TAVI IN BICUSPID AOV AND VALVE-IN-VALVE

Petros S. Dardas, MD, FESC
St Lukes’ Hospital
Thessaloniki, GREECE

6ο ΣΥΝΕΔΡΙΟ ΔΙΑΚΑΘΕΤΗΡΙΑΚΗΣ ΘΕΡΑΠΕΙΑΣ ΚΑΡΔΙΑΚΩΝ ΒΑΛΒΙΔΟΠΑΘΕΙΩΝ ΑΘΗΝΑ 2017
BICUSPID AOV
Surgical experience

- **Annulus** – larger than anticipated
- **Sizing is difficult** – oval annulus
- **Calcification** – can be extensive, especially under the commisure
Potential Problems in Bicuspid Valves

- Often heavily calcified
  - Incomplete valve expansion
  - Paravalvar leak
  - Annulus rupture
- Frequently associated with ascending aortic aneurysm
  - Risk of rupture/dissection
- Oval shaped valve area
  - Risk of paravalvar leak
  - Long-term durability of the TAVI valve?

For these reasons bicuspid valves had been excluded from all randomized trials

Relative contraindication for TAVI according to guidelines
Pre vs. Post Implant MSCT
Sizing: What are the options?

**Annular method**
Perimeter - 73.2 mm
Area - 393 mm²
Diameter 27 x 17 mm

29 mm CoreValve

**Commissure-to-Commissure**
Diameter 25.9 mm

29 mm CoreValve
Self-Expandable TAVI in BAV: Experience from West China Hospital

Balloon size = shorter annulus diameter

- Annulus size = balloon size + 3 mm
- Select the valve accordingly

- Annulus size > balloon size + 3 mm
- Select a 1-size (3-mm) larger valve

Zhen-Gang ZHAO, CSI 2015
Valve size in bicuspid valves

• Avoid oversizing
  - Risk of rupture

• Usually it is safe to undersize
What is the Evidence?

- 139 patients w/ Bicuspid Aortic Valve (type 0, 1, and 2)
  - Balloon Expandable THV=41 patients
  - Self Expandable THV=91 patients
- Encouraging short/intermediate term results
- Increase incidence of AR
  - Mitigated with proper CT sizing

*Mylotte, J Am Coll Cardiol. 2014;64(22):2330-233*
Performance of transcatheter aortic valve implantation in patients with bicuspid aortic valve: Systematic review

Altayyeb Yousef a,1, Trevor Simard a,1, Ali Pourdjabbar a, John Webb b, Derek So a, Aun-Yeong Chong a, Christopher Glover a, Michel Le May a, Benjamin Hibbert a, Marino Labinaz a,.*

a Division of Cardiology, University of Ottawa Heart Institute, Ottawa, Ontario, Canada
b Division of Cardiology, St. Paul's Hospital, University of British Columbia, Vancouver, British Columbia, Canada

• Literature Review – 92 patients
• 56% self expanding, 77% TF
• 8.6% 30 day mortality
  – 2 from aortic dissections
• PVL moderate to severe in 31%
• Long term survival good
More Evidence in Favor of Bicuspid

- 51 Patients with Bicuspid Aortic Valve anatomy underwent THV with SAPIEN 3 valve
- No Embolization Noted
- PVL
  - None/Trivial AR noted in 63%
  - Mild AR in 37%
  - No moderate or severe PVL noted
Venus A Trial – 1 yr survival

Cumulative incidence of Survival

No. at risk

Days post procedure

Bicuspid 44 41 40 30
Tricuspid 53 51 51 43
Who Should We Not Treat?

• Aortopathy (>4.5 cm) if operative

• Younger, lower risk?
  – Calcification pattern
  – Size

• Grossly too large

• Coronary Anatomy
Case 1

Cardiac Team Work

- 75 female
- Coarctation operated 1969
- CABG x 2 1999
  - LIMA - LAD
  - Gastroepiploic – dom Cx
- Bilateral carotid stenting
- Increasing SOB and angina
• ECHO
  – Severe AS – gradient 65mmHg, AVA 0.6 cm²
  – **Bicuspid valve**
  – EF 40%
  – PHT 55mmHg
  – Asc Ao = 4.0 cm

• LHC
  – Patent grafts
  – Severe peripheral vessel disease – severe iliac stenoses
  – Severe L subclavian disease
• EUROSCORE 22.5%
• TRANSAORTIC TAVI
• CORE VALVE 26 mm
Mini aortotomy

Wire in LV
Valve expanded

Fully expanded – minimal AR
Final result 2 D echo
TIPS AND TRICKS - BICUSPID

- CT sizing either annular or supraannular
- **Smaller valve downsize** according to supraannular commissure to commissure size
- **Predilatation and balloon sizing** for heavy calcification
- **High implantation** as true stenosis is not at the annulus but slightly higher
- Both projections to assess valve
- Bicuspid valve: **ao fragile**
- Oval shape post implantation **don’t overexpand** because valve may disrupt – especially in LVOT calcification
Valve in Valve
VIV - attractive treatment option

Avoids redo operation
  Less trauma
  Faster recovery

Easier Procedure
  Less/no contrast
  Near Perfect Implant zone

Every patient with degenerated Surgical valve is NOT for VIV
Main Concerns with VIV Aortic

- SHV
  - Malposition
  - High Gradients
  - Coronary Obstruction
- THV
- Native anatomy
Sizing the Surgical Prosthesis

Which Measurement is Most Relevant?

- Stent ID – ID without leaflets
- True ID – ID with leaflets
Why use True ID - Example

- Helps choose correct size TAVI Valve to avoid excess oversizing

**CE Porcine: size 27**

**Stent ID - 25**

**True ID – 23**

**Sapien XT - Not 29 but 26**

**CoreValve - Not 29 but 26**
Impact of Leaflets on True ID of Prosthesis

True ID = Stent ID – Leaflets

Porcine 2mm → Bovine Pericardium Inside Stent 1mm → Bovine Pericardium Outside Stent 0mm

* Courtesy V. Bapat
Sizing the Prosthesis

CT Measurement

Limitations
- Blooming artifact
- Unclear what is measured: Stent, Leaflets, Pannus

Valve ID: 20.2 x 21.5 mm
Valve in Valve App

Valve In Valve

Supported by NIHR Biomedical Research Centre at Guys' and St. Thomas' NHS Foundation Trust and KCL

Developed by Mr. Vinayak (Vinnie) Bapat in conjunction with the technology company UBQO Limited

www.ubqo.com/viv

Enter

Surgical Valves

Aspire

Fluoroscopic Part
Fluoroscopic Markers - Sewing ring and stent post tip

Biocor / Epine

CE SAV

CE Standard

Hancock

Intact

Magna

21

23

25

Image scrolls horizontally
Valve in Valve App

Review this information just before each case!
Correct Placement Requires Understanding of Valve Geometry

- Narrowest Portion – Sewing Ring
- Identifying Sewing Ring Crucial
- Place Sapien 15% Below Sewing Ring

Biocor/ Epic – Thin wire at the level of sewing ring

* Courtesy V. Bapat
Sewing ring is visible

Hancock 2

Sewing ring not always visible

CE Standard: Intra-annular design

CE SAV: Supra-annular design

Stentless Bioprostheses

Homograft

Freestyle Root

Lack of stent frame and fluoroscopic markers makes the procedure difficult.
What is the proper location?

- Valve should be positioned based on neo-annulus
  - Sapien – 10-15% below
  - CoreValve – 4-5mm below

- Malposition leads to improper seal and anchoring
  - Too high
    - Embolization
  - Too low
    - PVL
    - Poor hemodynamics

- Repositional valve helpful
Malposition and embolisation

Incidence

- Stentless > Stented
- Mosaic > other stented SHVs
- Experience – Unfamiliarity with SHV
- Time
Evaluation of Medtronic CoreValve Evolut R Valve Size and Position on Valve-in-Valve Hemodynamics
Perimount 21mm
CoreValve 23mm
**Depth: 1.3mm**
Post mean gradient: 11mmHg

Perimount 21mm
CoreValve 23mm
**Depth: 6.2mm**
Post mean gradient: 25mmHg

Perimount 21mm
CoreValve 23mm
**Depth: 9.8mm**
Post mean gradient: 24mmHg

Simonato M. CircCvInt 2016
Perimount 21mm
SAPIEN 23mm
Depth: 0.41%
Post mean gradient: 17mmHg

Perimount 21mm
SAPIEN 23mm
Depth: 25.41%
Post mean gradient: 33mmHg

Pericarbon 21mm
SAPIEN 23mm
Depth: 43.93%
Post mean gradient: 50mmHg

Simonato M. CircCvInt 2016
Implantation Depth and Gradients

CoreValve Evolut (n = 159)

- Depth ≤ 5mm: 15%
- 5mm < Depth < 10mm: 34.5%, p = 0.02
- Depth ≥ 10mm: 34.3%

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Multivariate Analysis
Elevated Post-Procedural Mean Gradients

- High Implantation (vs. low)\( p < 0.001 \)
- CoreValve use (vs. SAPIEN XT)\( p = 0.02 \)
- Male sex (vs. Female)\( p = 0.11 \)
- Age (yrs.)\( p = 0.09 \)
- Left ventricular ejection fraction (%)\( p = 0.63 \)
- Small surgical valve (vs. larger valves)\( p = 0.29 \)
- Stenosis and mixed failure (vs. regurgitation)\( p = 0.002 \)

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Coronary Obstruction

- Function of
  - Smaller anatomy
  - Narrow sinuses
  - Oversizing - Stent post deflection
  - Valves with leaflet outside the stent

Low  

High
Wide sinuses
No or low risk

Narrow Sinuses
Higher risk
Screening for Coronary Occlusion

- Aortogram – Relationship of posts to coronary ostia
- CT Scan
  - Coronary ostia
  - Sinus width
Be Cautious with Certain Valve Types

3F Valve

Mitroflow

St. Jude Trifecta
Stentless Valves

Challenging

- Not visible under fluoroscopy
- No anchor
- ID - Affected by implantation method

Highest risk of Coronary obstruction and malposition
Tips and tricks

- Slow deployment
- Contrast injections
- Wire in Coronary
- Use of Echo
- Use repositionable devices
Transcatheter aortic implants in failed valves (VinV) (n = 1,360)

- Stented Valve in Valve (n = 1,130)
- Stentless Valve in Valve (n = 230)

Tricuspid Valve in Valve / Valve in Ring

Patients undergoing procedures in 114 sites in Europe, North-America, Australia, New Zealand, South Africa, South America and the Middle-East (n = 2,012)
Patients after Aortic Valve-in-Valve Implantation

Death from any cause (%)

No at risk:
459  289  258  237  228

Months

16.8%
Coronary Obstruction Following Transcatheter Aortic Valve Implantation for Degenerative Bioprosthetic Surgical Valves: Insights from the Valve-in-Valve International Data (VIVID) Registry

34 / 1,508 (2.25%)

**Correlates per Multivariate analysis:**

Stentless surgical valves (OR 8.76, p<0.001)

Stented with externally mounted leaflets (OR 4.95, p=0.001).

Thirty-day mortality was 52.9% in the coronary obstruction group vs. 3.9% in the control group.
Summary

1. Know the surgical valve well
2. Use True ID
3. Look out for Coronary obstruction
4. Consider repositionable devices for stentless valves
CASE 1 – valve in valve

- 84 MALE
- AVR bioprosthetic MITROFLOW 23 – 8 years ago
- Renal failure – hemodialysis
- Severe heart failure – NYHA IV
- Repeated episodes of pulmonary oedema
• **ECHO:**
  severe transvalvular AR - moderate AVR stenosis – moderate LV impairment

• **LHC:**
  moderate CAD

• **EUROSCORdE = 34.7**
VALVE in VALVE
CORE VALVE 23 mm
36 months later: NYHA II
CASE 2 – valve in valve

- 84 female
- AVR St Jude 2001
- AVR severe stenosis – mean gradient 55 mmHg
- Moderate LV dysfunction
- Acute LVF
- Logistic Euroscore 48.46%
EVOLUT R 23mm

Initial too deep

Recapture
EVOLUT R 23mm

Post dilatation

Final
EVOLUT R 23 mm ECHO
TIPS AND TRICKS – VALVE IN VALVE

- **CT assess length of native leaflets** if they disappear before appearance of the coronary ostia
- **CT overestimates size** measuring ring to ring and not contrast to contrast (includes leaflets)
- **In shallow sinuses** and VIV EVOLUT R lower
- **In cor occlusion retract valve** if cannot cannulate the cors
  - Cases at risk should be identified before – *redo surgery*
- **VIV very fast pacing**
- **VIV if in doubt use smaller valve** – size is not of significance
- **VIV tends to dive** during deployment – *implant higher*
- **VIV if balloon does not cross check if wire is crossed paravalvular with TOE**
- **Always use hemodynamics after VIV and gradient** Increased risk of thrombosis
  - Consider acoagulation if gradient increases gradually and bleeding risk low