# TAVI Valve in Valve: Planificación del procedimiento

*Aníbal Damonte (damontea@icronline.com)*
*Jefe del Servicio de Hemodinamia y Cardiología Intervencionista; Instituto Cardiovascular de Rosario*
*Ex Presidente CACI; Ex Presidente SOLACI*

# Introducción

• La degeneración de prótesis biológicas quirúrgicas, puede manifestarse con estenosis, insuficiencia o ambas.

• La reoperación se asocia a resultados desfavorables en relación al reemplazo quirúrgico de válvula nativa, con > mortalidad operatoria (4,6 vs 2,2%), ACV, insuficiencia y necesidad de MCP definitivo.

• La mortalidad de una reoperación en pacientes octogenarios es aún mayor (6,7% - 13%) por lo que TAVI ha surgido como una alternativa efectiva en estos casos, particularmente en pacientes con riesgo quirúrgico alto o prohibitivo, y desde hace años cuenta con la aprobación de la FDA, para el tratamiento de la disfunción de prótesis biológicas en posición aórtica.

FDA News Release

**FDA expands use of CoreValve System for aortic "valve-in-valve" replacement**

*Device is first of its kind for this use and eliminates need for open heart surgery*

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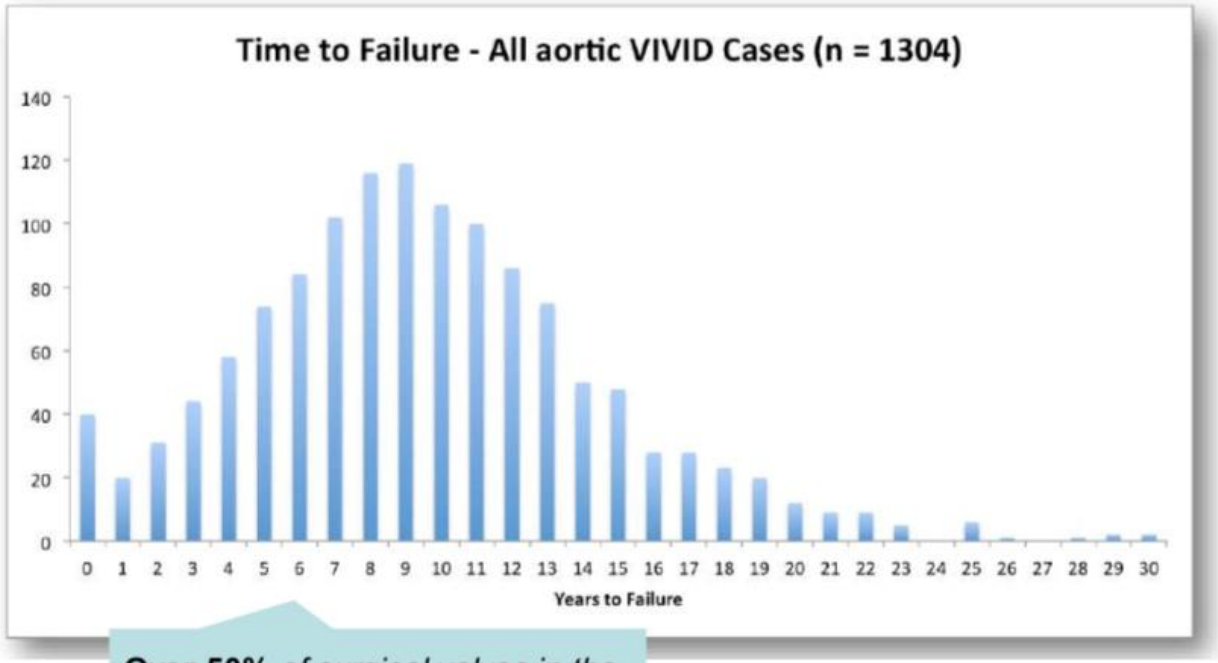
**For Immediate Release**

March 30, 2015

# VIVID Registry Data




**Over 50%** *of surgical valves in the VIVID registry* ***failed by 10 years***

*Presented by Dr. Webb at TVT 2016

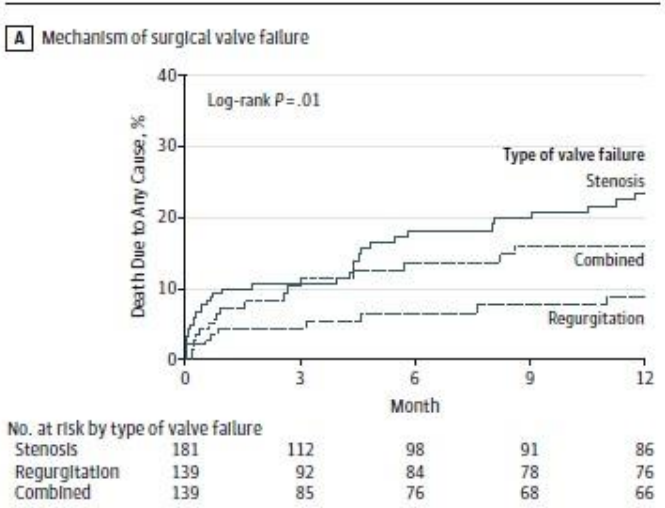
Original Investigation

# Transcatheter Aortic Valve Implantation in Failed Bioprosthetic Surgical Valves

Danny Dvir, MD; John G. Webb, MD; Sabine Bleiziffer, MD; Miralem Pasic, MD, PhD; Ron Waksman, MD; Susheel Kodali, MD; Marco Barbanti, MD; Azeem Latib, MD; Ulrich Schaefer, MD; Josep Rodés-Cabau, MD; Hendrik Treede, MD; Nicolo Piazza, MD, PhD; David Hildick-Smith, MD; Dominique Himbert, MD; Thomas Walther, MD; Christian Hengstenberg, MD; Henrik Nissen, MD, PhD; Raffi Bekeredjian, MD; Patrizia Presbitero, MD; Enrico Ferrari, MD; Amit Segev, MD; Arend de Weger, MD; Stephan Windecker, MD; Neil E. Moat, FRCS; Massimo Napodano, MD; Manuel Wilbring, MD; Alfredo G. Cerillo, MD; Stephen Brecker, MD; Didier Tchetche, MD; Thierry Lefèvre, MD; Federico De Marco, MD; Claudia Fiorina, MD; Anna Sonia Petronio, MD; Rui C. Teles, MD; Luca Testa, MD; Jean-Claude Laborde, MD; Martin B. Leon, MD; Ran Kornowski, MD; for the Valve-in-Valve International Data Registry Investigators

**Table 3. Clinical Outcomes**

| Outcomes | All (n = 459) | Mechanism of Surgical Valve Failure, No. (%) | | | | Device Used, No. (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | Stenosis (n = 181) | Regurgitation (n = 139) | Combined (n = 139) | *P* Value | Self-Expandable (n = 213) | Balloon-Expandable (n = 246) | *P* Value |
| Duration of hospital stay, median (IQR), d | 8 (5-12) | 7 (5-11) | 7 (5-12) | 8 (6-13) | .21 | 7 (5-12) | 8 (6-13) | .07 |
| Thirty-day outcomes | | | | | | | | |
| Death, No. (%) | 35 (7.6) | 19 (10.5) | 6 (4.3) | 10 (7.2) | .04 | 15 (7) | 20 (8.1) | .66 |
| Cardiovascular death, No. (%) | 30 (6.5) | 16 (8.8) | 5 (3.6) | 9 (6.5) | .06 | 12 (5.6) | 18 (7.3) | .47 |




JAMA 2014;312:162-170

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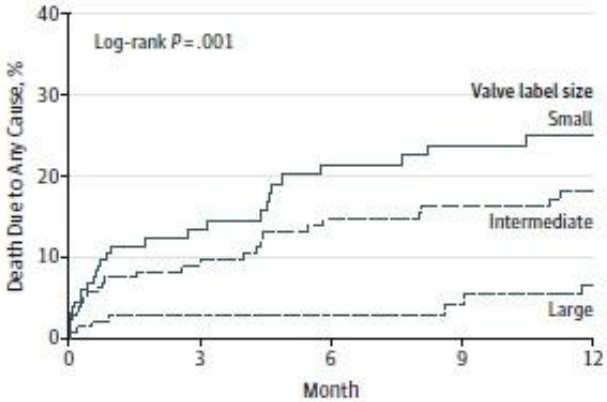
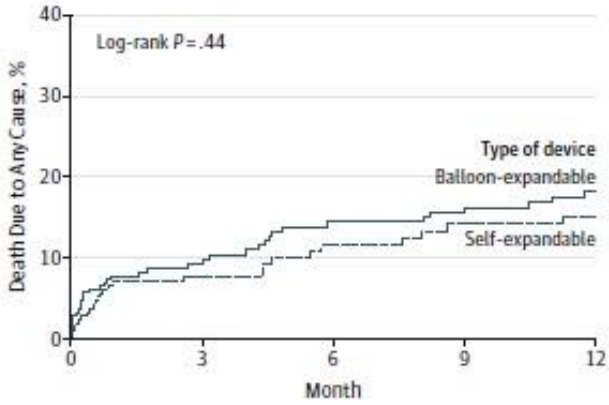
B Surgical valve label size[a]




C Device used during valve-in-valve implantation

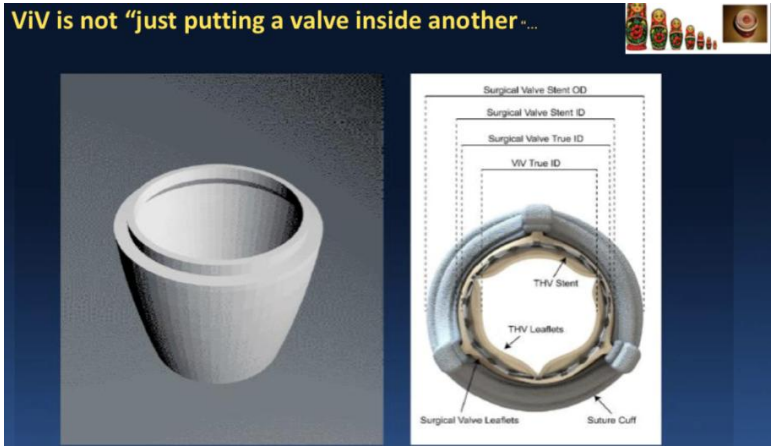



JAMA 2014;312:162-170

# Valve in Valve: Desafíos

- Técnica del implante.
- Seguimiento a largo plazo.
- Consideraciones especiales:

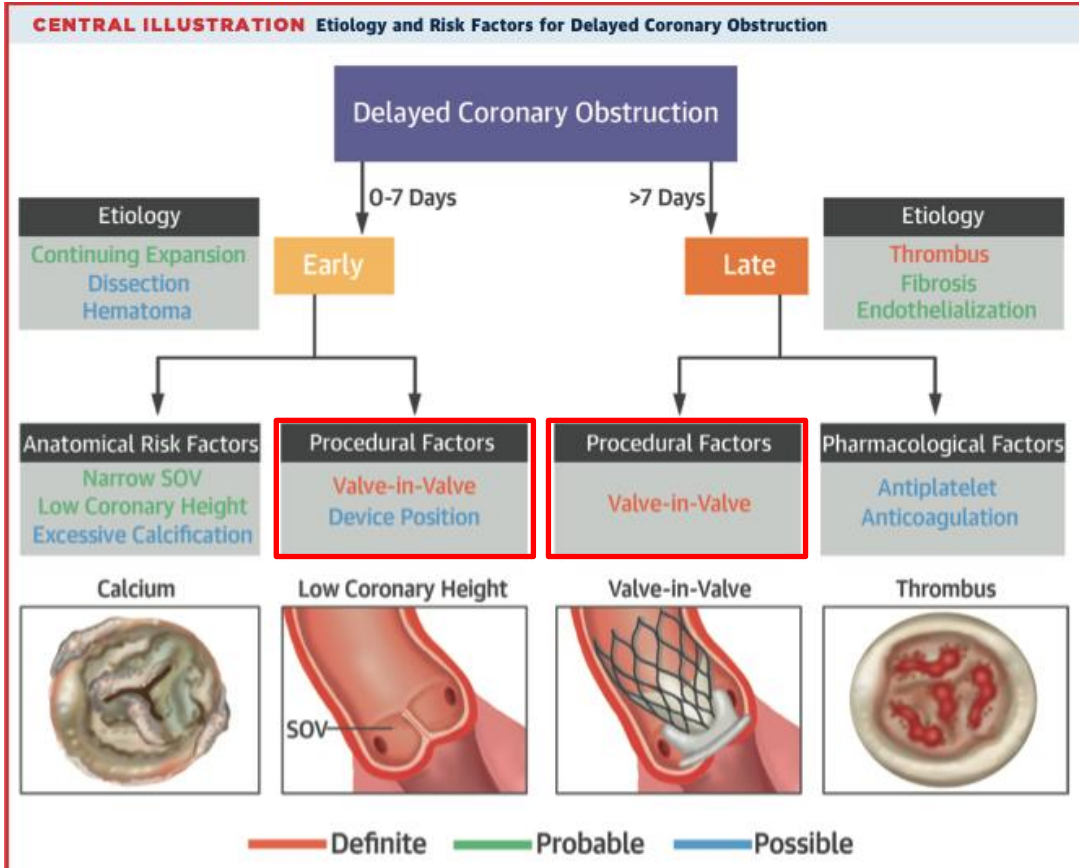
1) Riesgo de obstrucción de los ostium coronarios.
2) Tamaño de la prótesis quirúrgica.
3) Selección del tipo de dispositivo para Valve in Valve.

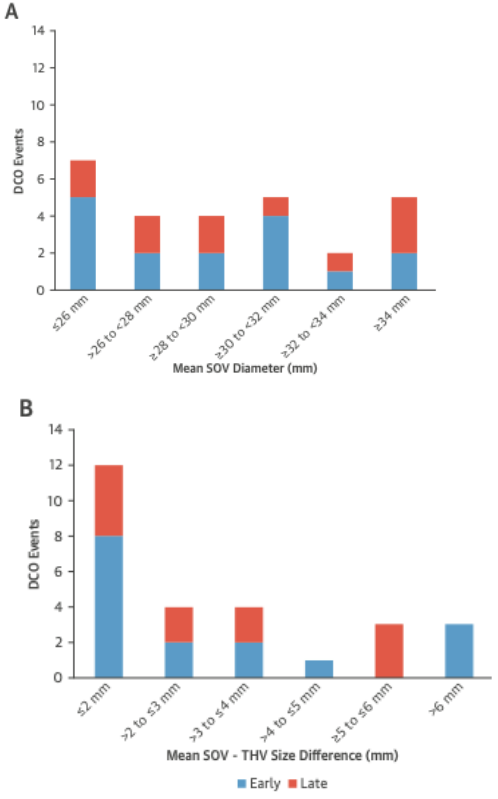


# Factores de riesgo de oclusión coronaria en TAVI

- Senos de valsalva pequeños.
- Ostium coronarios bajos.
- Calcificación voluminosa de los velos.
- Implante protésico alto.
- TAVI en bioprótesis quirúrgica - VIV (particularmente en bioprótesis con velos exteriores al stent)

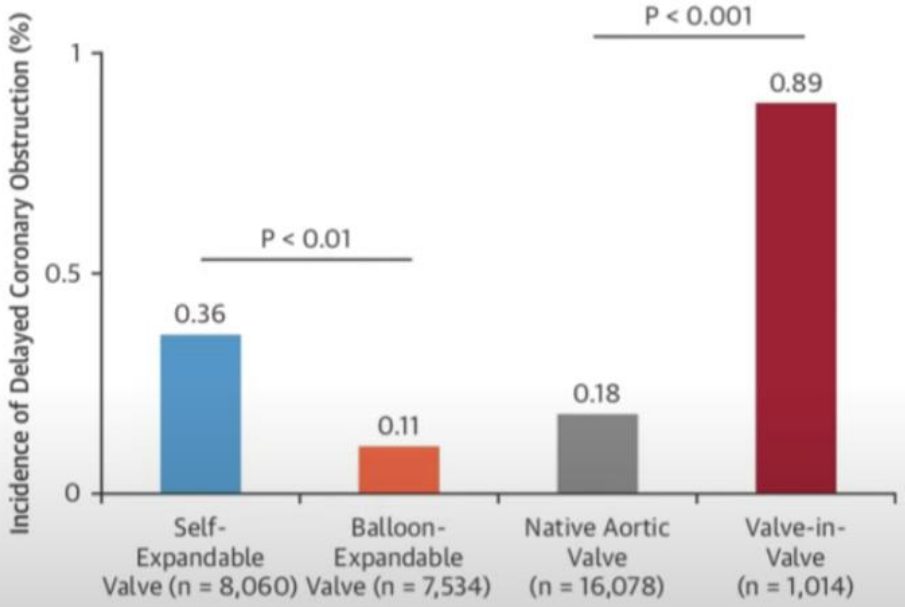
# Etiología de la oclusión coronaria en TAVI



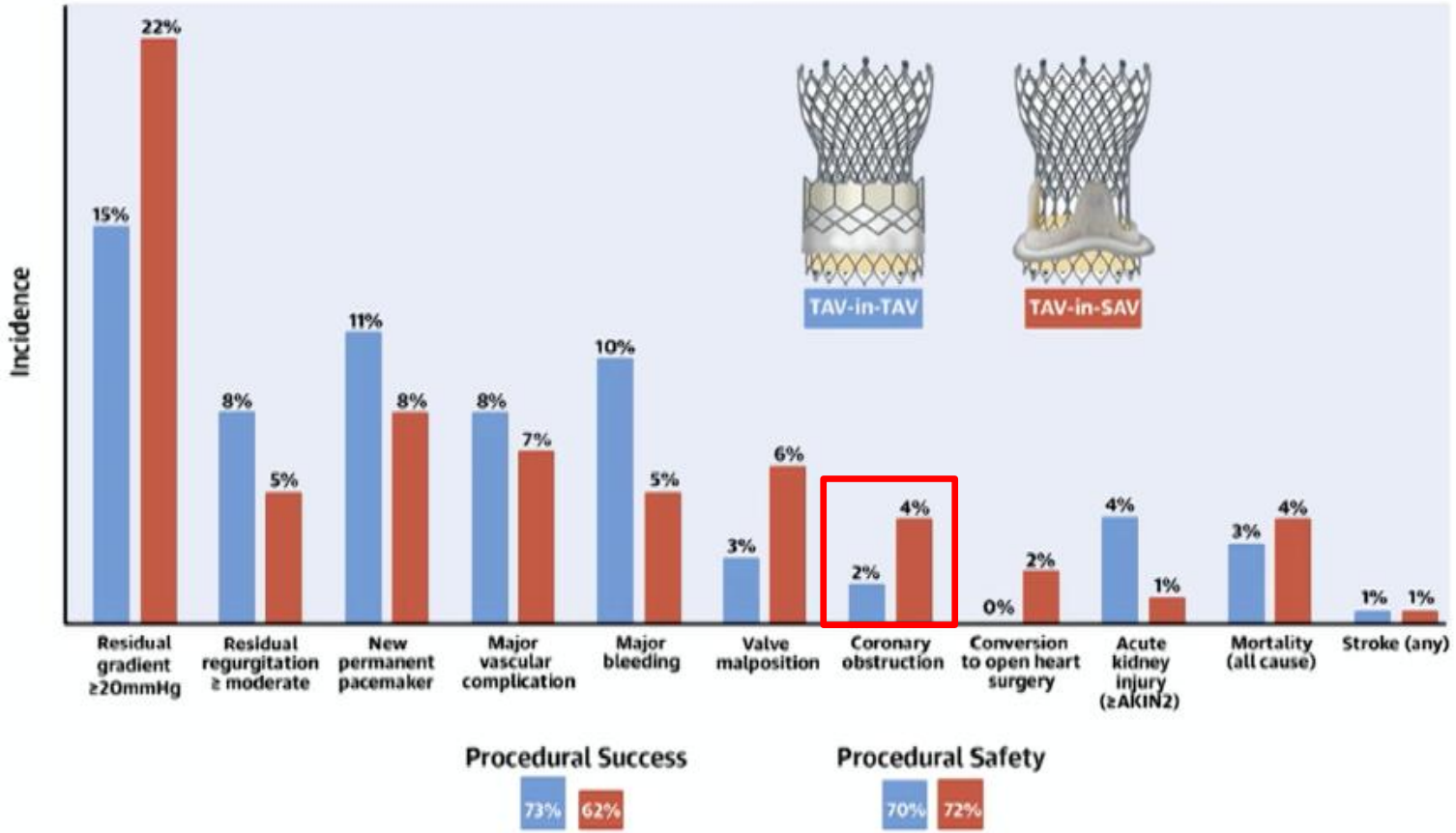



# Oclusión coronaria: Diseño de prótesis y procedimiento

- Retrospective Registry
- 18 Centers
- N = 17092 TAVI procedures

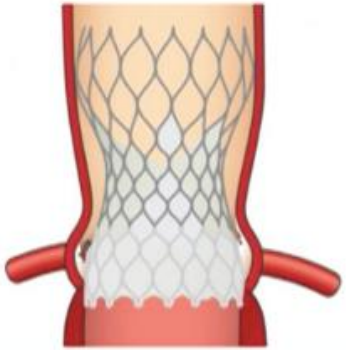



Jabour et al. J Am Coll Cardiol 2018;71:1513-24



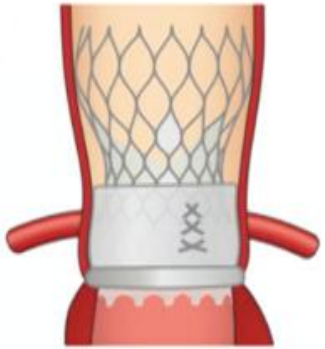

Landes, U. et al. J Am Coll Cardiol. 2021;77(1):1-14.

## Native Valve



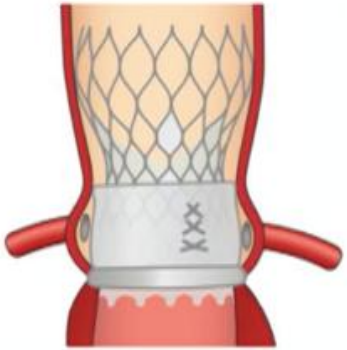
Displaced native leaflet covering coronary ostium

## Valve-in-Valve



Displaced surgical valve leaflets covering coronary ostium

## Valve-in-Valve



Displaced surgical valve leaflets blocking at level of sinotubular junction.

# Oclusión coronaria en VIV de acuerdo al tipo de bioprótesis

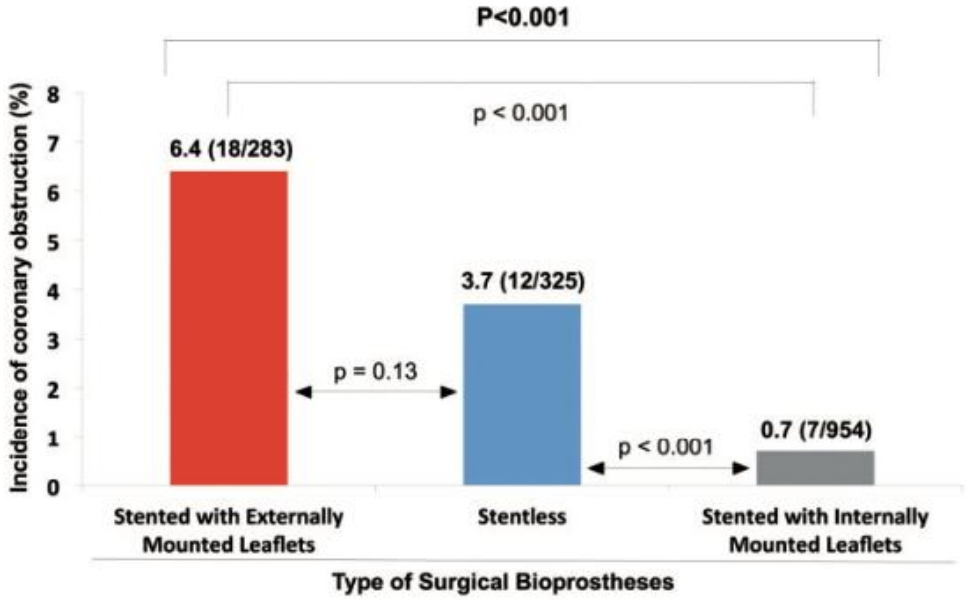



**Figure 2** Incidence of coronary obstruction following valve-in-valve procedures according to surgical bioprosthesis type.

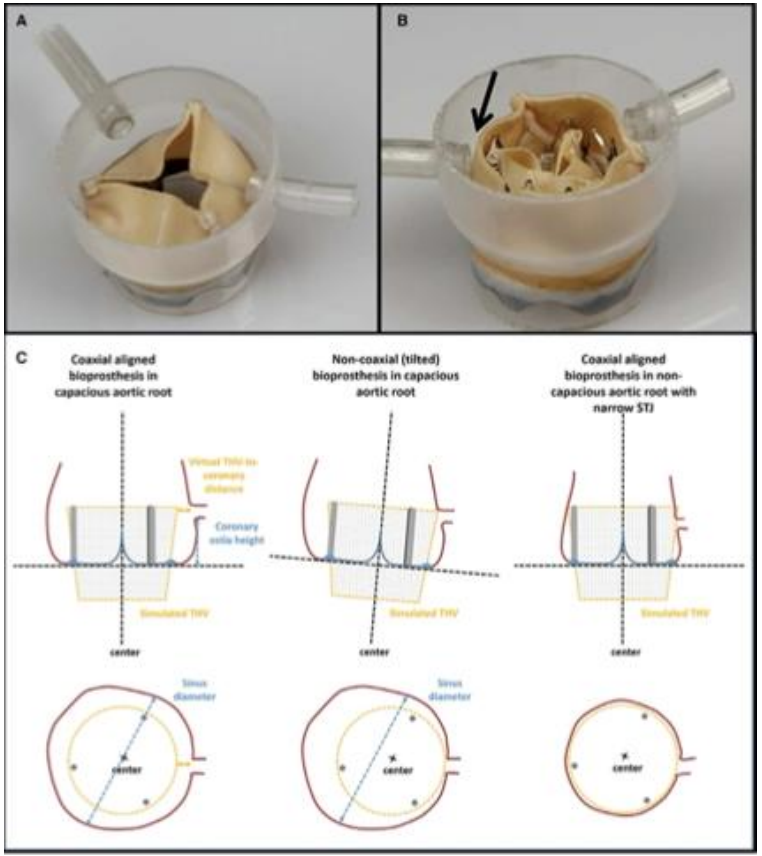
Ribeiro E, EHJ 2018;39:687-695

# Oclusión coronaria en VIV de acuerdo a la dimensión de los senos

Senos en relación al anillo
Dimensión de prótesis de TAVI en relación a SOV
Distancia del anillo a los ostium coronarios
Inclinación de la prótesis de TAVI

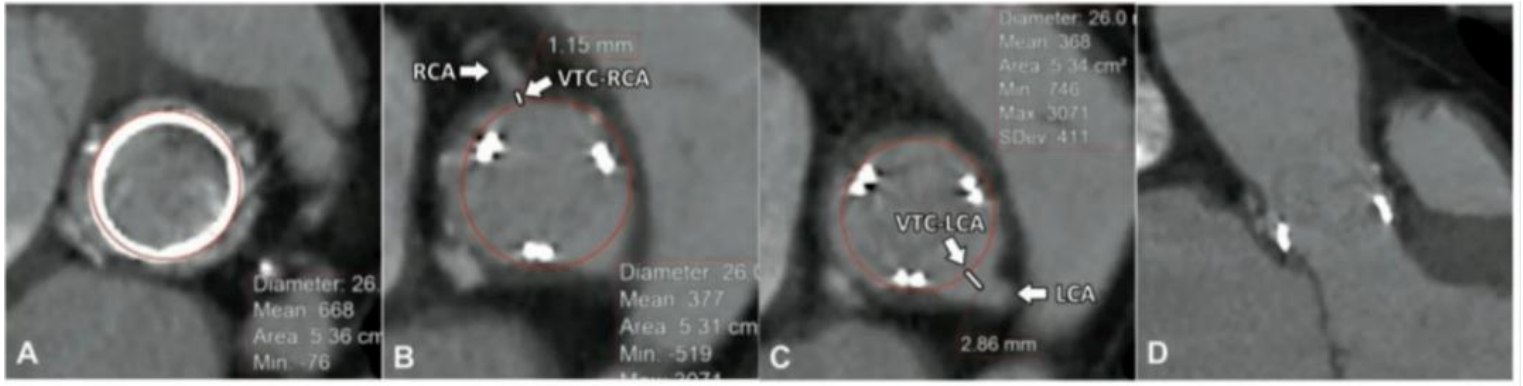
Riesgo de O.Coronaria de acuerdo a la distancia virtual entre THV y ostium coronario (VTC distance)

- < 3 mm alto riesgo de oclusión
- 3 -6 mm riesgo intermedio de oclusión
- > 6 mm bajo riesgo de oclusión

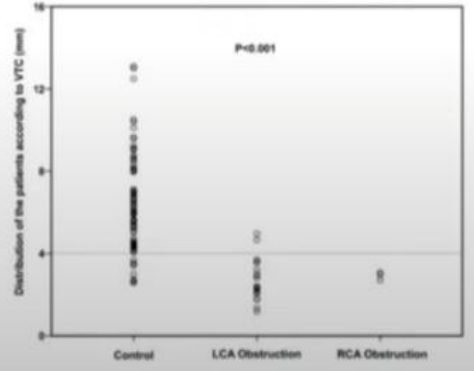



Dvir D, Circ CVI 2015;8:1-10

# Distancia virtual de THV al ostium coronario



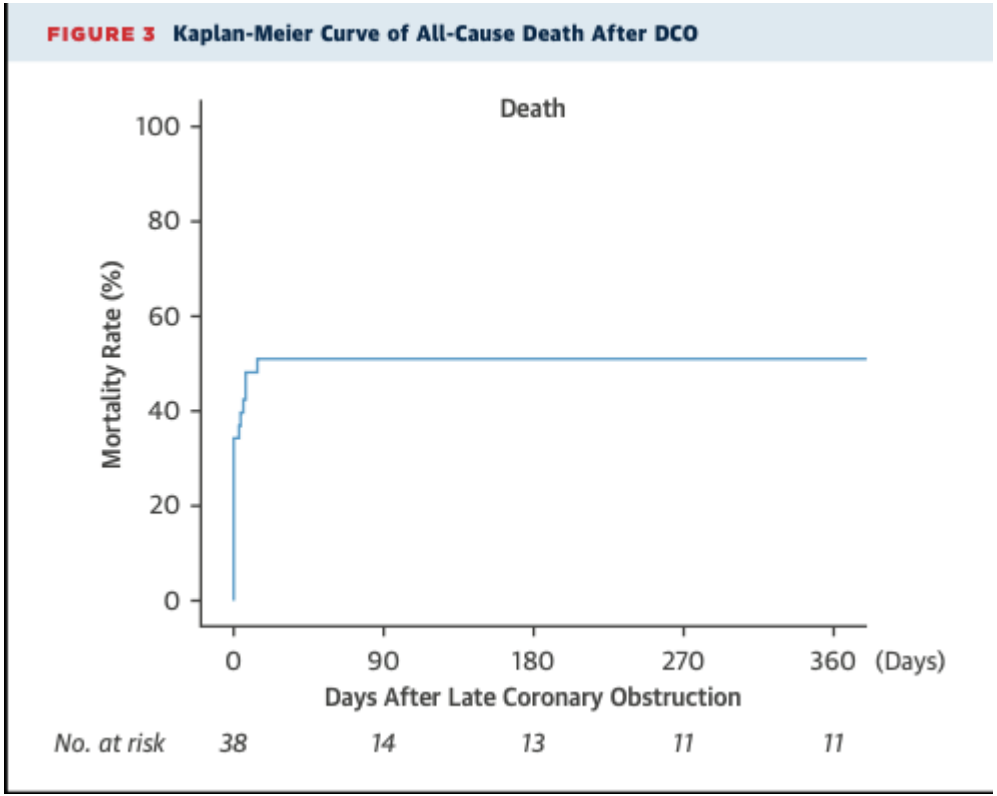

- **VIVID Registry**
- **N = 1612 valve-in-valve**
- **Coronary obstruction 2.3% (n = 37)**




Ribeiro et al. EHJ 2018;39:687-95

| Anatomical Factors | Procedural –Related Factors | Valve-Related Factors |
|---|---|---|
| Low-lying coronary ostia (<12mm) | High implantation | No stent frame (homograft/stentless valve) |
| Narrow Sinus of Valsalva (<29mm) or sinotubular junction | External sealing skirt | Externally mounted leaflets e.g. Mitroflow, Trifecta |
| Heavy/bulky leaflet calcification | Commissural malalignment | Supra-annular position |
| Long leaflet length extending above coronary ostia | | Bulky calcified leaflets |
| Virtual THV to coronary distance (VTC) <3mm | | |

# Oclusión coronaria: Distribución temporal



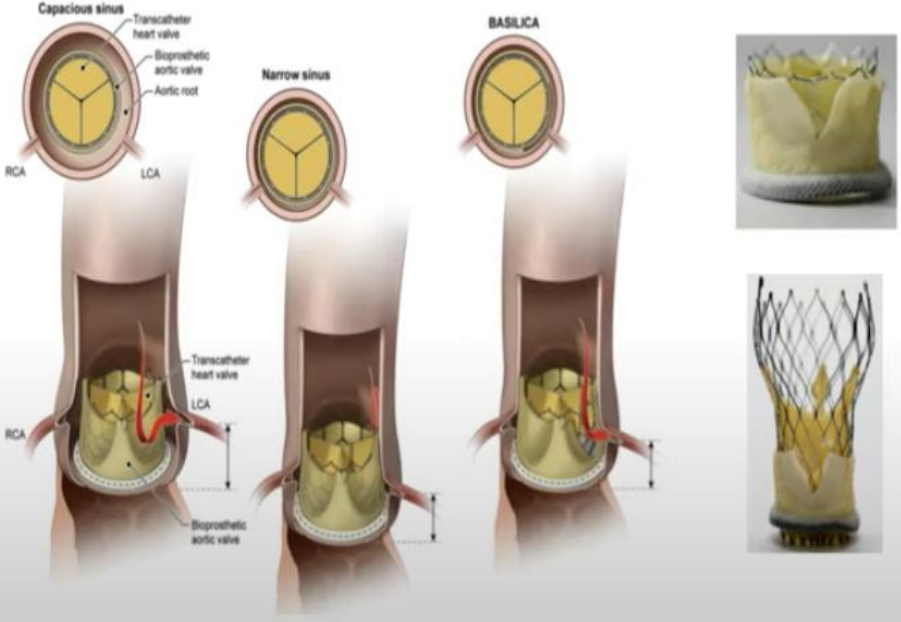

Jabour et al. JAmCollCardiol 2018;71:1513-24

# Prevención de oclusión coronaria en TAVI

- Minuciosa planificación basados en la MSCT
- Considerar BAV con aortograma
- Protección coronaria (cuerda + stent)
- Técnica de chimenea
- Basílica
- Prótesis recapturable y reposicionable

# BASILICA – Principios de la técnica

- **Bioprosthetic or native aortic scallop intentional laceration to prevent coronary artery obstruction (BASILICA)**

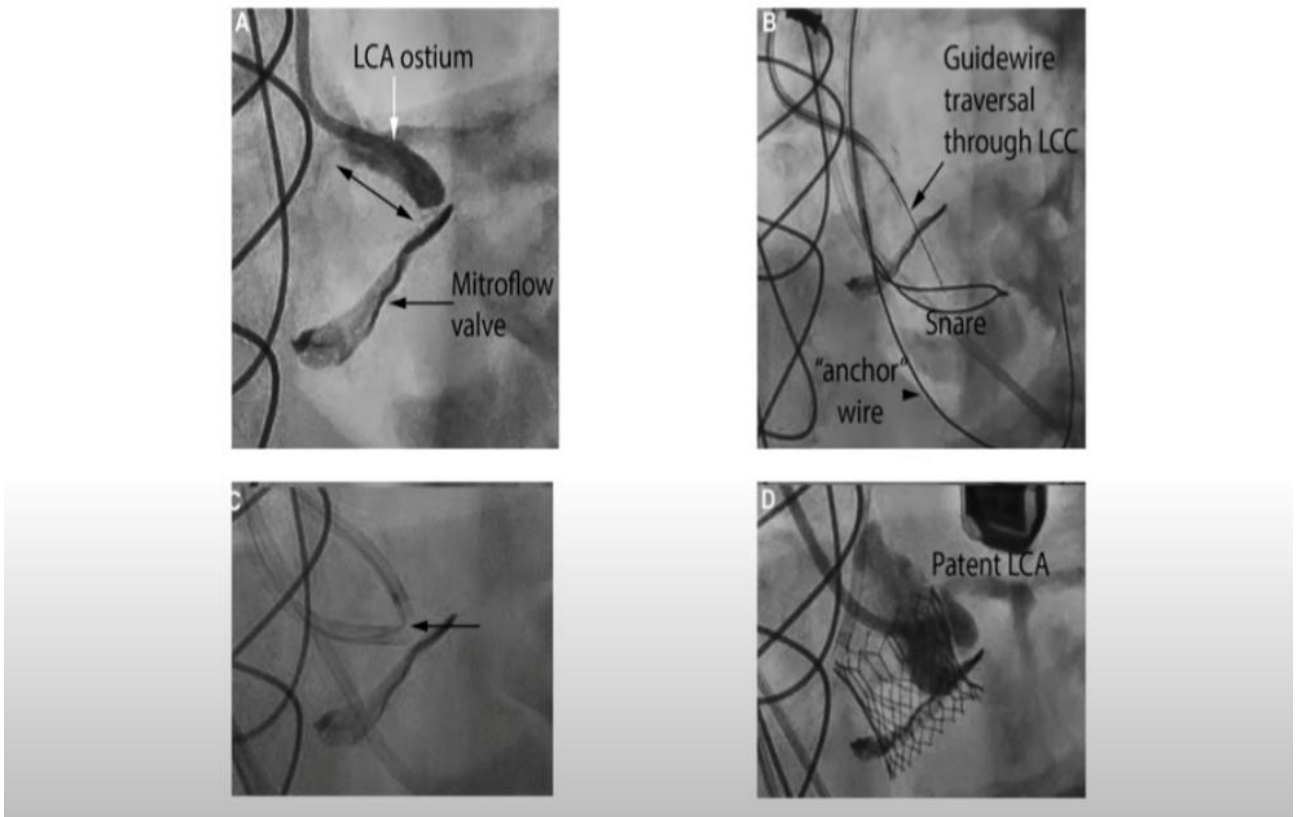




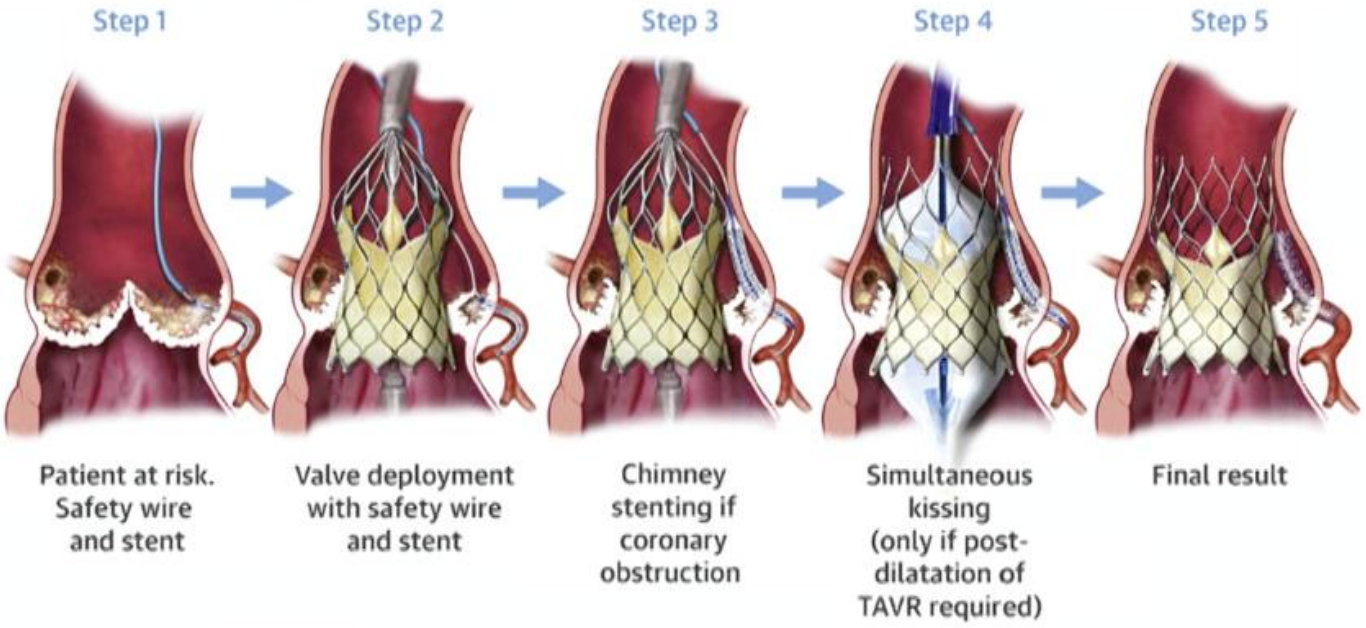



Khan et al. J Am Coll Cardiol Intv 2018;11:677–89

# BASILICA




Khan et al. J Am Coll Cardiol Intv 2018;11:677–89



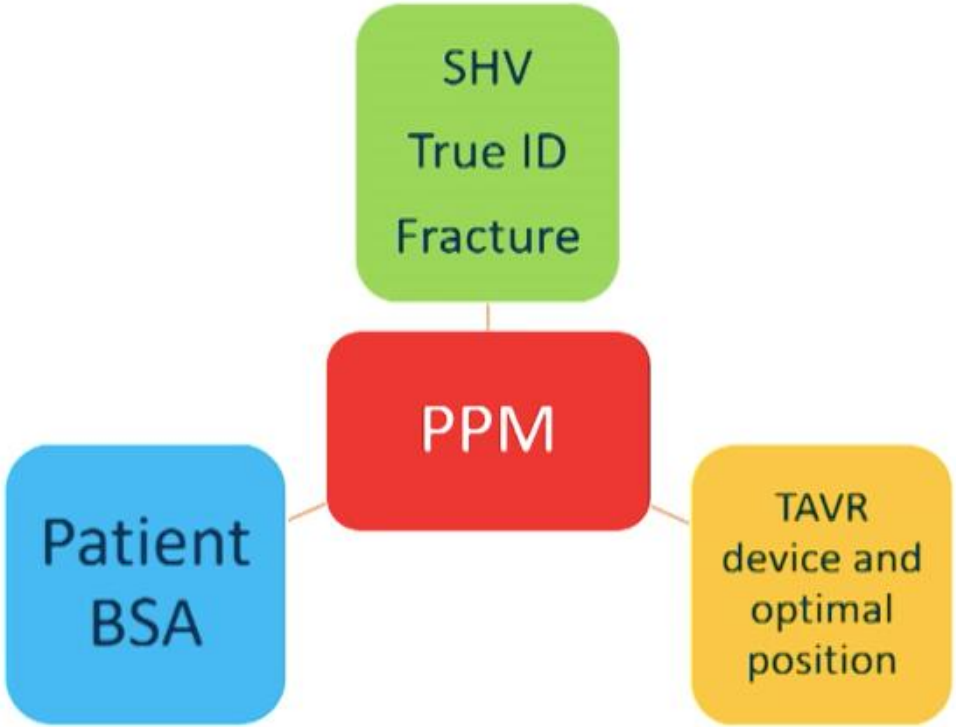

Mercanti, F. et al. J Am Coll Cardiol Intv. 2020;13(6):751-61.

**Step 1**: An undeployed coronary stent, appropriately sized for the shaft of the left main coronary artery, and with sufficient length to extend into the ascending aorta to the level of the sinotubular junction, is parked in the mid left anterior descending coronary before transcatheter heart valve (THV) deployment. **Step 2**: During THV implantation, the guide catheter is backed out into the ascending aorta. **Step 3**: If coronary blood flow is compromised, the undeployed stent is carefully retracted beyond the coronary ostium and above the displaced stenotic aortic leaflets and subsequently deployed. **Step 4**: If post-dilatation of the THV is required, simultaneous kissing balloon inflation can be performed between the THV and chimney stent to avoid deformation of the chimney stent. **Step 5**: Final angiographic assessment is mandatory. TAVR — transcatheter aortic valve replacement.

# Técnica de ”Chimenea” - Limitaciones


- **Longevity/stent patency unclear**
- **Re-engage coronary ostium almost impossible**
- **Future stent issues e.g. stent thrombosis might be fatal**

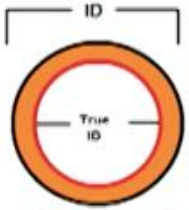
# Mismatch prótesis paciente: PPM



# Mismatch prótesis paciente: PPM

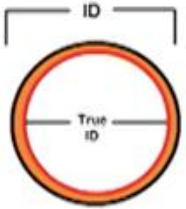
## 3 Types of Valves – different True ID

Porcine Leaflets Mounted inside



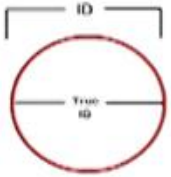

True ID = Stent ID – 2mm

Pericardial Leaflets Mounted inside




True ID = Stent ID – 1mm

Pericardial Leaflets Mounted outside

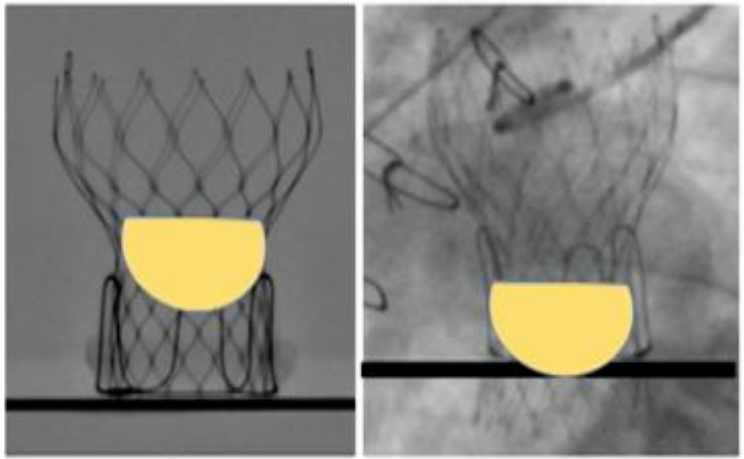



Stent ID = True ID

True ID <21
Increases
Risk of PPM

# Profundidad del TAVI en SAVR y performance hemodinamica

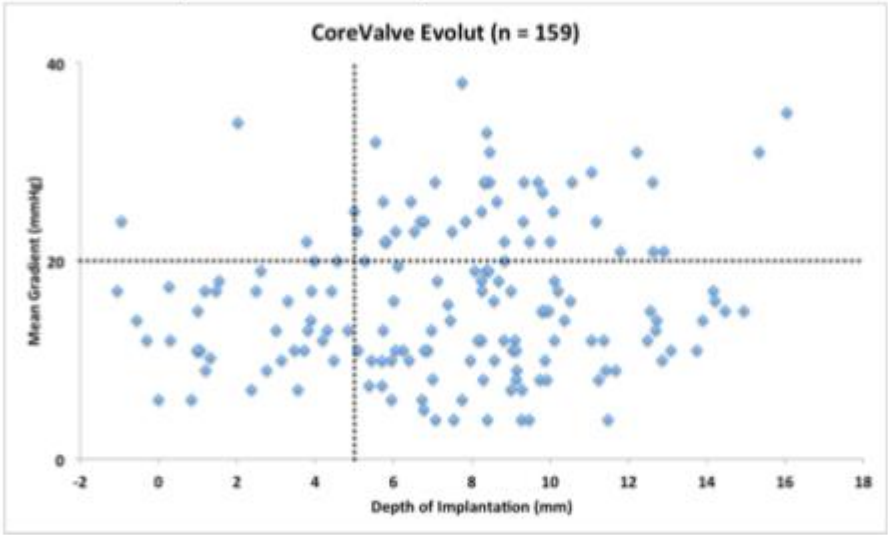
Example



# Técnica de Implante

Valve-in-Valve International Data VIVID

## Implantation Depth and Gradients

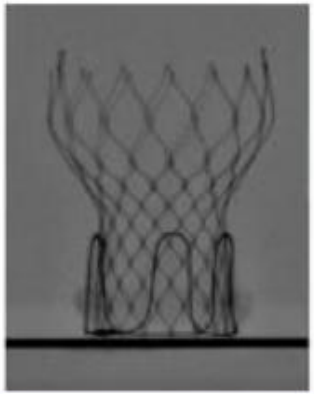



Median Implantation Depth: 8.57mm (IQR 5.7mm – 11.4mm)

**Simonato et al. VIVID Registry. CircCVIntervention. 2016**

- Valve should be positioned based on neo-annulus
  - Sapien – ***10-15 % below***
  - CoreValve – ***3-4 mm below or less***

- Malposition leads to improper seal and anchoring
  - Too high
    - Embolization / Coronary occlusion
  - Too low
    - PVL
    - Poor hemodyanamics



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EDITORIAL COMMENT

# Valve-in-Valve Outcomes

## Features of the Failed Bioprosthesis, Characteristics of the Treating Transcatheter Valve, and Procedural Techniques—All Are Important*

Danny Dvir, MD

**TABLE 1 Transcatheter Heart Valve Features That Are Beneficial for Valve-in-Valve Procedures**

| |
|---|
| Optimal hemodynamic results* |
| High device integrity† |
| Easy positioning and full repositonability‡ |
| Low coronary obstruction risk§ |
| Easy coronary access post-procedure‖ |
| Resistance to clinical thrombosis |
| Long-term durability |
| Safe TAVR treatability¶ |

*Especially in conditions prone to device underexpansion. †Resistant to high-pressure balloon inflation that is performed during ring fracture. ‡Beneficial in cases at risk for coronary obstruction and those that lack fluoroscopic markers. §Low radial force at the level of the coronary ostia with minimal displacement of the failed valve leaflets. ‖Which may enable treating coronary obstruction, if it occurs. ¶Enables safe and effective TAVR therapy within that device if fails.

TAVR = transcatheter aortic valve replacement.

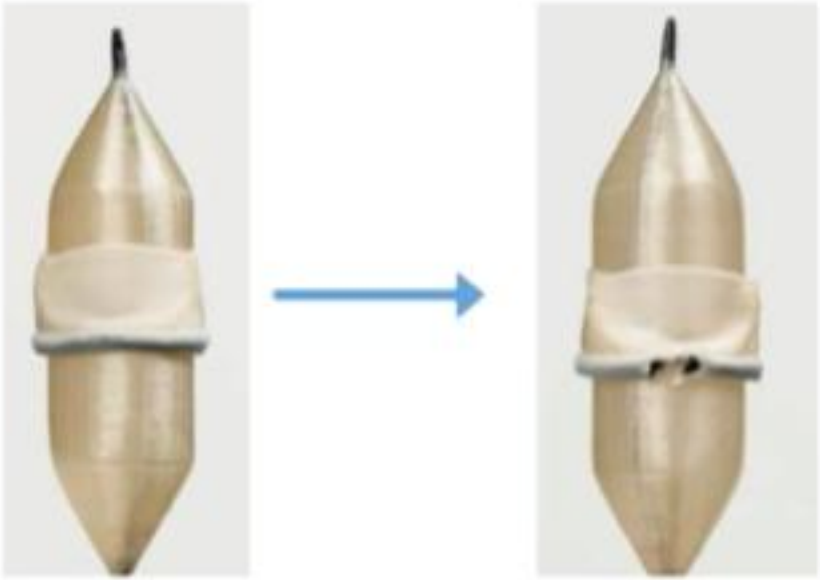
| Factors | Balloon-expandable valve preferred | Self-expanding valve preferred |
|---|---|---|
| Smaller SAV (true ID <23 mm) | | ✔ |
| Need for coronary re-access | ✔ | |
| Pure aortic regurgitation in a stentless SAV | ✔ | ✔ |
| BVF feasible | ✔ | |
| BVF not feasible or safe | | ✔ |

Tarantini G; EuroInt 2021;17:709-719

# Fractura de la prótesis quirúrgica durante Valve in Valve TAVI

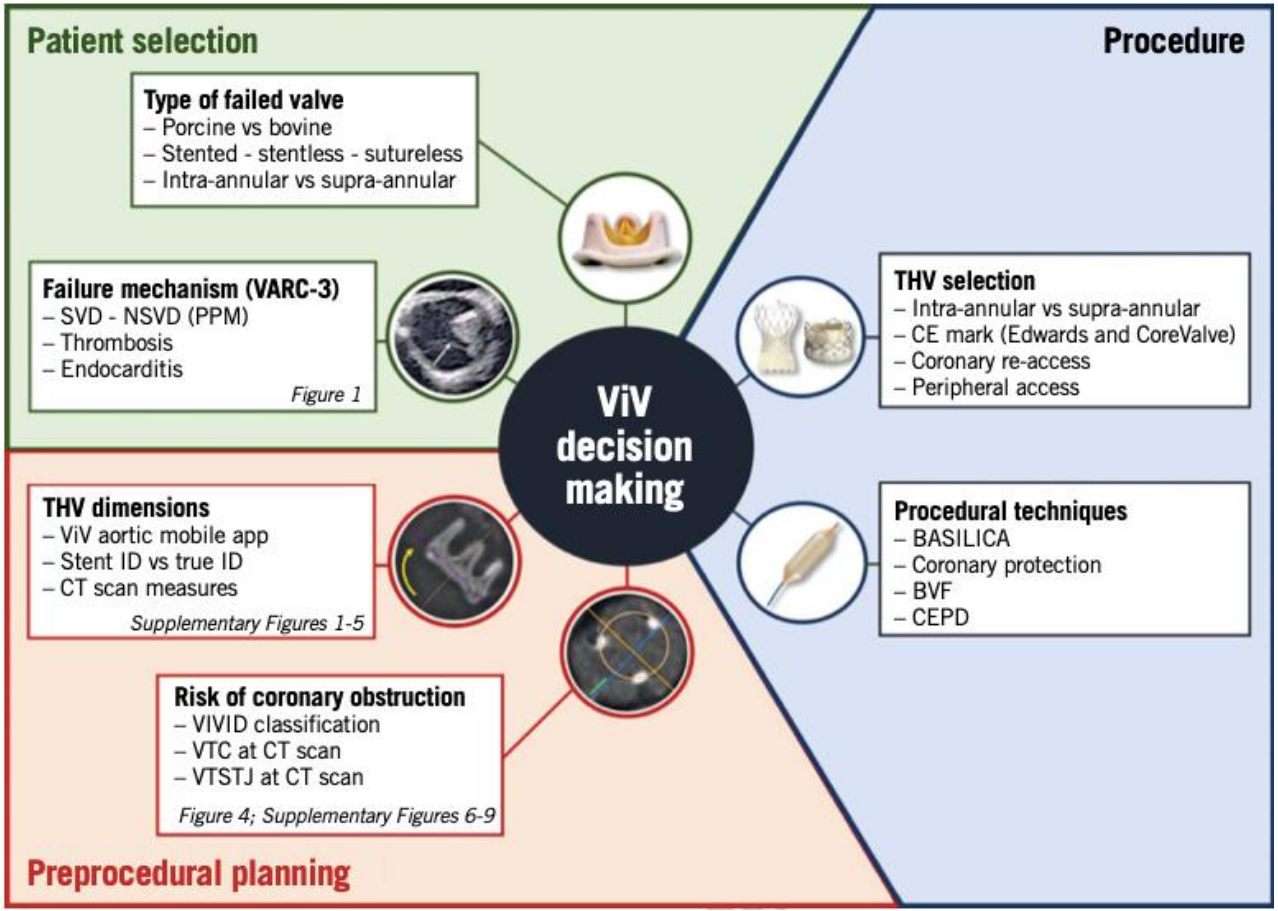
**Controversias:**

Pre o post TAVI?
Tamaño del balón
Recoil?
Injuria del anillo
Riesgo de daño de los velos de TAVI



| | BVF before TAVI | BVF after TAVI |
|---|---|---|
| Advantages | – Easier to implant self-expanding valve with less sizing mismatch<br>– Can confirm successful fracture before finalising TAV size | – Better TAV expansion, especially in balloon-expandable valves<br>– Less risk of acute severe aortic regurgitation |
| Disadvantages | – Acute severe aortic regurgitation causing haemodynamic collapse<br>– May need to post-dilate to optimise haemodynamics | – TAV migration or embolisation<br>– Acute TAV failure from leaflet injury<br>– Unknown effect on TAV durability |

Tarantini G; EuroInt 2021




Tarantini G; EuroInt 2021;17:709-719