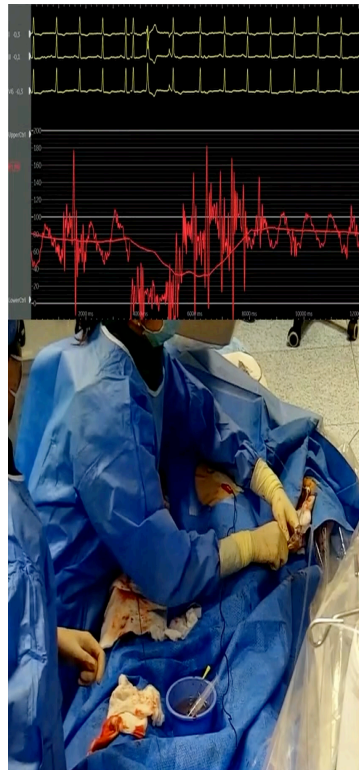


# Redo-TAVI Procedure – Valve deployment

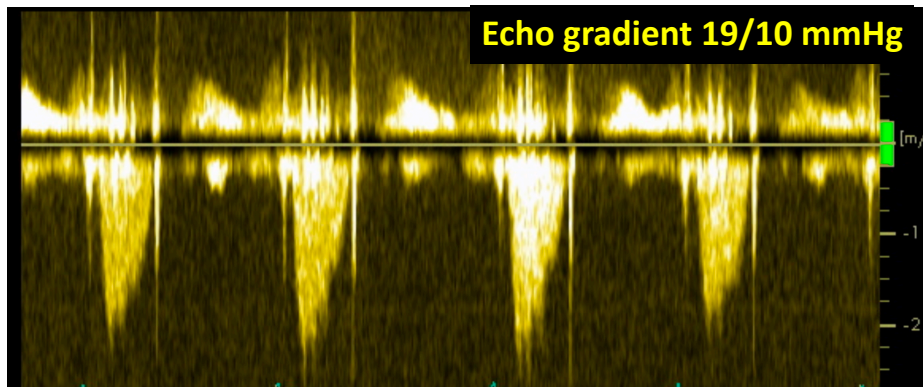
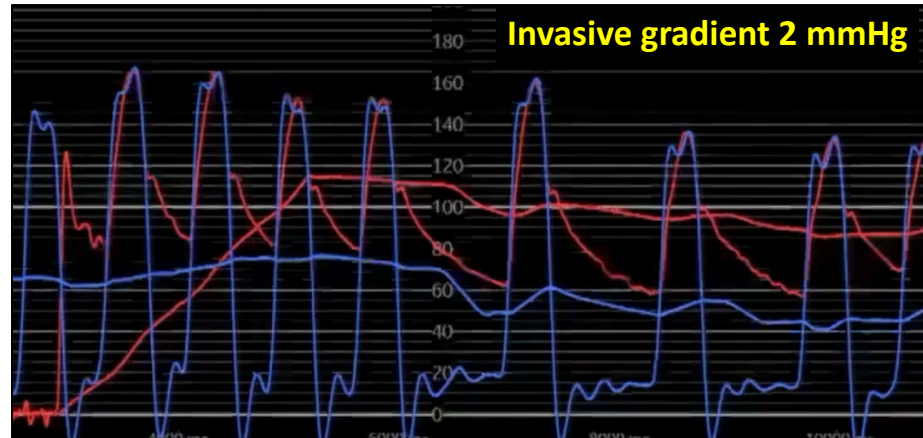
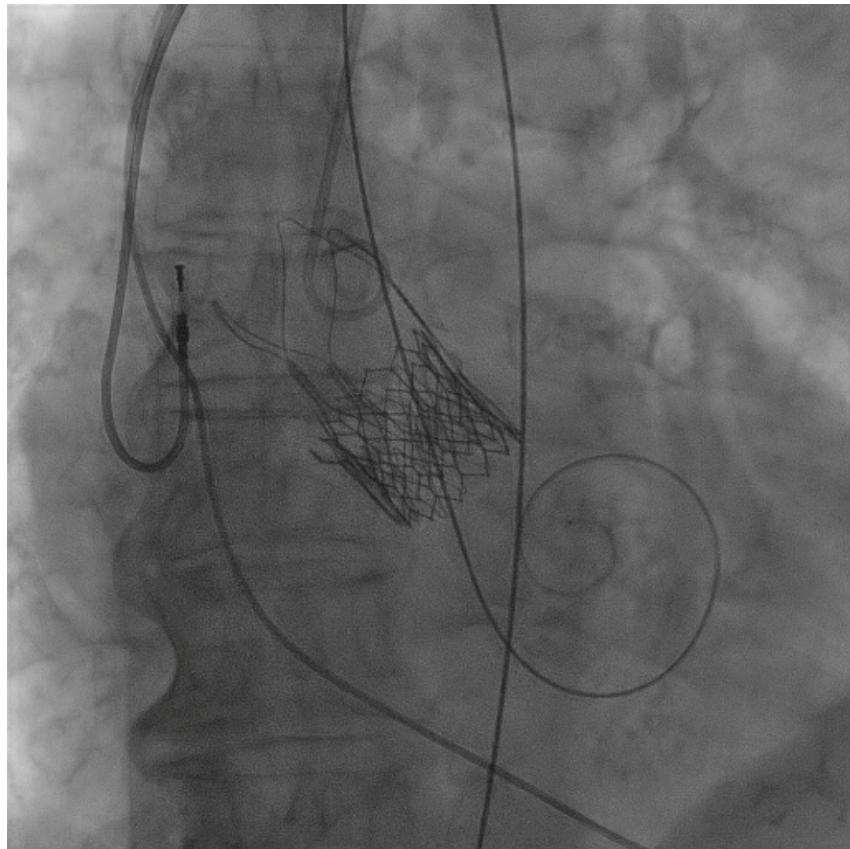




# Redo-TAVI Procedure – **Coronary perfusion**



# Redo-TAVI Procedure – **Final result**

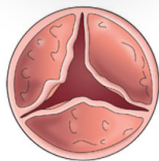




# CLINICAL CASE #2 - From Re-Do TAVI Registry



**Woman, 84 y.o., BSA 1.6 m<sup>2</sup>**  
**Hypertension, DM, severe CKD**



**2018 – NYHA II**

**Severe High-Gradient AS; Normal LVEF - No CAD**

**Heart Team → TF TAVR SAPIEN 3 26 mm (-1cc) + PM**

**Good procedural result (mean grad 8 mmHg, trivial PVL)**

**2026 – NYHA IV**



**SVD stage 3 (mean grad 33 mmHg -  $\Delta$  25 mmHg), 3+/4 AR,**  
**LVEF 30%, LVEDV 80 ml/m<sup>2</sup>**

**STS 10.3%      Heart Team → RedoTAVR**

# Redo-TAVI Procedure – **Procedural Plan**

## PROBLEMS



### High risk for coronary obstruction

despite short frame index THV for low coronary ostia and small VTC/VTA



### Mechanism of failure

Aortic stenosis



### Appropriately sized

SAPIEN 26 mm

## OUR STRATEGY



RedoTAVR with  
**SAPIEN 3 ULTRA RESILIA**  
26 mm (nominal)



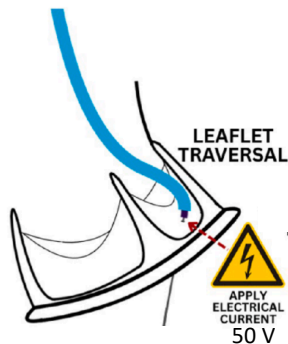
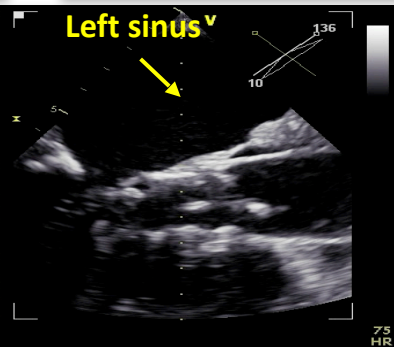
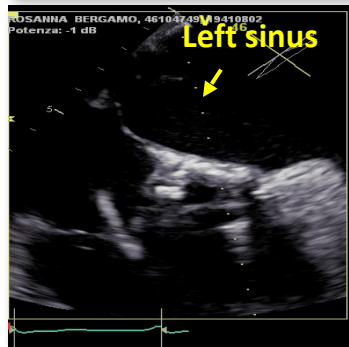
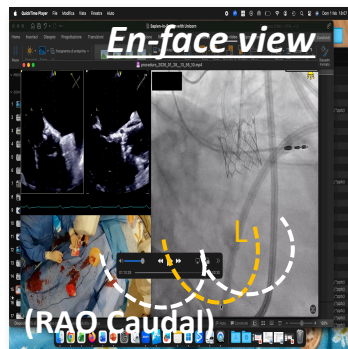
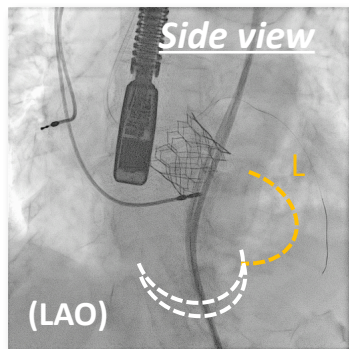
**Coronary protection**



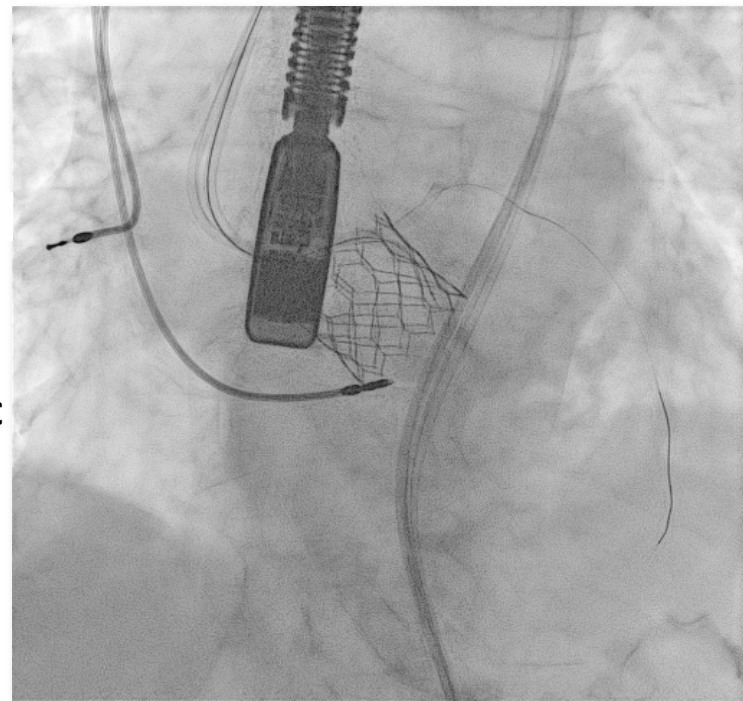
**Leaflet modification – UNICORN**  
(Undermining Iatrogenic Coronary  
Obstruction With Radiofrequency Needle)

# INDEX THV LEAFLET MODIFICATION

**UNICORN** (Undermining Iatrogenic Coronary Obstruction With Radiofrequency Needle)

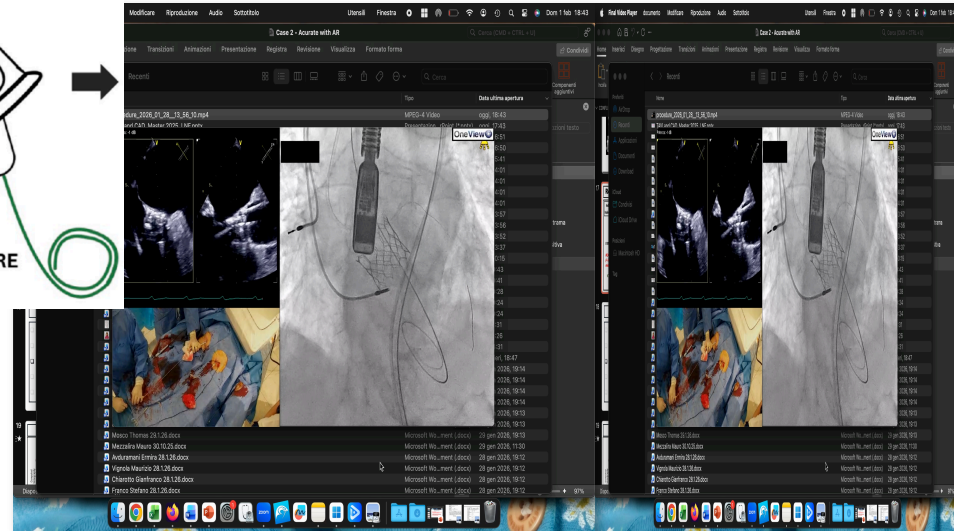
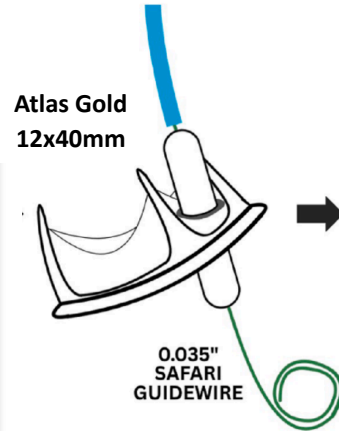
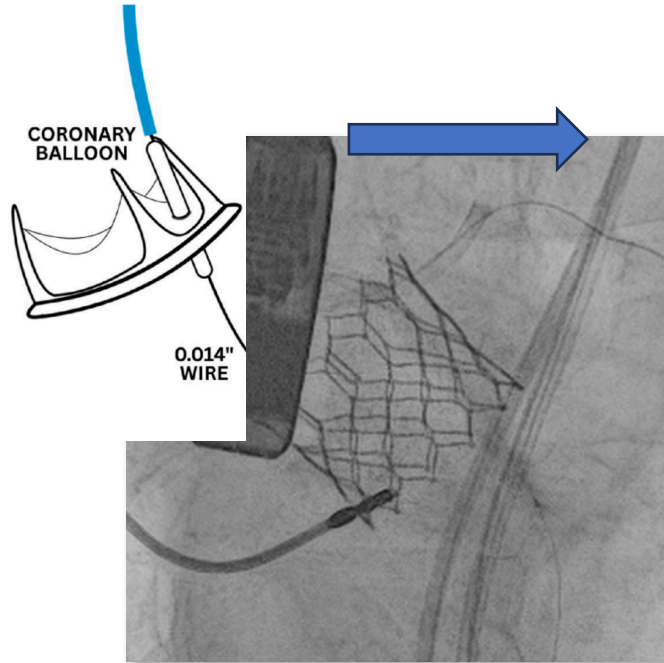


Amplatz Left 1 7F GC  
+  
Finecross MG  
Microcatheter  
+  
Astato GW



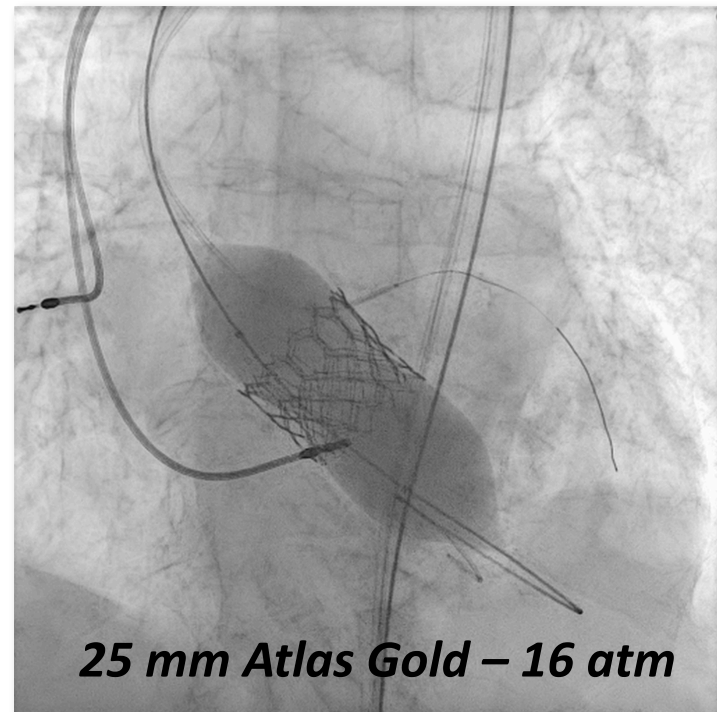
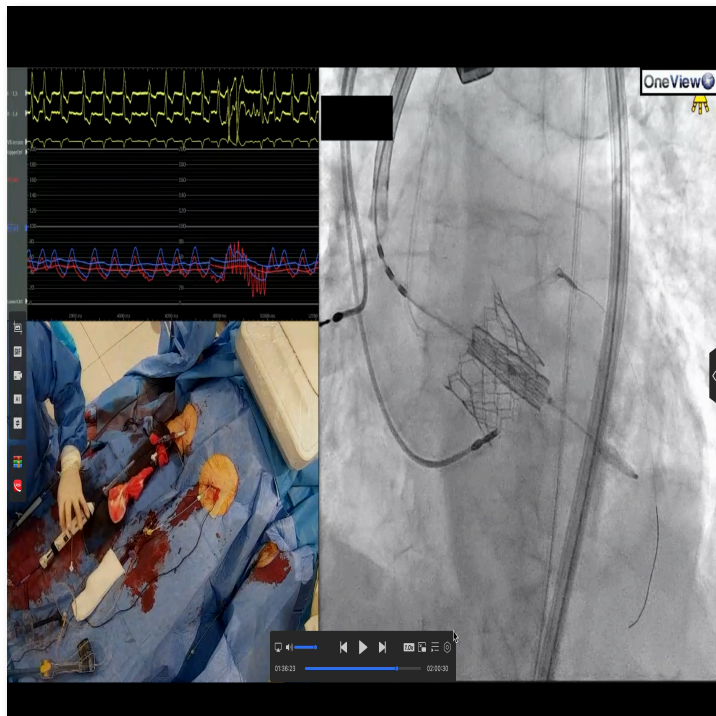
# INDEX THV LEAFLET MODIFICATION

**UNICORN** (Undermining Iatrogenic Coronary Obstruction With Radiofrequency Needle)

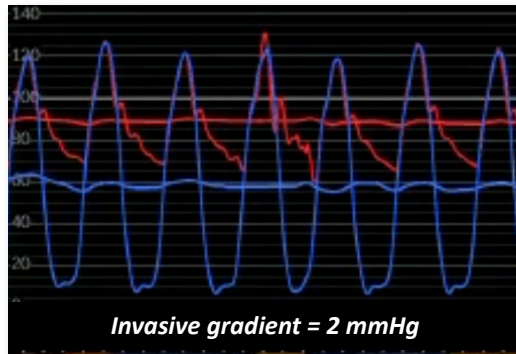
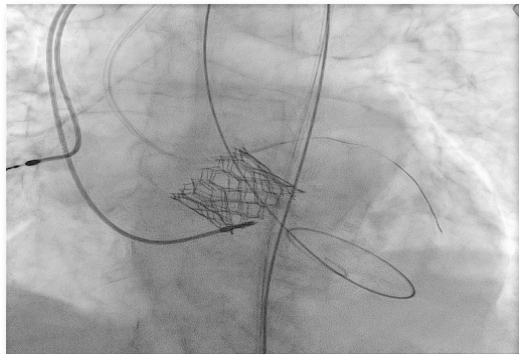




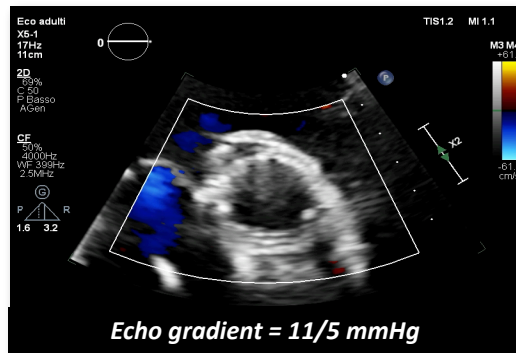
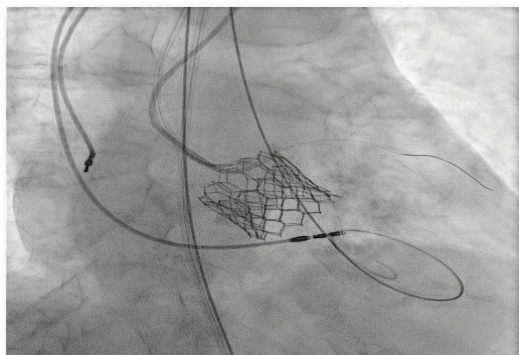
# THV IMPLANTATION AND OPTIMIZATION



# FINAL RESULT



**Discharged home  
after 2 days**



**Scheduled 30-day  
CT scan follow up**

## TAKE HOME MESSAGES

- ❑ **TAV-in-TAV is not just a repeat procedure** — it requires a **forward-thinking** strategy from the **very first implant**.
- ❑ **CT-based planning** and understanding of **valve metrics** are key to **correct sizing, positioning**, and preserving future intervention possibilities.
- ❑ **Optimization is Key**
- ❑ **A short-frame THV** with the risk plane below the coronaries **keeps future options open**; a **tall-frame** limits options and **often calls for a short-frame in redo** procedures.





*Thank  
You!*



@interventionalcardiologyteampadova



@giuseppetarantinimdphd



@G\_Tarantini01