Coronary occlusion after TAVI

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Potential conflicts of interest

Speaker's name: Ioannis, Iakovou, Athens

☑ I do not have any potential conflict of interest
TAVI and coronary occlusion

- What is the magnitude of the problem
- Coronary occlusion risk factors
- What is the mechanism?
- What is the outcome?
- How to prevent it
TAVI and coronary occlusion

• What is the magnitude of the problem
• Coronary occlusion risk factors
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• How to prevent it
Incidence of coronary obstruction during TAVI

Pooled studies 0.35%
- Sapien 0.42%
- CoreValve 0.19%

Ribeiro et al JACC Interv 2013
Incidence of Late Coronary Obstruction

Richad J. Jabbour...A Latib et al, JACC 2018
Global Valve-in-Valve Registry
High incidence of coronary obstruction with ViV

<table>
<thead>
<tr>
<th></th>
<th>Stenosis (n=182)</th>
<th>Regurgitation (n=139)</th>
<th>Combined (n=139)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre implantation valvuloplasty</td>
<td>35.7%</td>
<td>14.4%</td>
<td>38.1%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Initial device malposition</td>
<td>6.6%</td>
<td>10.8%</td>
<td>14.5%</td>
<td>0.07</td>
</tr>
<tr>
<td>Attempted Valve retrieval</td>
<td>4.0%</td>
<td>5.1%</td>
<td>5.8%</td>
<td>0.75</td>
</tr>
<tr>
<td>2nd device implanted</td>
<td>4.4%</td>
<td>5.8%</td>
<td>7.2%</td>
<td>0.57</td>
</tr>
<tr>
<td>Post implantation valvuloplasty</td>
<td>13.0%</td>
<td>10.9%</td>
<td>7.2%</td>
<td>0.25</td>
</tr>
<tr>
<td>Clinically-evident Coronary obstruction</td>
<td>3.9%</td>
<td>0.8%</td>
<td>0</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Dvir D. et al. Circulation 2013
Incidence of Coronary Obstruction According to Approach

Ribeiro et al. JACC 2013

P=0.297

P=0.338

Incidence of coronary obstruction (%)

0.61

0.83

1.02

Transfemoral (n=4,934)

Transapical (n=1,559)

Transaortic (n=98)
TAVI and coronary occlusion

- What is the magnitude of the problem
- Coronary occlusion risk factors
- What is the mechanism?
- What is the outcome?
- How to prevent it
Traditional criteria

Predictive Factors, Management, and Clinical Outcomes of Coronary Obstruction Following Transcatheter Aortic Valve Implantation
Insights From a Large Multicenter Registry

A minority of the patients who did not suffer coronary obstruction had both, a coronary height of <12 mm and an aortic SOV diameter of <30 mm (13.3%), meaning that the combination of these 2 anatomic factors has to be taken into account when evaluating the possibility of coronary obstruction due to TAVI. The degree of valve calcification as

<table>
<thead>
<tr>
<th>Prosthesis type</th>
<th>Count (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balloon-expandable valve: Sapien/Sapien XT</td>
<td>37 (84.1)</td>
</tr>
<tr>
<td>Self-expandable valve: CoreValve</td>
<td>7 (15.9)</td>
</tr>
</tbody>
</table>
More common in females

**Female gender**

- Coronary Obstruction: 83.3%
- Registries: 53.1%
- PARTNER-A: 42.8%
- PARTNER-B: 53.6%

**Prior CABG**

- Coronary Obstruction: 4.2%
- Registries: 20.2%
- PARTNER-A: 43.4%
- PARTNER-B: 41.6%

*p<0.001*
LM obstruction > RCA obstruction

<table>
<thead>
<tr>
<th>Obstructed coronary artery</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Left main</td>
<td>20 (83.3%)</td>
</tr>
<tr>
<td>Right</td>
<td>3 (12.5%)</td>
</tr>
<tr>
<td>Both coronary arteries</td>
<td>1 (4.2%)</td>
</tr>
</tbody>
</table>

Ribiero H. et al. JACC: Cardiovascular Interventions 2013
Coronary obstruction is common in patients with low LM height and small SOV diameter.
Predictors of coronary obstruction during VIV TAVR

- Bioprosthetic valve factors
- Anatomic factors
- Transcatheter valve factors
Components of stented bioprosthesis

**Stent posts** + **Base ring** = **Prosthesis**

- **Elgiloy wireform stent**
- **Elgiloy and Polyester ring and stent posts**
- **Edwards PERIMOUNT Magna**
- **Acetyl homopolymer stent**
- **Stellite ring**
- **Haynes Alloy eyelets**
- **Medtronic Hancock II**
### Components of stented bioprosthesis

<table>
<thead>
<tr>
<th>Stent posts</th>
<th>Base ring</th>
<th>Prosthesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetyl stent</td>
<td>Silicone base ring</td>
<td>Polyester covered stent and base ring with outer single layer of pericardium</td>
</tr>
</tbody>
</table>

Components of stented bioprosthesis
Predictors of coronary obstruction during VIV TAVR: Anatomic factors

- Narrow and low-lying STJ
- Low coronaries
- Shallow SOV
- Reimplanted coronaries
Predictors of coronary obstruction during VIV TAVR: TAVR factors

• Height of THV implantation

• Extreme oversizing - outward deflection of surgical leaflets increased with oversizing

• Balloon expandable
  Retrievable vs. non-retrievable valves
Left Main Occlusion
Huge calcific nodule close to left main

Displacement of left coronary leaflet over LM origin
Left Main Occlusion
Huge calcific nodule close to left main

Balloon valvuloplasty does not break it. Just moves it
Aetiology and risk factors for delayed coronary obstruction
TAVI and coronary occlusion

- What is the magnitude of the problem
- Coronary occlusion risk factors
- What is the mechanism?
- What is the outcome?
- How to prevent it
Unsuccessful PCI during LM occlusion: 100% mortality

The overall mortality is 40.9%, in unsuccessful PCI it is 100%, in successful PCI it is 22.2%.
TAVI multicenter registry: patients, 44 centers, 6688 pts, 81 coronary obstruction

<table>
<thead>
<tr>
<th>Treatment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PCI attempted</td>
<td>33 (75.0)</td>
</tr>
<tr>
<td>Successful</td>
<td>27 (81.8)</td>
</tr>
<tr>
<td>Stent successfully implanted</td>
<td>25 (75.8)</td>
</tr>
<tr>
<td>Guide-wire protection only</td>
<td>1 (3.0)</td>
</tr>
<tr>
<td>Catheter cannulation only</td>
<td>1 (3.0)</td>
</tr>
<tr>
<td>Unsuccessful</td>
<td>6 (18.2)</td>
</tr>
<tr>
<td>Coronary cannulation failure</td>
<td>2 (33.3)</td>
</tr>
<tr>
<td>Wire crossing failure</td>
<td>2 (33.3)</td>
</tr>
<tr>
<td>Stent could not be advanced</td>
<td>1 (16.7)</td>
</tr>
<tr>
<td>Stent implanted but no flow</td>
<td>1 (16.7)</td>
</tr>
</tbody>
</table>

Ribeiro et al JACC 2013
Late coronary obstruction after TAVR

In hospital mortality of 50%
Coronary occlusion after Sapien XT
Coronary occlusion after Sapien XT
TAVI and coronary occlusion

• What is the magnitude of the problem
• Coronary occlusion risk factors
• What is the mechanism?
• What is the outcome?
• How to prevent it
The most important preventive measure, is preprocedural imaging

pre-TAVR evaluation

3mensio analysis
81 years, female, BMI=26, hypertensive, severe COPD, (previous pneumonectomy), chronic renal failure (baseline Cr:2.0 mg/dl), anemia, CAD (SVG → RCA) and surgical bioprosthetic valve replacement (Sorin Soprano No 18) 4 years ago with recent onset of dyspnea and hospitalization with acute pulmonary edema (Euroscore I: 47%, STS: 11).

**TTE & TEE:** Severe AS, AVA: 0.6 cm², Peak Gr: 87 mmHg, Mean Gr: 55 mmHg RVSP=55mmHg, EF: 55% , RHC: PASP: 62 mmHg, restricted leaflet mobility, no evidence of thrombus (TEE)
pre-TAVR evaluation

3mensio analysis
Virtual THV to coronary distance

D. Dvir et al, Contemporary review in interventional cardiology 2017

Blanke et al JCCT 2016
TAVI VIV in a pt with small aortic anatomy unsuitable for transfemoral/subclavian approach

**Sorin Soprano Valve**

- A pericardial tissue valve designed for a totally supra-annular seating
- Pericardial leaflets sutured inside the stent

![Diagram of Sorin Soprano Valve](image)
TAVI VIV in a pt with small aortic anatomy unsuitable for transfemoral/subclavian approach

- A decision was made to use a Sapien S3 20 valve with simultaneous wire protection of the LM
- Plan for a contrast media free implantation
- Very slow inflation
- 15-20% below the fluoroscopic marker in the sewing ring (ViV App)
TAVI VIV in a pt with small aortic anatomy unsuitable for transfemoral/subclavian approach

Set up

Sapien S3 20 (very) slow inflation

Amplatz super stiff

Certitude 14

EBU 3.5

BMW heavyweight
87 yo, female, severe AS (mean Gr 56 mm Hg), Euroscore I: 29% with small anatomy

<table>
<thead>
<tr>
<th>Sinus of Valsalva Diameter (mm)</th>
<th>24.6</th>
<th>24.9</th>
<th>23.7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LCC</td>
<td>RCC</td>
<td>NCC</td>
</tr>
<tr>
<td>Sinus of Valsalva Height (mm)</td>
<td>16.5</td>
<td>18.3</td>
<td>14.3</td>
</tr>
<tr>
<td></td>
<td>LCC</td>
<td>RCC</td>
<td>NCC</td>
</tr>
<tr>
<td>Coronary Ostia Height (mm)</td>
<td>10.5</td>
<td>11.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>Right</td>
<td></td>
</tr>
<tr>
<td>LVOT Diameter (mm)</td>
<td>13.3</td>
<td>24.6</td>
<td>19.0</td>
</tr>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Mean</td>
</tr>
</tbody>
</table>
87 yo, female, severe AS (mean Gr 56 mm Hg), Euroscore I: 29% with small anatomy

First things first: Valvuloplasty Numed 18 x 400
87 yo, female, severe AS (mean Gr 56 mm Hg), Euroscore I: 29% with small anatomy

First things first: Chimney procedure
Conclusions

• Coronary obstruction during TAVR is still, one of the last serious procedural complications associated with high mortality rates.
• Low LM height, shallow SOV and VIV procedures contribute to higher risk for coronary occlusion during TAVR.
• The use of a balloon expandable valve is associated with a much higher risk of coronary obstruction during TAVR than a self expandable valve.
Conclusions (cont’d)

• In partial obstruction, the success rate of coronary dilatation is very high
• Prevention is best utilized using a meticulous preprocedural imaging and measurements
• Prevention and treatment during the procedure, is best utilized with pre-emptive coronary protection for high risk patients
Patient History

81 years, female, BMI=26, hypertensive, severe COPD, (previous pneumonectomy), chronic renal failure (baseline Cr: 2.0 mg/dl), anemia, CAD (SVG → RCA) and surgical bioprosthetic valve replacement (Sorin Soprano No 18) 4 years ago with recent onset of dyspnea and hospitalization with acute pulmonary edema (Euroscore I: 47%, STS: 11).

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pre-TAVR evaluation

Baseline CAA
pre-TAVR evaluation
TAVI VIV in a pt with small aortic anatomy unsuitable for transfemoral/subclavian approach

How to tackle the issue:

• Send pt for SAVR
• Just don’t do it
• More VKA/ LMWH
• TAVR with transapical approach ± LM protection
• Any other suggestion (?)
Immediately post TAVR

- Hemodynamics are fine, ACT = 354 s
- The same for EKG
- Do we need to assess valve function (TTE, TEE, aortography)?
- Do we need to assess LM patency?
Sometimes TAVI is Not Just a Valvular Procedure!

- Immediately post TAVI ➔
  - Filling defects @ LAD & LCX
Sometimes TAVI is Not Just a Valvular Procedure!

Export → thrombus aspiration @ the LAD and LCX followed by balloon inflations @ the LCX
Sometimes TAVI is Not Just a Valvular Procedure!

Something needs to be done about that LCX!
Sometimes TAVI is Not Just a Valvular Procedure!

Prox Bifurcation $\rightarrow$ provisional stenting
Rewiring & Ballooning of the OM1

Distal Bifurcation $\rightarrow$ TAP stenting
POT, Rewiring & Ballooning of the OM2, KB, rePOT

Resolute Int 3.0 x 26
Resolute Int 2.75 x 18
Resolute Int 2.75 x 22
Sometimes TAVI is Not Just a Valvular Procedure!
Conclusions

• In TAVR expect the unexpected
  • be careful of the prolonged pacing?
  • and ...of the protective coronary wiring?
• always study carefully the CT/TOE to identify possible thrombi
• urgent coronary flow restoration/revascularization maybe needed
Conclusions

• Coronary occlusion is making a resurgence

• Must increase index of suspicion based on preprocedural imaging even if does not meet traditional criteria

• Some mechanisms are still poorly understood