How to Assess Coronary Obstruction Risk on CT Prior to Aortic Valve-in-Valve Procedures

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Disclosures

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Edwards Lifesciences
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SPH Cardiac CT Core Lab, providing services to
Edwards Lifesciences
Neovasc
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Medtronic
Coronary obstruction in Valve-in-Valve Procedures

Background

Original Investigation

Transcatheter Aortic Valve Implantation in Failed Bioprosthetic Surgical Valves

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- 459 patients with failed surgical bioprostheses
- Coronary obstruction in 2% of ViV procedures (3.5% 2012)
- Predisposing valve types: internally stented Mitroflow, Trifecta, stentless
Complications Remain - Ostial Coronary Obstruction

Center #11, case#11
Mosaic 21mm (ID 18.5mm)
Transapical Edwards-SAPIEN 23mm

Center #37, case#9
Mitroflow 21mm (ID 17.3mm)
Transapical Edwards-SAPIEN 23mm

Center #34, case#6
Mitroflow 21mm (ID 17.3mm)
Transfemoral CoreValve 26mm

Center #13, case#4
Sorin Freedom Stentless 23mm (ID 21mm)
Balloon Valvuloplasty
before attempted CoreValve implantation

Center #29, case#7
Sorin Freedom Stentless 21mm (ID 19mm)
Transfemoral CoreValve 26mm

Center #27, case#3
CryoLife O’Brien (stentless) 25mm (ID 23mm)
Transfemoral CoreValve 29mm

Center #13, case#11
Mosaic 21mm (ID 18.5mm)
Transapical Edwards-SAPIEN 23mm

Courtesy of Danny Dvir/VIVID Registry
Coronary obstruction in Valve-in-Valve Procedures

Valve design

Mitroflow #27 in an aortic root model

Valve-in-Valve with SAPIEN 29mm

Dvir et al. 2014
Coronary obstruction in Valve-in-Valve Procedures

Potential risk factors

• Anatomic factors
  • Narrow sinotubular junction/low sinus height
  • Narrow sinuses of Valsalva
  • Previous root repair (eg. root graft and coronary reimplantation)
  • Low-lying coronary ostia

• Bioprosthetic valve factors
  • Supra-annular position vs. Intra-annular
  • High leaflet profile
  • Internal stent frame (eg. MitroFlow, Trifecta)
  • No stent frame (homograft, stentless valves)
  • Bulky leaflets

• Transcatheter valve factors
  • Extended sealing cuff
  • High implantation
Assessment for Valve-in-Valve Procedures

Anatomical issues and potential measurements

Common native root anatomy measures:
- Coronary artery height
- Sinus of Valsalva with
- Sinus height

Distortion of Anatomy
- Tilting of the surgical prosthesis
- Lower coronary height

Prediction of the proximity of the coronary ostia to the anticipated final position of the displaced bioprosthetic leaflets after THV implantation
Assessment for Valve-in-Valve Procedures

Virtual THV to Coronary (VTC) distance

Assessment for Valve-in-Valve Procedures

Virtual THV to Coronary (VTC) distance

**Step 1:** Identify SHV, e.g. using a volume rendering

**Step 2:** Center cross-hairs with SHV

**Step 3:** Manipulate cross-hairs for double-oblique transverse plane to match basal ring (here three valleys, white arrows); center of cross-hairs centered within basal ring (asterisk)
Assessment for Valve-in-Valve Procedures

Virtual THV to Coronary (VTC) distance

Step 4: Move double-oblique transverse plane to level of coronary ostium (here left main, white arrows); rotate views for better visualization of coronary ostium.

Step 5: Simulate THV e.g. using a region of interest of a specific diameter (dashed circle, center matches center of cross-hairs); subsequently assess VTC as distance measurement between simulated THV and coronary orifice (green line).
Assessment for Valve-in-Valve Procedures

Virtual THV to Coronary (VTC) distance

Advanced postprocessing

Pay attention to STJ above ostium as sealing may occur up there!
Assessment of valve type: Stented vs. stentless?

- Stented
  - Level of coronary ostia: Above stent posts?
    - yes
      - Potential risk of coronary occlusion: VTC assessment
    - no
      - No risk of coronary occlusion, no further action
  - Coronary height and SoV assessment
Assessment for Valve-in-Valve Procedures

Virtual THV to Coronary (VTC) distance

Minimal distance to sinus wall/STJ above left main ostium - 20mm THV

Comment: VTC 6.3 mm for 20mm THV, 4.8 mm for 23mm THV, 3.3 mm for 26mm THV

Non-contrast images are sufficient, but need to be gated!
Assessment for Valve-in-Valve Procedures

Example

Dvir et al. 2014
Assessment for Valve-in-Valve Procedures

Virtual THV to Coronary (VTC) distance

![Graph showing distribution of patients according to VTC-LCA (mm)](image)

P < 0.001

Magic number – 4mm?

VIVID Registry, presented at TCT 2016 (Ribiero et al)