

Optimal Sizing of Sapien 3 THV by MDCT : AMC Sizing Algorithm

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Only CT Before TAVR

- Suitable Aortic Root Anatomy
- Iliac and Femoral Anatomy
- Coronary Disease Status

No, Aortogram/Peripheral/Coronary angiogram

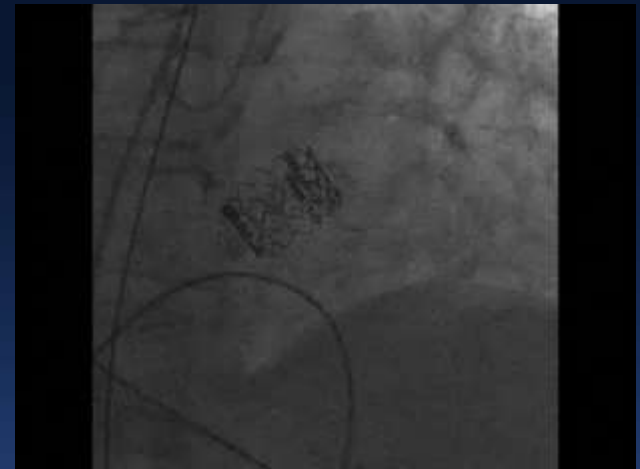
Sizing Matters

Oversize

Undersize



Annulus Rupture



PVL

VS.



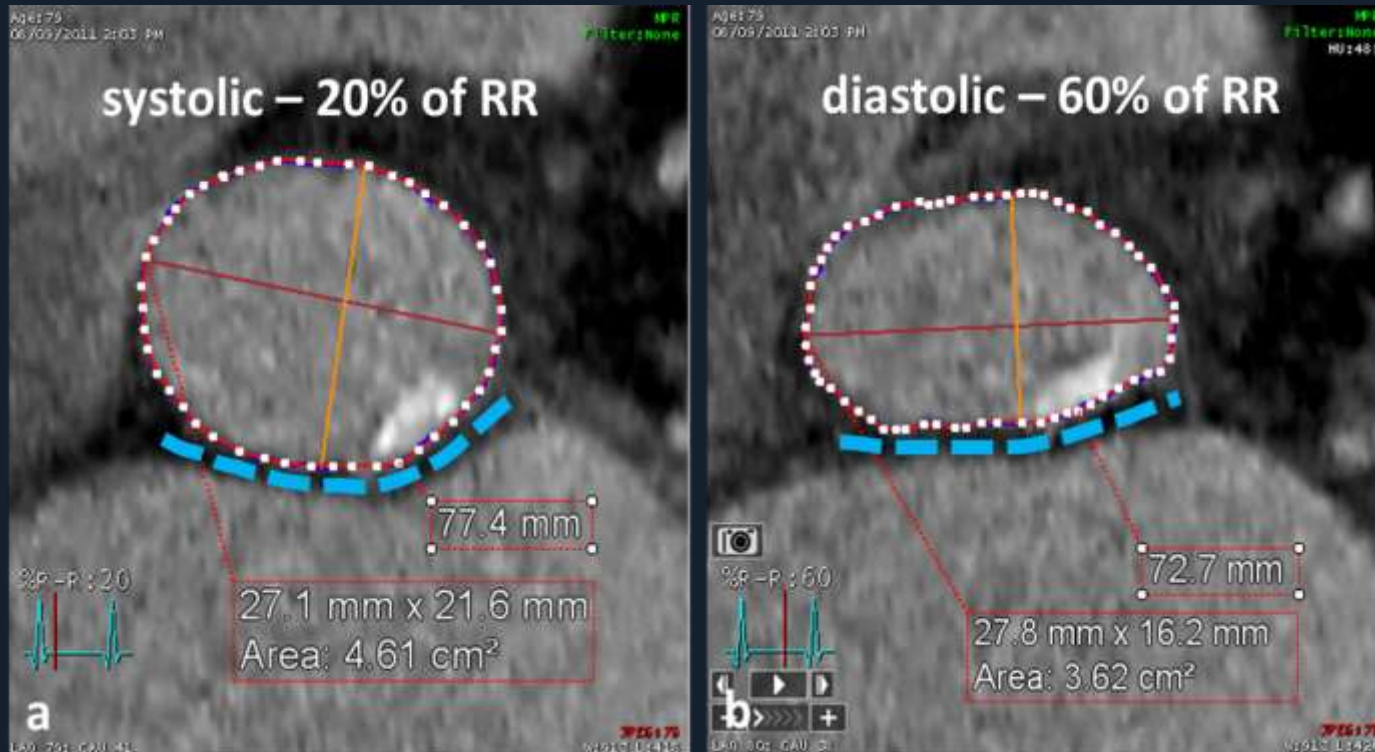
Contained Rupture



Embolization

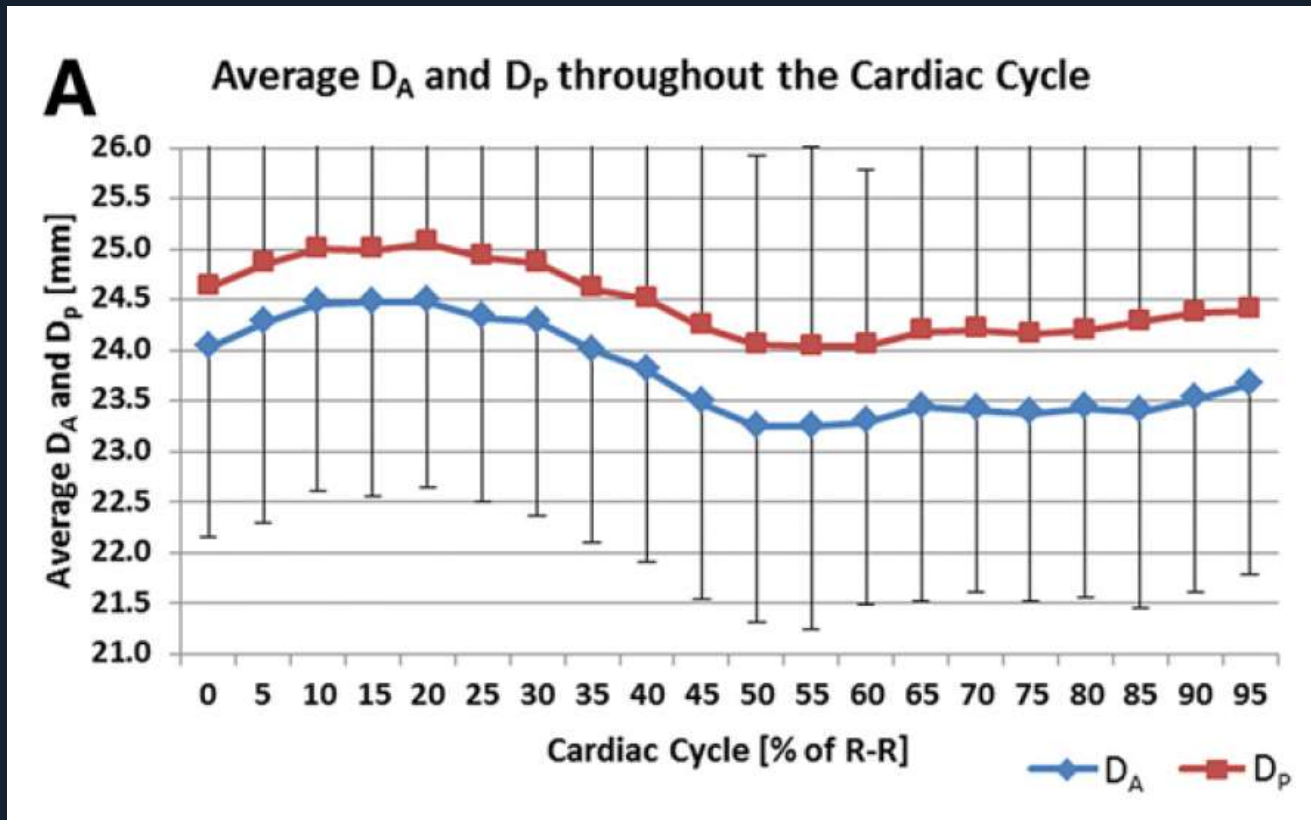
Annular dynamism

- Annular size changes throughout cardiac cycle



Annular dynamism

- Measure systolic / maximal annular area

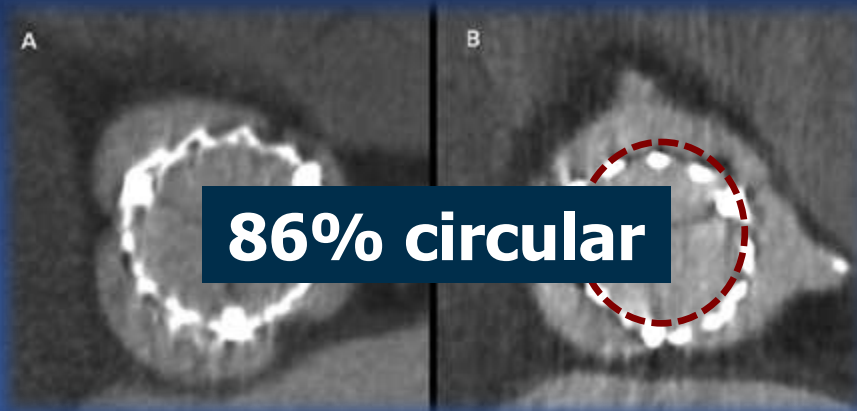


Circularization of the Annulus

Balloon-expandable prosthesis



Prosthesis “remodels”
the annulus

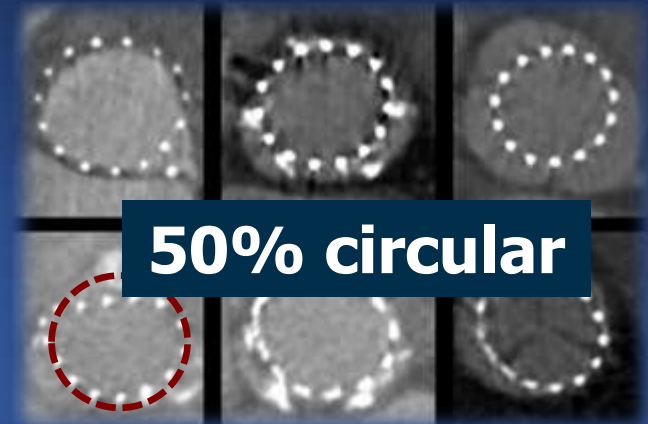


Delgado et al. Eur Heart J 2010;31:1114-1123

Self-expanding prosthesis



The “annulus”
remodels the prosthesis



Schultz C et al. JACC 2009; 54:911-8

How To Choose Valve Type (Balloon-Expandable vs Self-Expandable) in the TAVR Practice?

Mostly, depending on the physician's preference

1. Personal experience
2. Availability of device
3. Clinical and anatomical situations

**Until recently, there is no clear-cut criteria favoring
Specific type of device.**

Valve Type Selection in AMC

- **Size Matters:** Select valve with size in the “Safety Zone”
- **Prefer SAPIEN 3**
 - Less annular/subannular calcification
 - Annulus eccentricity (less eccentric)
- **Prefer EVOLUT R**
 - Severe heart failure (avoid rapid ventricular pacing)
 - Bicuspid valve with severe calcification
 - Low coronary height (<10 mm)
 - Larger annulus (>29 mm)
 - Smaller peripheral vessel diameter (<5.5 cm)

Size Selection for
Balloon-Expandable Valve

SAPIEN 3



$$\text{Area Oversizing \%} = \frac{\text{nominal Sapien 3 area}}{\text{Systolic annular area}} \times 100$$

Conventional S3 Sizing Chart



SAPIEN 3 Valve Size	23mm	26mm	29mm
Native Annulus Size By TEE	18-22mm	21-25mm	24-28mm
Native Annulus Area (CT)	338-430mm ²	430-546mm ²	540-683mm ²
Area-derived Diameter (CT)	20.7-23.4mm	23.4-26.4mm	26.2-29.5mm

External Valve Area of Sapien 3

THV Size

20 mm

23 mm

26 mm

29 mm



Nominal Area

328 mm²

409 mm²

519 mm²

649 mm²

Nominal Diameter

20.44 mm

22.75 mm

25.71 mm

28.75 mm

Nominal Perimeter

64.18 mm

71.44 mm

80.73 mm

90.28 mm

Optimal Target for Area Oversizing : SAPIEN 3

0%

5 - 15%

20%

Paravalvular
leakage

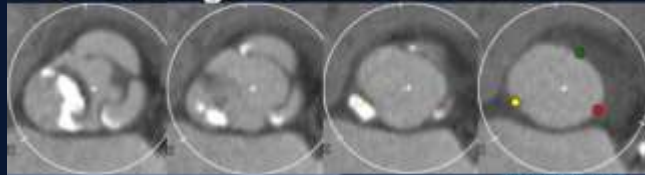
Optimal

Annulus
Rupture

PPM

CT Report of AMC

CT findings – Aortic annulus view



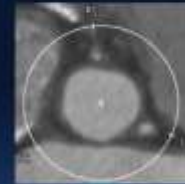
Annulus plane

Aortic Annulus parameters	
Annulus short diameter	23.3 mm
Annulus long diameter	26.9 mm
Annulus mean diameter	26.1 mm
Annulus area	522 mm ²
Annulus area-driven diameter	25.8 mm
Annulus perimeter	81.9 mm
Annulus perimeter-driven diameter	26.1 mm

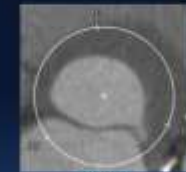
CT findings – Aortic Valve Complex CT findings – Aortic Valve Complex



Sinus of Valsalva



STJ



LVOT

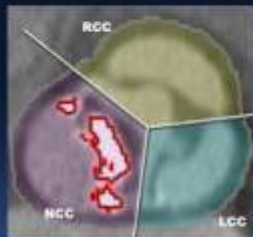
Sinus of Valsalva		STJ	
Area	874 mm ²	Area	438 mm ²
Sinus / Annulus Area Ratio	1.67	STJ/ Annulus Area Ratio	0.88
NCC diameter	36.6 mm	Mean diameter	24.1 mm
LCC diameter	30.4 mm		
RCC diameter	30.3 mm		

Mean Sinus / Annulus Area Ratio: 1.83 ± 0.29 Mean STJ / Annulus Area Ratio: 1.41 ± 0.31

LVOT	
Area	659 mm ²
LVOT / Annulus Area Ratio	1.26
Short diameter	25.2 mm
Long diameter	33.0 mm

Mean LVOT / Annulus Area Ratio: 0.93 ± 0.15

CT findings – Aortic Valve Complex



Calcium volume	
NCC	338 mm ³
RCC	2 mm ³
LCC	12 mm ³
Total	352 mm ³

CT findings – Coronary Height

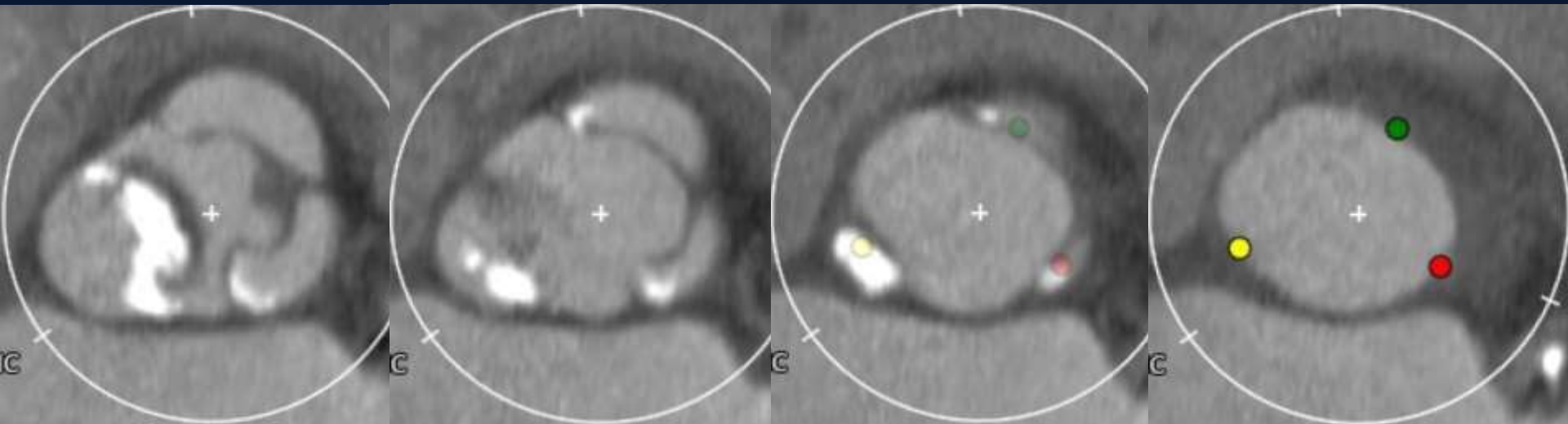


Coronary Height	
LCA	21.2 mm
RCA	16.1 mm

Sizing for Sapien 3

Size	Area_oversize (%)	Perimeter_oversize (%)
23	78.4	87.2
24	85.4	91.0
25	92.6	94.8
26	99.4	98.6
27	107.2	102.4
28	115.3	106.2
29	124.3	110.2

82/M – Aortic annulus view



Annulus plane

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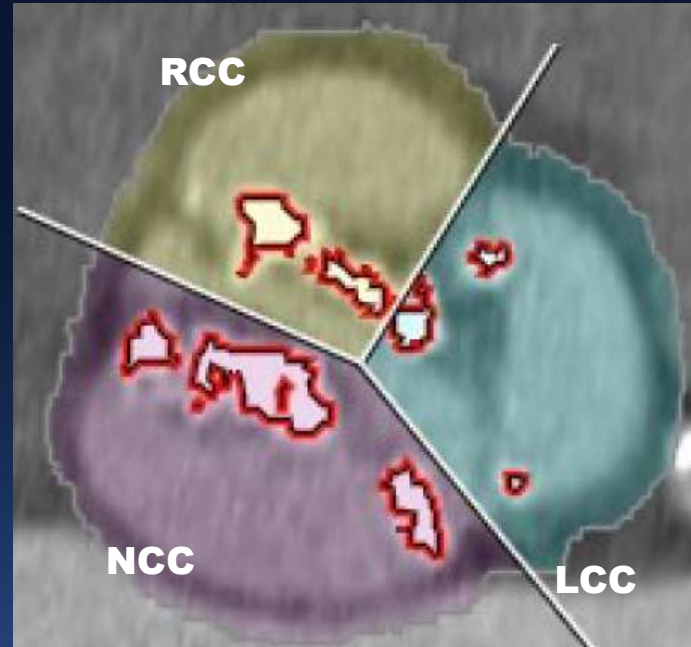
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Adjusting S3 Size by Balloon volume



CT findings – Aortic Valve Complex



**Mean Ca volume
365 mm³**

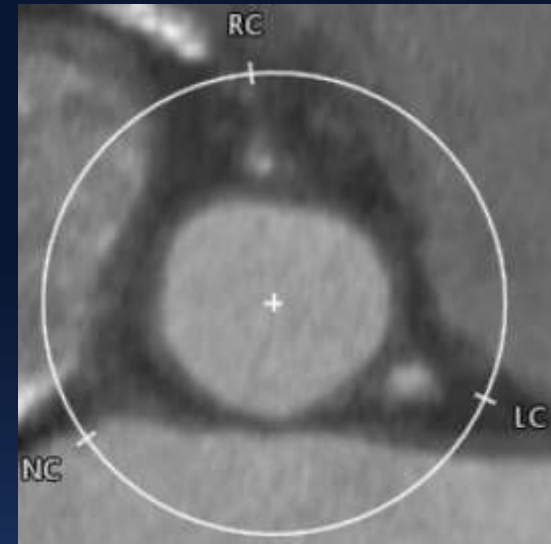
(Ca over 860 HU)

Calcium volume	
NCC	501 mm ³
RCC	242 mm ³
LCC	87 mm ³
Total	830 mm ³

Aortic Valve Complex



Sinus of Valsalva



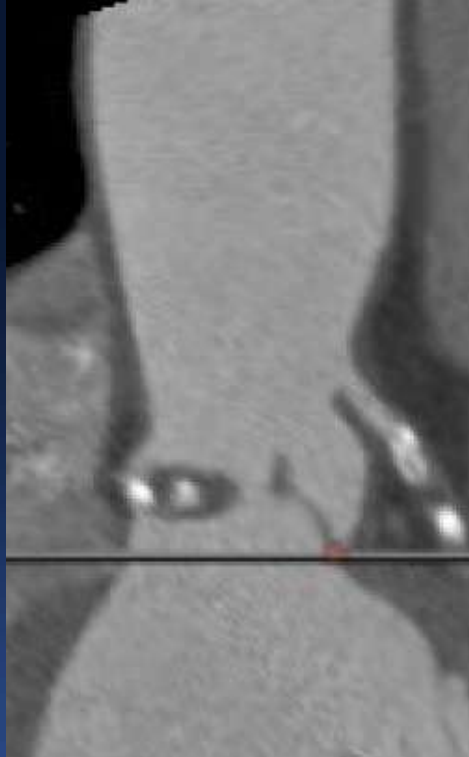
STJ

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Mean Sinus / Annulus Area Ratio **1.83 ± 0.29**

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CT findings – Coronary Height



Coronary Height	
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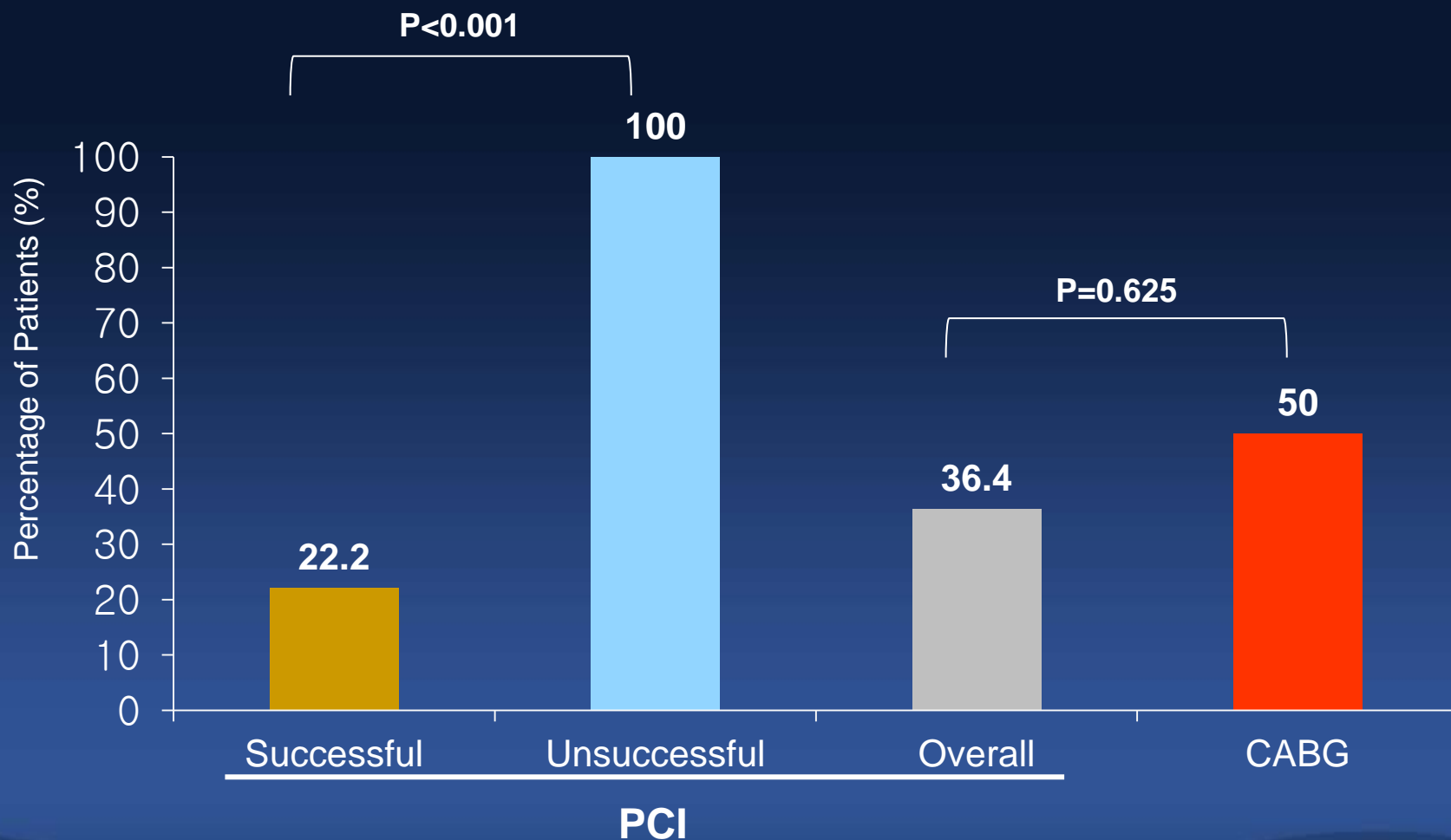
Coronary Obstruction

- The displacement of a **Bulky Calcified Native Valve** over a coronary ostium: The most cases
- An obstruction by a portion of the THV frame or the sealing cuff placed directly over a coronary ostium (hypothetically)

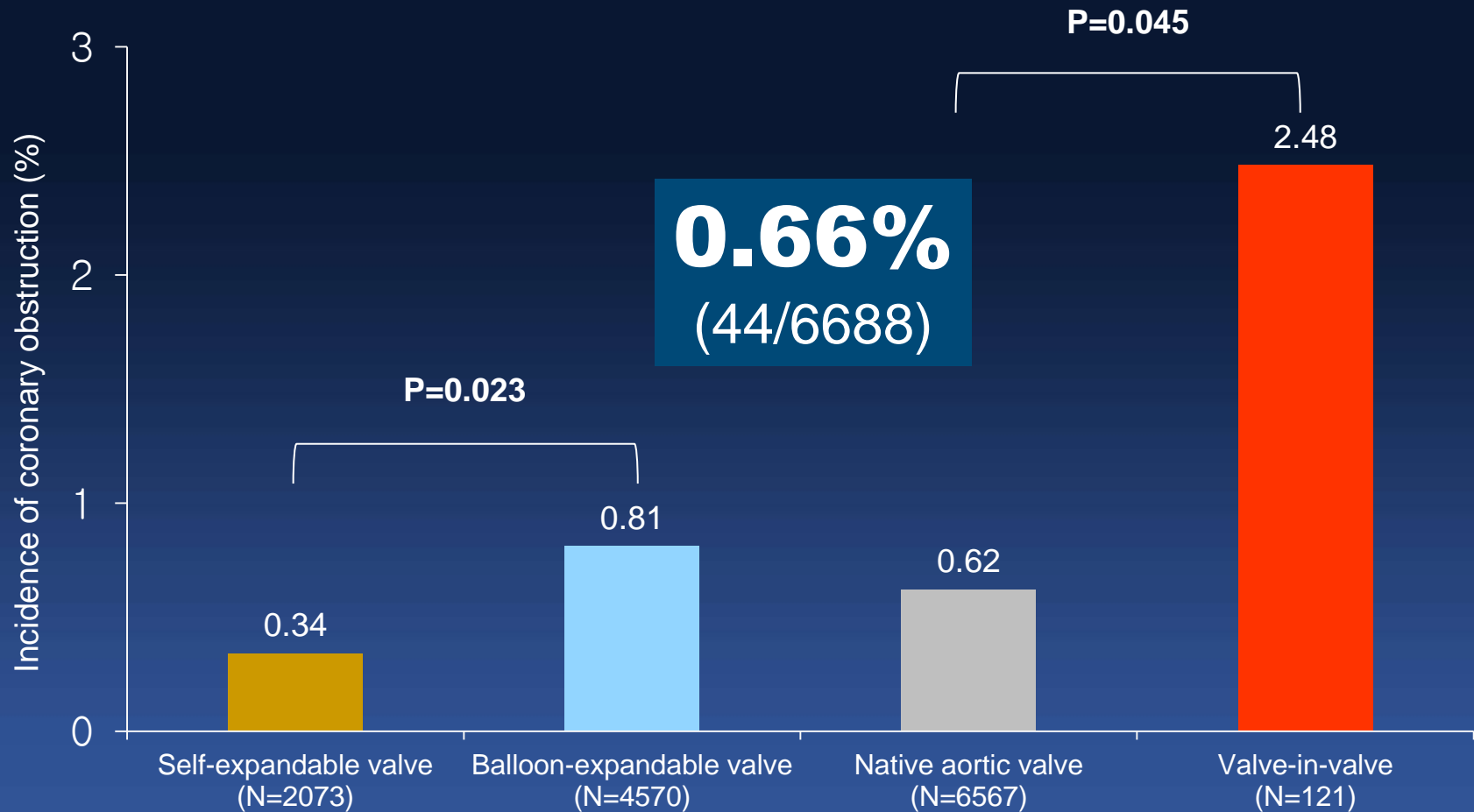
Interventional Cardiology Review, 2015;10(2):94–7

Coronary Obstruction

30 Day Mortality



Coronary Obstruction



Risk of Coronary Obstruction

Multifactorial

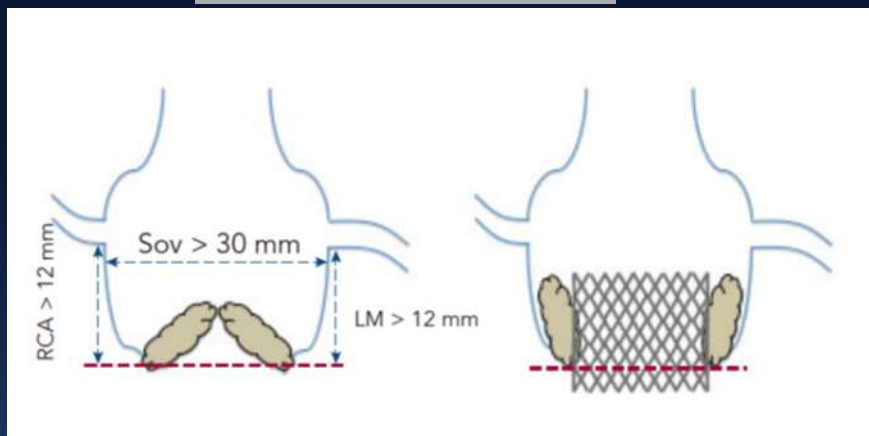
- Women
- Low Coronary Height (<10mm to <12mm)
- Shallow Sinus of Valsalva (<30mm)
- Long Leaflet
- Left Coronary Artery
- Bulky Calcification
- Valve Implantation Height
- Device (Balloon Expandable)

Yamamoto M, et al. Int J Cardiol. 2016 May 4;217:58-63

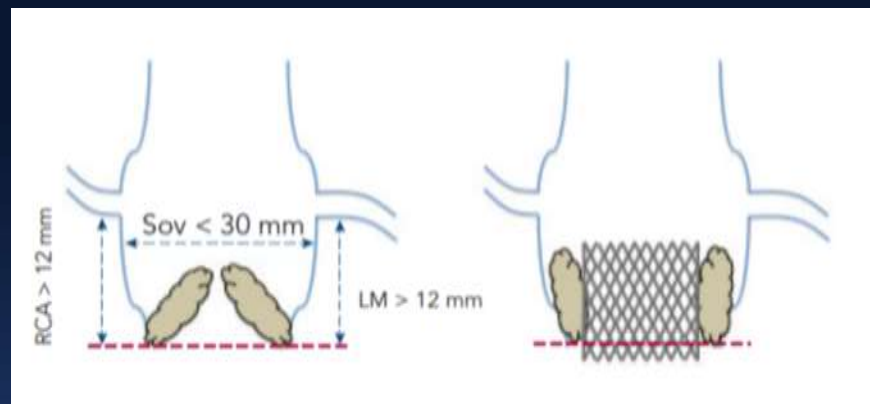
Riberiro HB, et al. J Am Coll Cardiol. 2013 Oct 22;62(17):1552-62

Coronary Obstruction

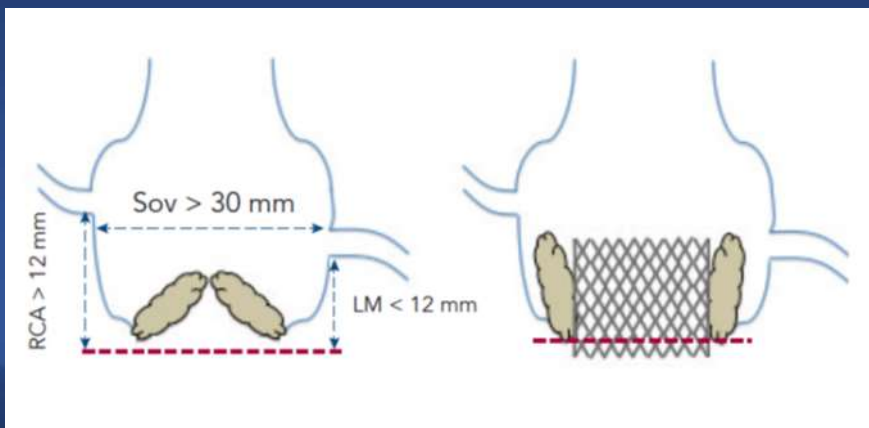
Wide and High



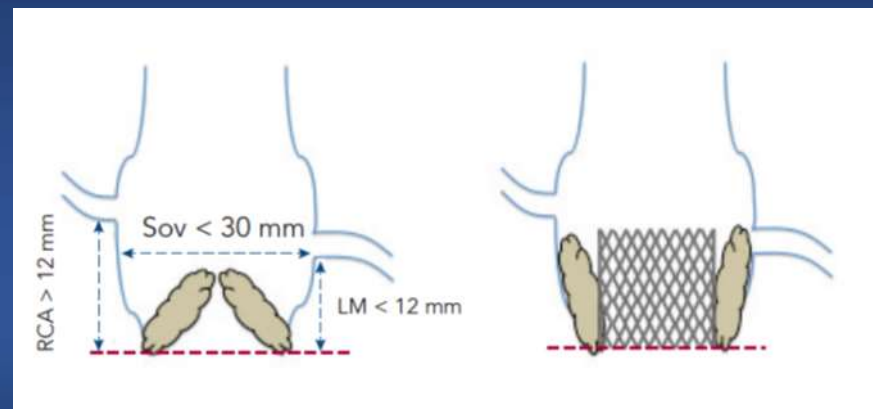
Shallow and High



Wide and Low

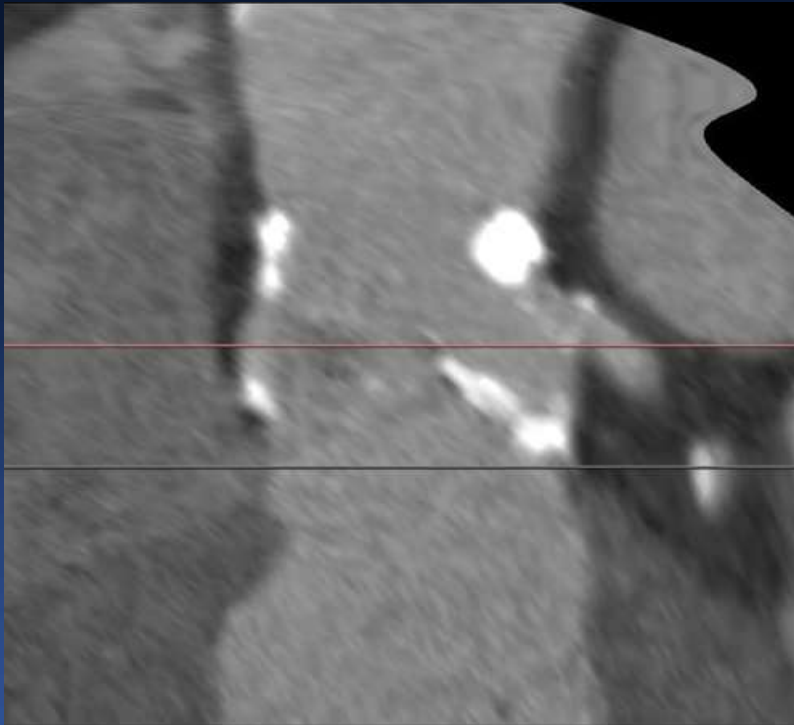


Shallow and Low



Low Coronary Height

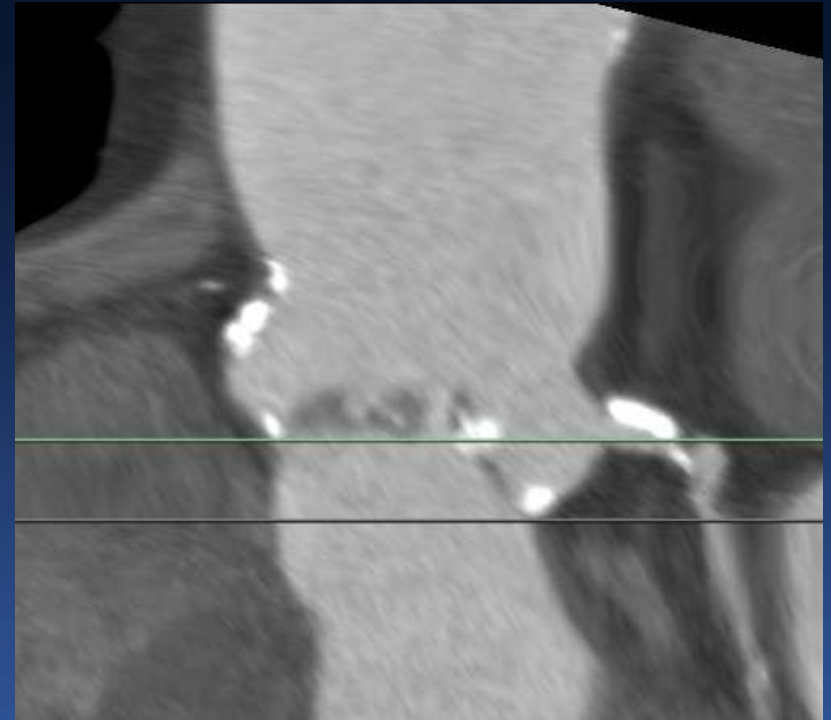
Patient 1



LCA Height 10mm

SOV 26 mm

Patient 2



LCA Height 7.8mm

SOV 33 mm

To avoid Coronary Obstruction

- If Sinus of Valsalva to Annulus area ratio < 1.5 & coronary Height < 10 mm,
 1. Smaller Oversizing (lesser than 10%)
 2. Consider Self-expandable Valve

ST Junction

- Small and significantly calcified ST junction can potentially lead to device displacement, aortic damage during procedure.
- In case of low (<15 mm) and small (STJ to Annulus area ratio < 1), we consider lesser oversizing.

LVOT



LVOT

LVOT	
Area	659 mm ²
LVOT / Annulus Area Ratio	1.26
Short diameter	25.2 mm
Long diameter	33.0 mm

Mean LVOT / Annulus Area Ratio **0.93 ± 0.16**

LVOT



- LVOT device landing zone calcification could be associated with paravalvular leakage, annulus rupture.
- In case of small (LVOT to annulus area ratio < 0.80) or calcified LVOT, we consider lesser oversizing.

AMC S3 Sizing Algorithm

Severe AS w/ tricuspid AV

10~15% Area Oversizing

Heavy Calcification
(Ca volume > 400 mm³)

5% lesser oversizing

Sinus of Valsalva to
Annulus Area ratio < 1.5
& Coronary height <10mn

**5% lesser oversizing
(or self-expandable valve)**

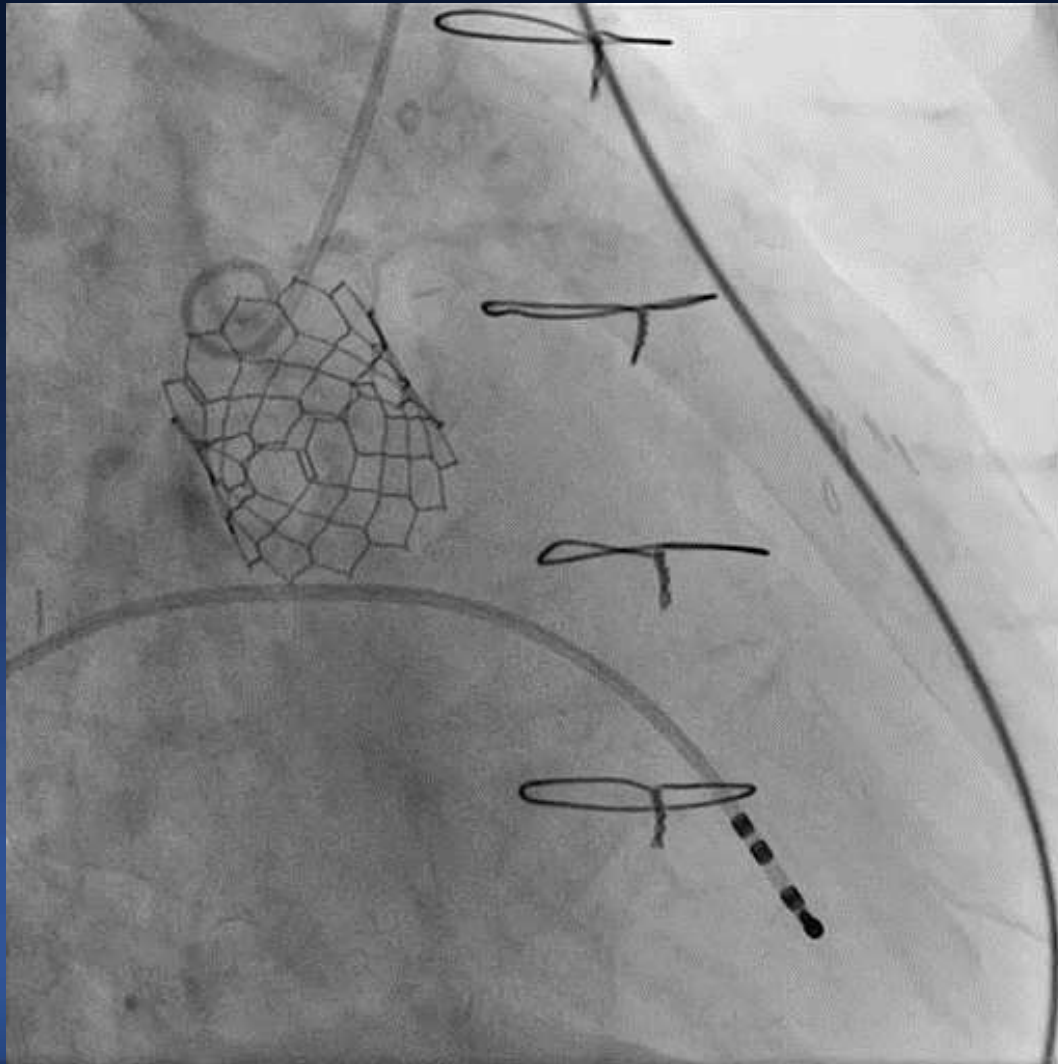
Small LVOT with
calcification

Consider more oversizing

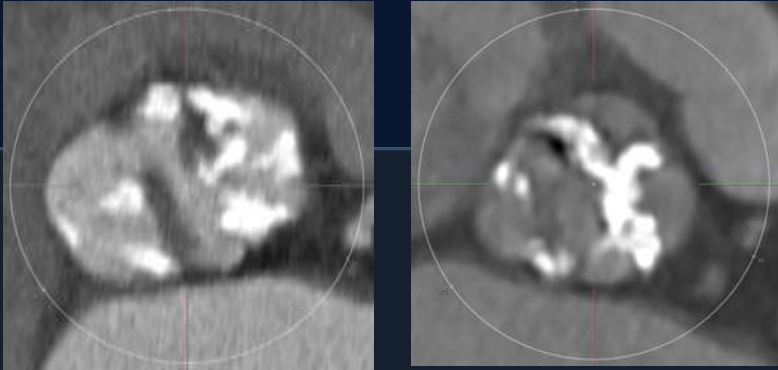
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TAVR with Sapien 3 26mm + 1cc



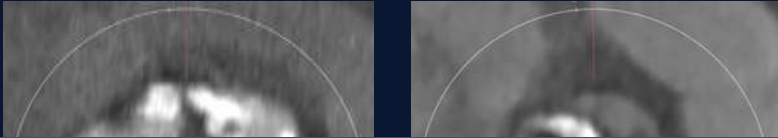
Bicuspid Aortic Valve



- Heavily calcified leaflet
- Calcified raphe
- Elliptical and larger annulus
- Combined dilated and/or horizontal aorta
- Lack of standardized annulus measurements



Bicuspid Aortic Valve



- In AMC, we use sizing as tricuspid valve, but, check balloon estimation before TAVR.

With this Sapien 3 Sizing Algorithm,

Only 2.2% implanted PPM,

Only 3.4% showed mod to severe PVL !!

Key message

- Achieve 5-15% area oversizing with Sapien 3
- Lesser oversizing is needed for valves with heavy calcification or high-risk feature of coronary obstruction.
- Comprehensive valvular assessment and size adjustment lead to better clinical outcome.