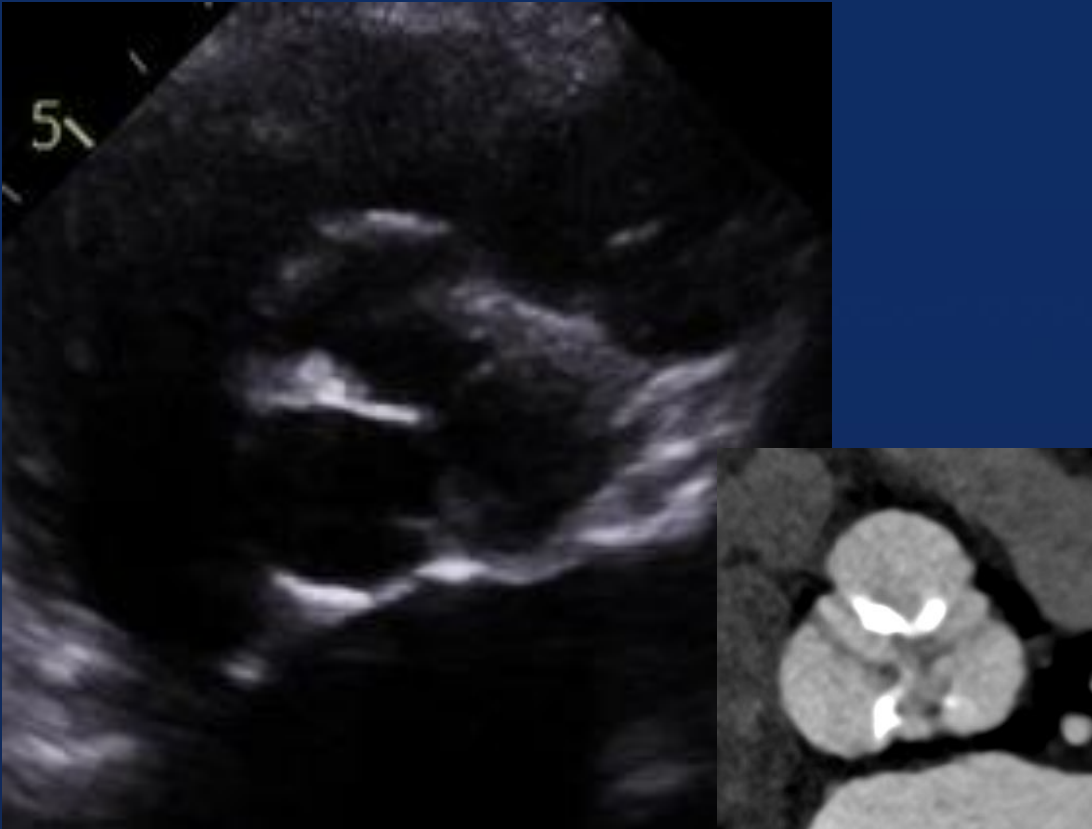


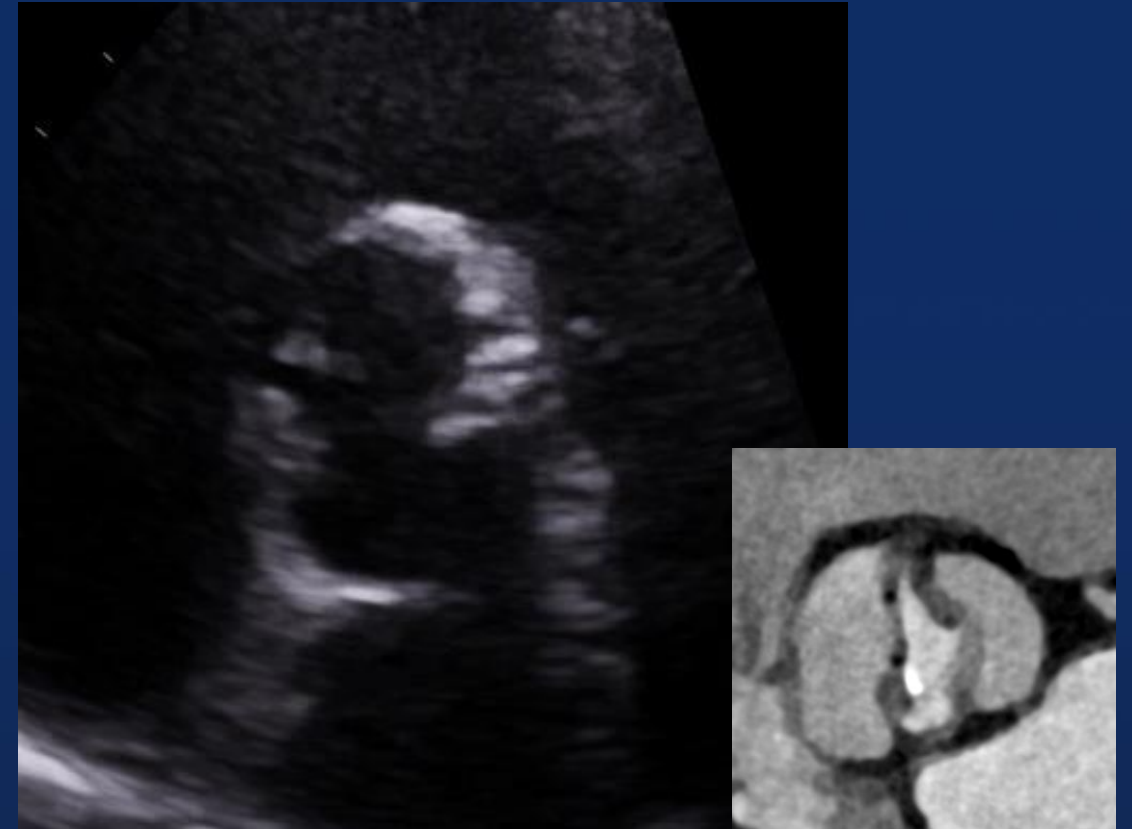
TAVR for Bicuspid

Ki-Nam LEE, RT
Cardiovascular Center, Anam Hospital
Korea University Medical Center
Seoul, Korea

Bicuspid Aortic Valve (BAV)

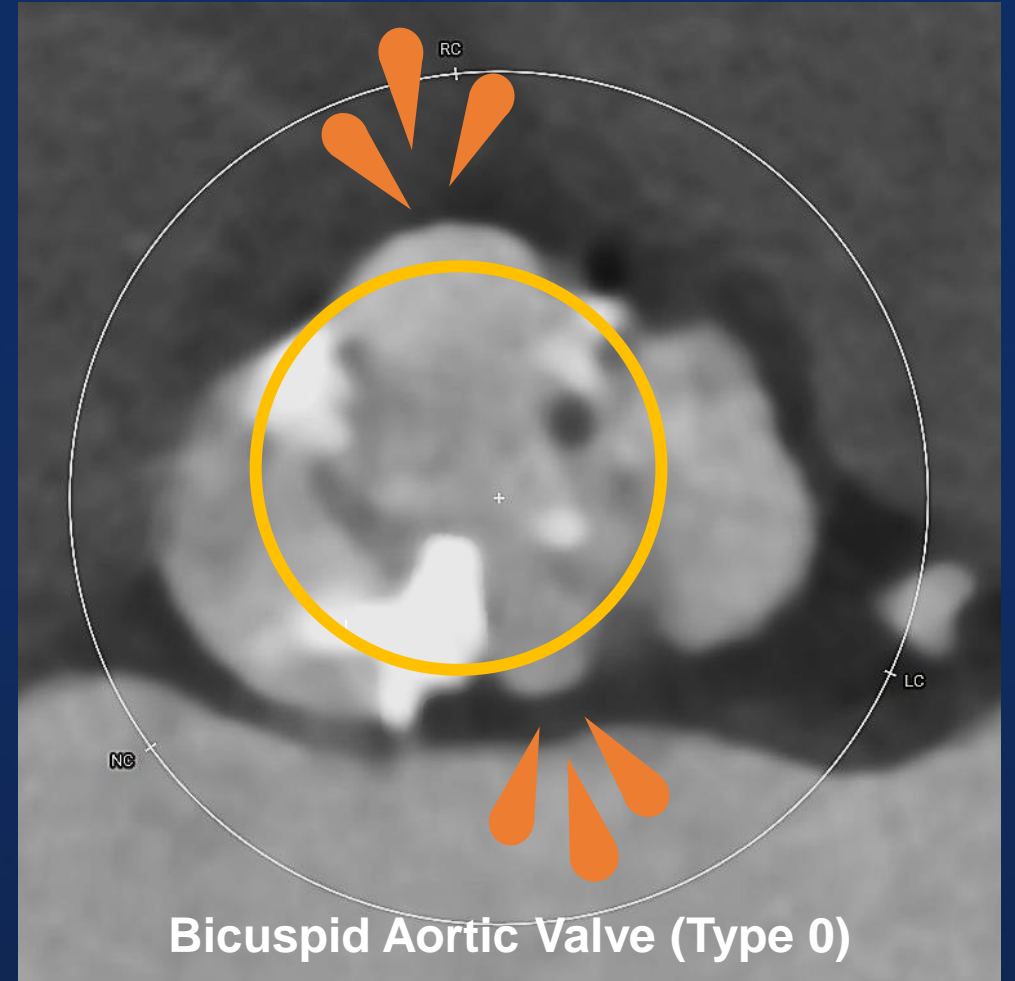
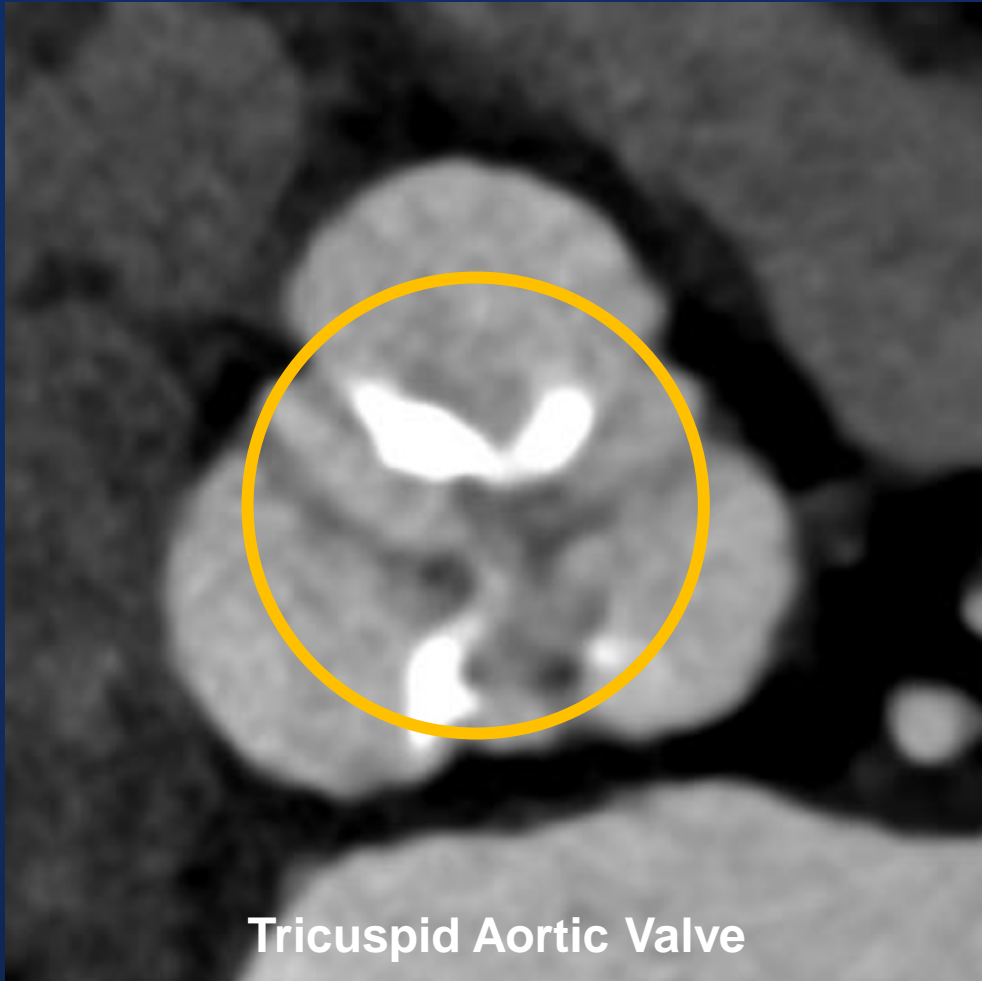


Tricuspid Aortic Valve



Bicuspid Aortic Valve (Type 0)

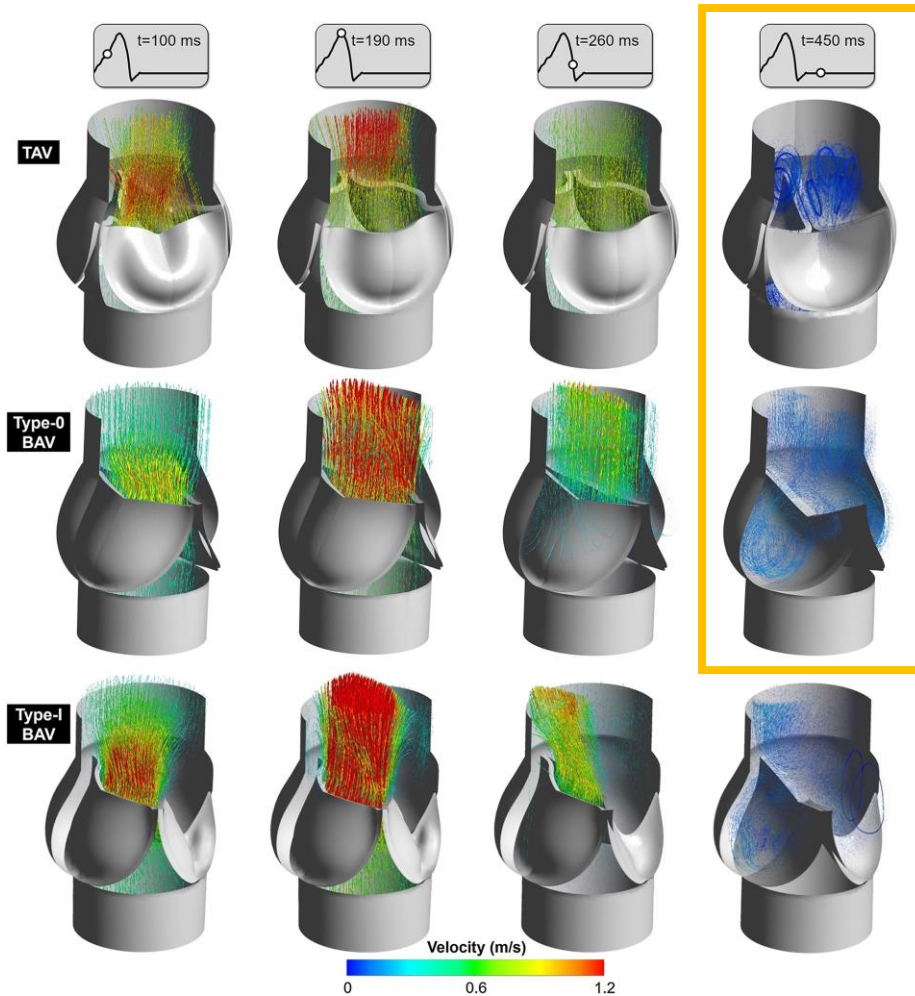
Bicuspid Aortic Valve (BAV)



BAV Pathophysiological Characteristics

- Congenital anomaly that 0.5% to 2.0% of the general population.
- Adults with a 3:1 male-to-female predominance.
- Calcification process begins at a relatively young age.

Why AR and AS are occurring in BAV

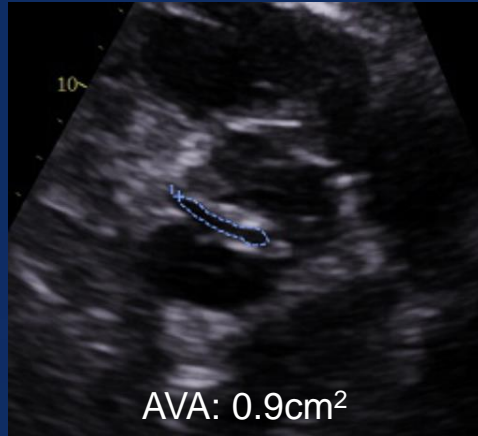


Asymmetrical BAV leaflet motion

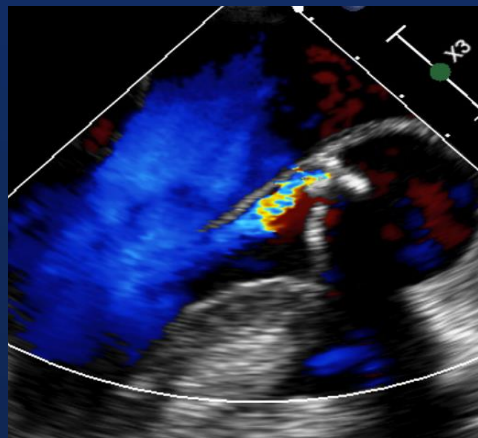
Higher leaflet coaptation point

increase the shear stress through the Valve leading to a calcification process

Incidence of AS or AR in BAV

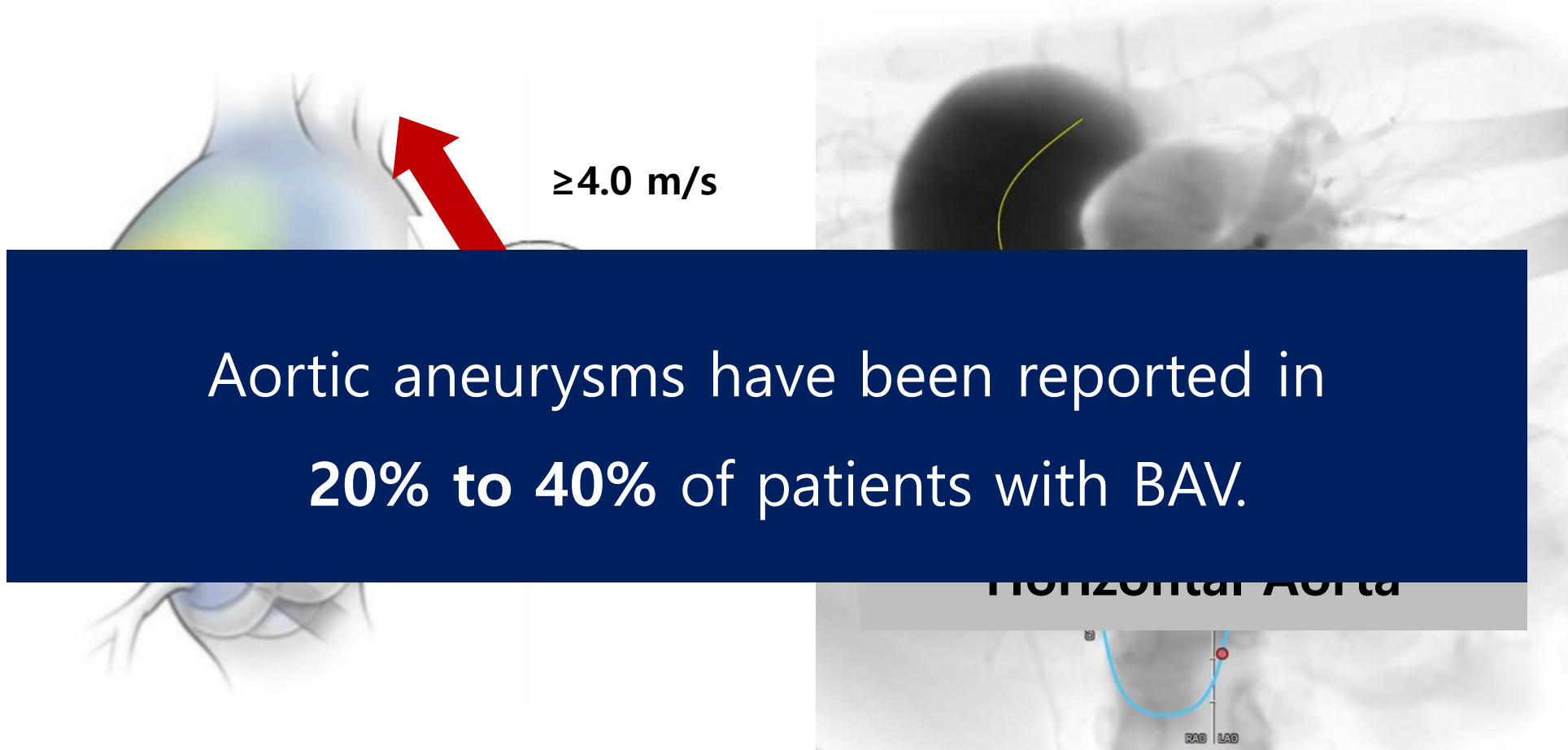


- Aortic Stenosis, AS
: **12% to 37%** of patients developed moderate or Severe



- Aortic Regurgitation, AR
: **13% to 30%** of patients developed moderate or Severe

Aortopathy



Aortic aneurysms have been reported in
20% to 40% of patients with BAV.

Effect of Aortic Stenosis on Wall Shear Stress in Bicuspid Aortic Valve

Nappi, Francesco, et al. "Patients with bicuspid aortopathy and aortic dilatation." *Journal of Clinical Medicine* 11.20 (2022): 6002.

Rodríguez-Palomares, Jose F., et al. "Mechanisms of aortic dilation in patients with bicuspid aortic valve: JACC state-of-the-art review." *Journal of the American College of Cardiology* 82.5 (2023): 448-464.

All-cause Mortality and Aortopathy

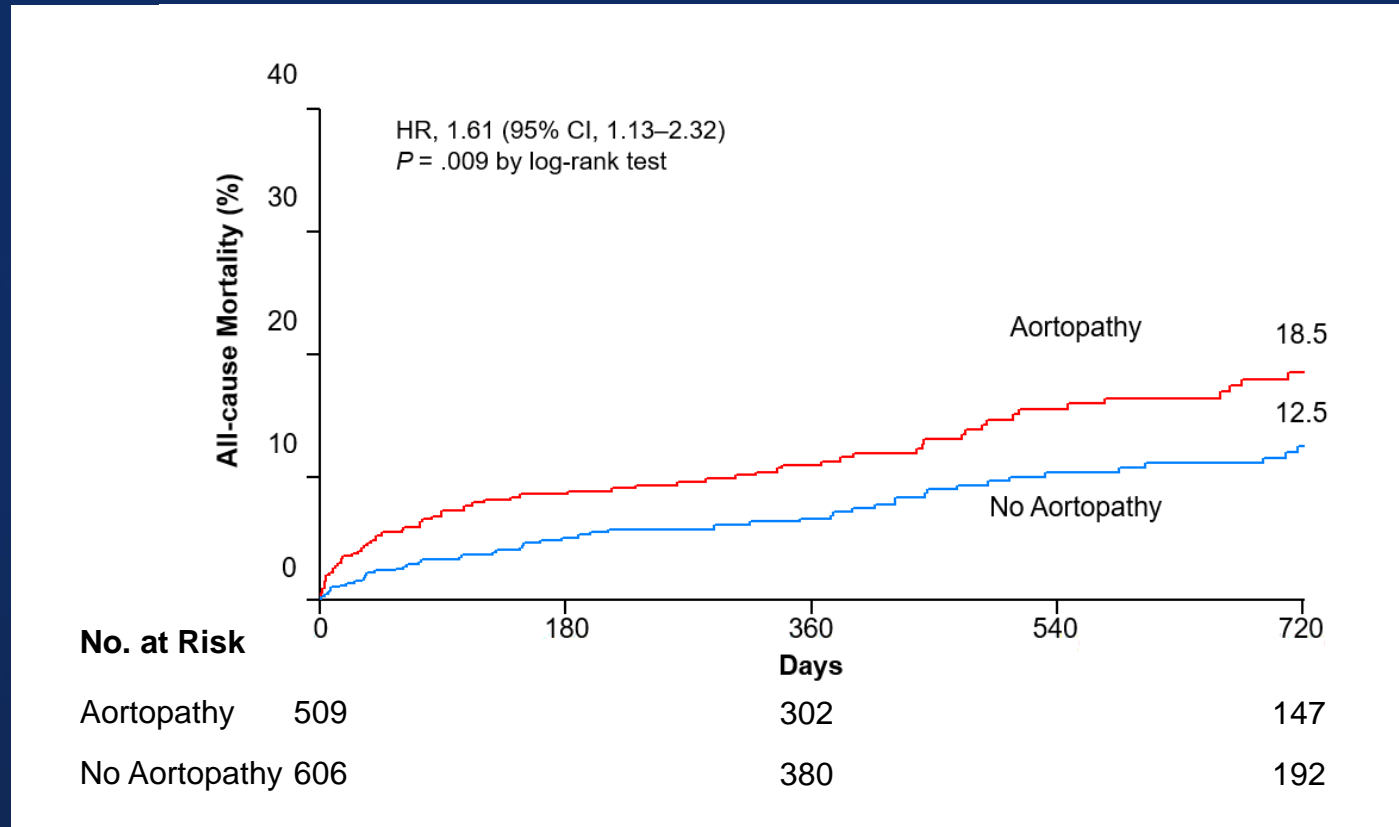


TABLE 3. Recommendations for aortic repair in patients with bicuspid aortic valve aortopathy

Recommendation	Class/LOE
Repair of the ascending aorta/root is recommended when the aortic diameter is ≥ 55 mm in patients without risk factors.	I/B ^{13,20,39-41}
Repair of the ascending aorta/root should be performed when the aortic diameter is ≥ 50 mm in patients with risk factors (ie, root phenotype or predominant aortic insufficiency, uncontrolled hypertension, family history of aortic dissection/sudden death, or aortic growth >3 mm/y).	IIa/B ^{13,20,39-41}
Repair of the ascending aorta/root may be performed in patients with an aortic diameter of ≥ 50 mm when the patients are at low surgical risk and operated on by an experienced aortic team in a center with established surgical results.	IIb/C ^{32,33}
Concomitant repair of the ascending aorta/root should be performed when the aortic diameter is ≥ 45 mm in patients undergoing cardiac surgery.	IIa/B ^{13,19,39,42}
Repair of the aortic arch is recommended in patients with an aortic arch diameter of ≥ 55 mm.	I/B ^{36,43}
Concomitant repair of the aortic arch should be performed in patients undergoing cardiac surgery with an aortic arch diameter of ≥ 50 mm.	IIa/C ⁴⁴
Concomitant repair of the aortic arch may be performed in patients undergoing cardiac surgery with an aortic arch diameter of ≥ 45 mm, provided the patients are at low surgical risk and operated on by an experienced aortic team with established surgical results.	IIb/C ⁴⁵
It is recommended that patients undergoing elective aortic arch repair be referred to an experienced aortic team with established surgical results.	I/B ^{37,38}

Imaging

Original Research | Cardiopulmonary Imaging | October 2010

Diagnostic Value of Cardiac CT in the Evaluation of Bicuspid Aortic Stenosis: Comparison With Echocardiography and Operative Findings

Authors: Ryoichi Tanaka, Kunihiro Yoshioka, Hiroyuki Niinuma, Satoshi Ohsawa, Hitoshi Okabayashi, and Shigeru Ehara | [AUTHOR INFO & AFFILIATIONS](#)

Volume 195, Issue 4 | <https://doi.org/10.2214/AJR.09.3164>

Results

According to echocardiography, 17 patients had moderate to severe aortic stenosis (mean \pm SD) pressure gradient of 45.5 ± 12.1 mmHg, and the aortic valve area (AVA) traced AVA in CT was 0.570 ± 0.14 cm², and the estimated AVA by Doppler echocardiography was 0.659 ± 0.234 cm² (Fig. 1). A fair correlation ($r = 0.44$) and a significant difference ($p < 0.05$) were observed between CT and Doppler echocardiography. According to the intraoperative findings, 17 patients had a bicuspid aortic valve and 33 patients had a tricuspid aortic valve.

The kappa score for interobserver agreement between the two radiologists in the interpretation of the CT scans was 0.953. The sensitivity, specificity, positive predictive value, and negative predictive value of cardiac CT were 94.1%, 100%, 100%, and 97.1%, respectively (Table 1). The diagnostic accuracy of CT was 98% (49/50).

CT Accuracy 98%

Original Article

Diagnostic accuracy study of routine echocardiography for bicuspid aortic valve: a retrospective study and meta-analysis

Mathias Hillebrand^{1*}, Dietmar Koschyk^{1*,#}, Pia ter Hark¹, Helke Schüler¹, Meike Rybczynski¹, Jürgen Berger², Amit Gulati², Alexander M. Bernhardt¹, Christian Detter¹, Evaldas Girdauskas¹, Stefan Blankenberg¹, Yskert von Kodolitsch¹

Diagnostic accuracy

71.6%, the positive likelihood ratio was 16.007, and the negative likelihood ratio was 0.552. In the (II) group of 158 individuals with availability of original TTE recordings, expert re-evaluation yielded a sensitivity of 59.7%, a specificity of 93%, an accuracy of 77.8%, a positive likelihood ratio of 8.560, and a negative likelihood ratio of 0.433. The sensitivity was higher on (II) re-evaluation than on (II) primary documentation ($P < 0.001$), but the specificity was similar in both groups ($P = 0.07$, Table 3).

TTE Accuracy 77.8%

Tanaka, Ryoichi, et al. "Diagnostic value of cardiac CT in the evaluation of bicuspid aortic stenosis." American Journal of Roentgenology 195.4 (2010): 895-899.

Hillebrand, Mathias, et al. "Diagnostic accuracy study of routine echocardiography for bicuspid aortic valve: a retrospective study and meta-analysis." Cardiovascular diagnosis and therapy 7.4 (2017): 367.

Sievers Classification

Type 0



No raphe

14.1 %

Type 1



R-N



L-R



L-N

Type 2

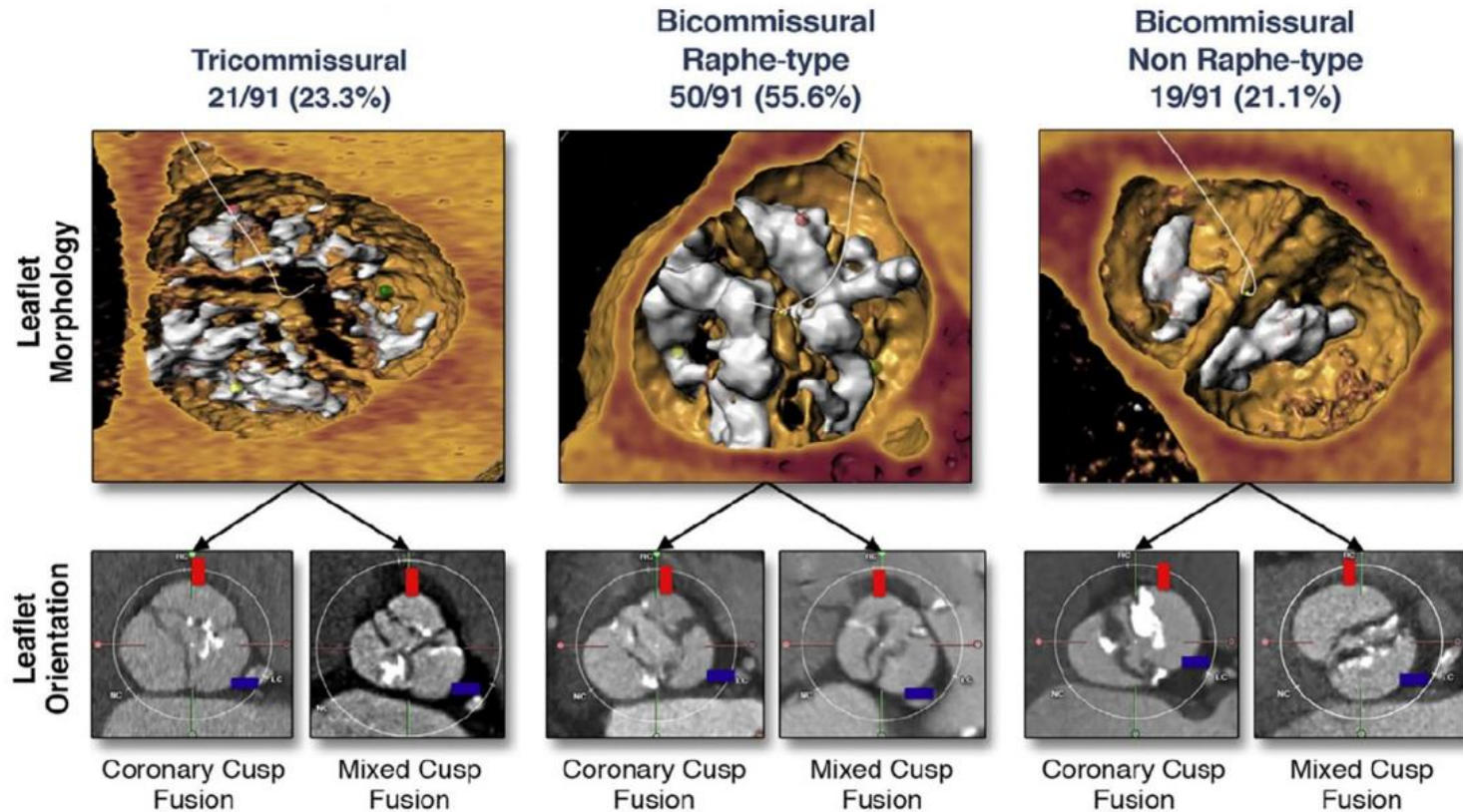


L-N / R-N

Two raphe

1.4%

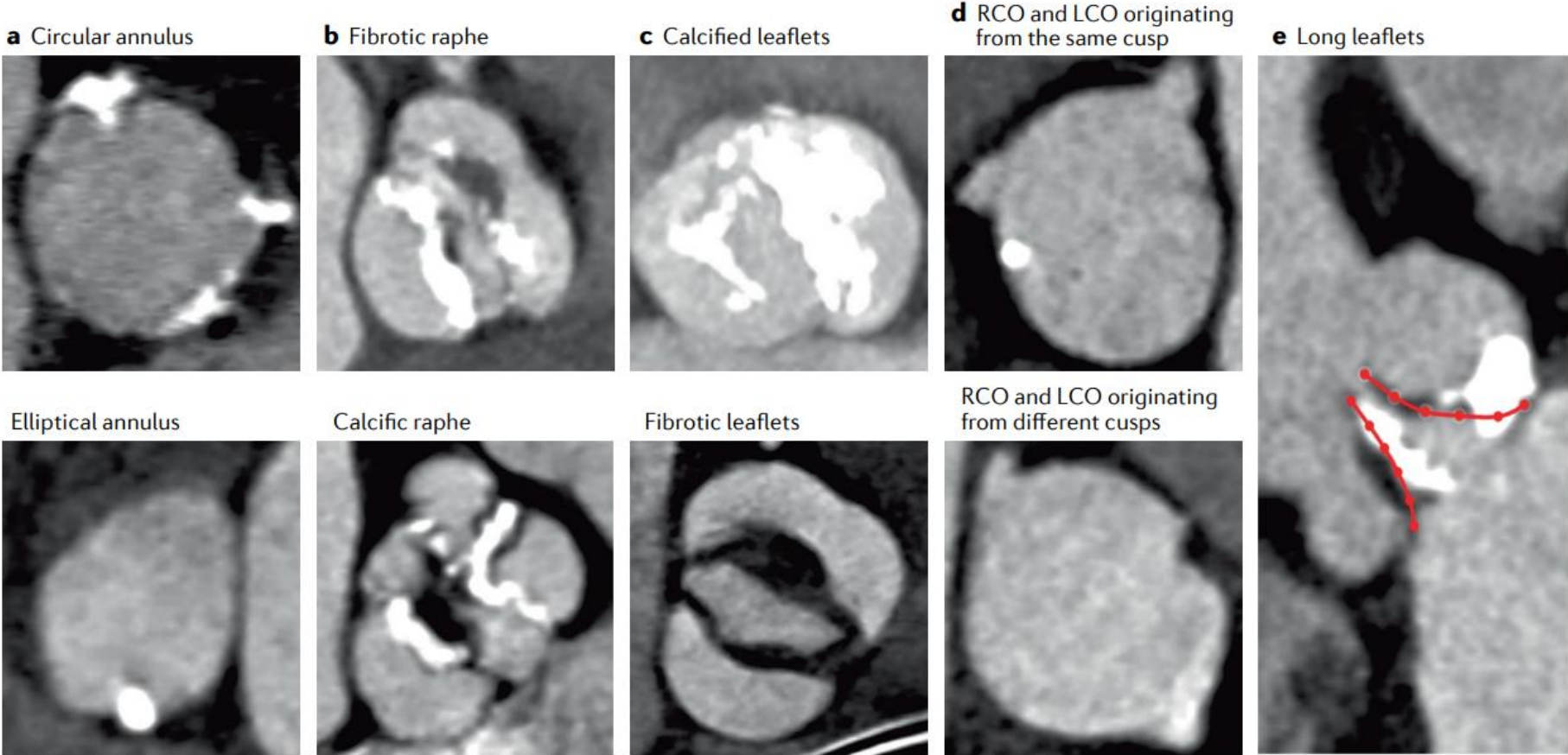
Current Classification for BAV



1. Elliptical annulus
2. Asymmetrical cusp
3. Bulky calcification on Raphe or Cusp
4. Anomalous Coronary Artery take-off
5. Long commissural distance

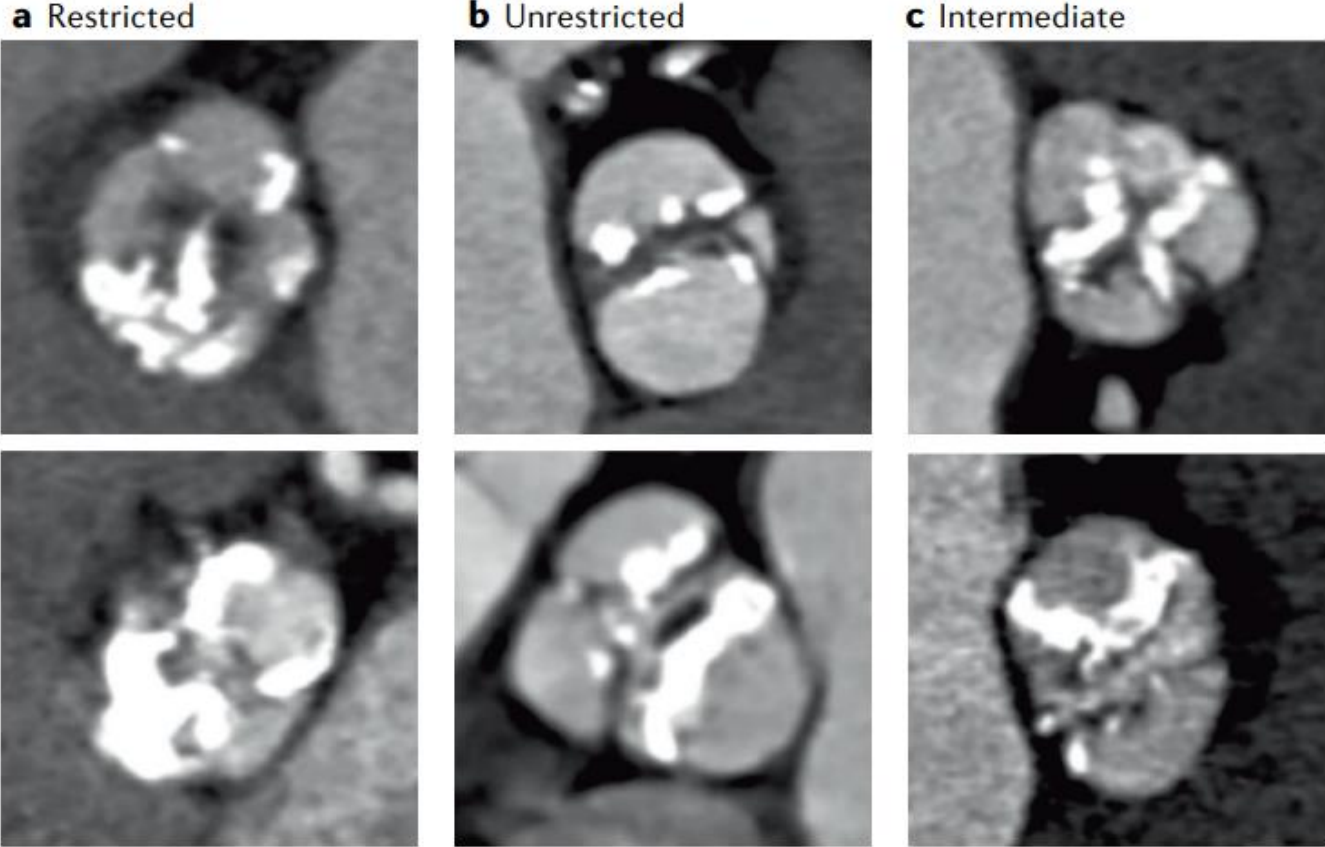
Transcatheter aortic valve implantation in patients with bicuspid valve morphology: a roadmap towards standardization

Tian-Yuan Xiong, Walid Ben Ali, Yuan Feng, Kentaro Hayashida, Hasan Jilaihawi, Azeem Latib, Michael

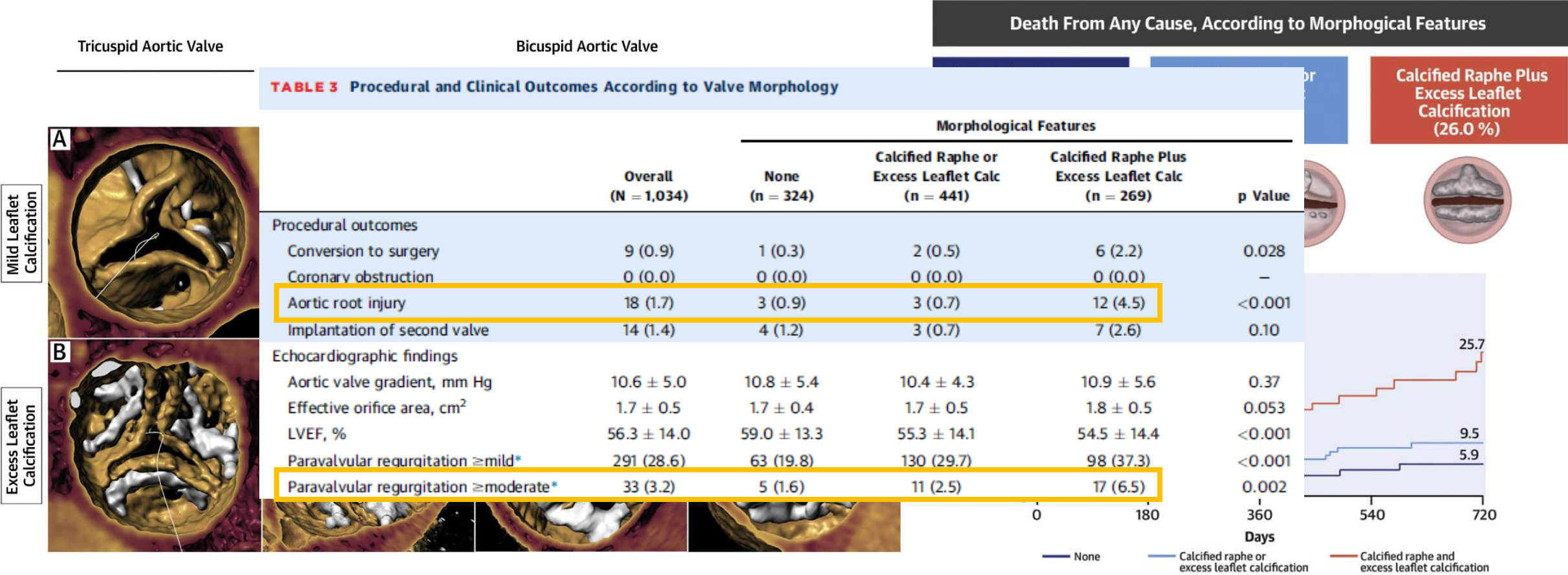


Transcatheter aortic valve implantation in patients with bicuspid valve morphology: a roadmap towards standardization

[Tian-Yuan Xiong](#), [Walid Ben Ali](#), [Yuan Feng](#), [Kentaro Hayashida](#), [Hasan Jilaihawi](#), [Azeem Latib](#), [Michael](#)



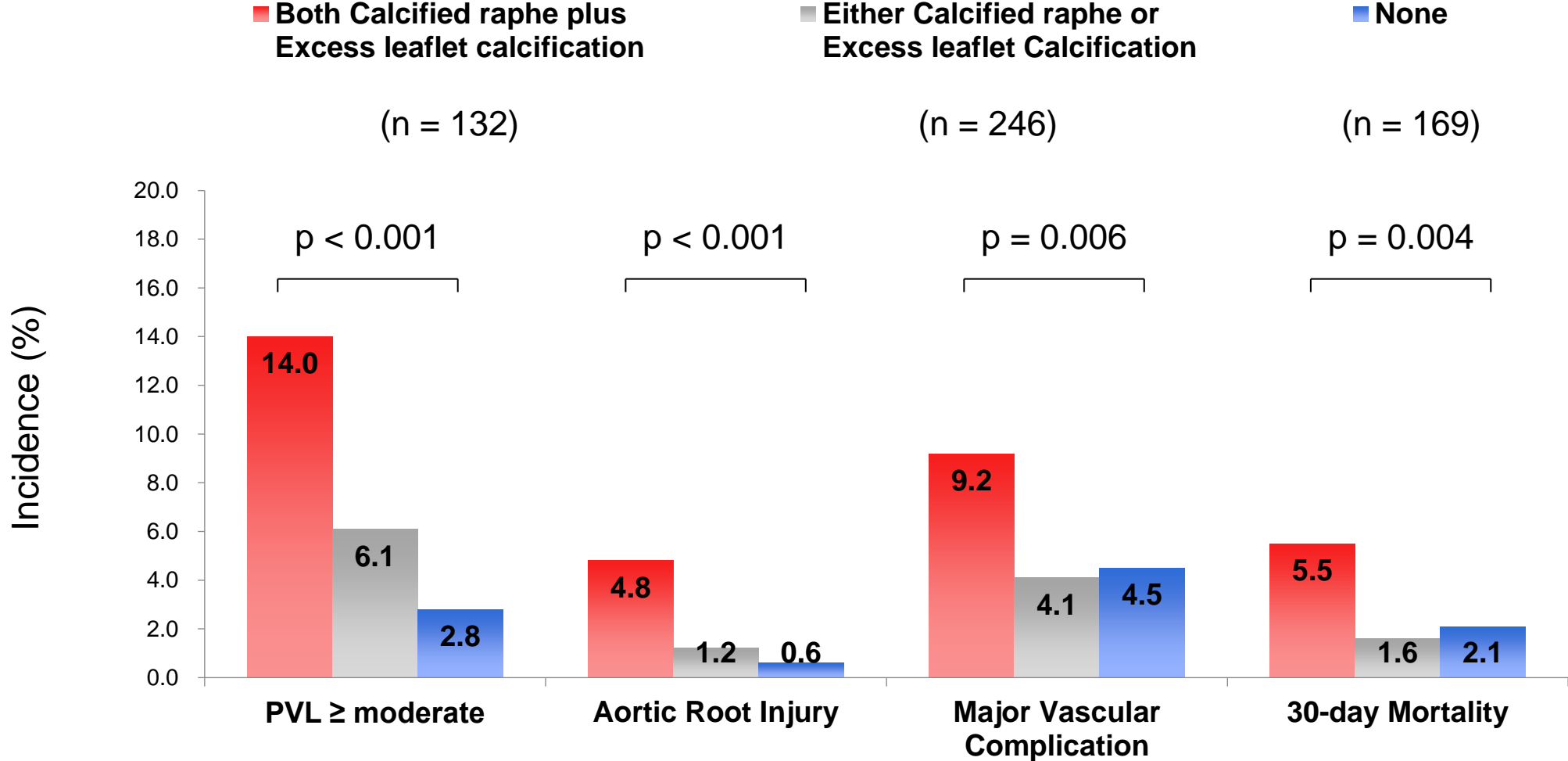
Bicuspid Aortic Valve Morphology and Outcomes After Transcatheter Aortic Valve Replacement



Yoon, Sung-Han, et al. "Bicuspid aortic valve morphology and outcomes after transcatheter aortic valve replacement." Journal of the American College of Cardiology 76.9 (2020): 1018-1030.

Bicuspid Aortic Valve Morphology and Outcomes After Transcatheter Aortic Valve Replacement

Procedural and 30-day Outcomes According to BAV Phenotype



Modified from Yoon and Makkar, JACC 2020

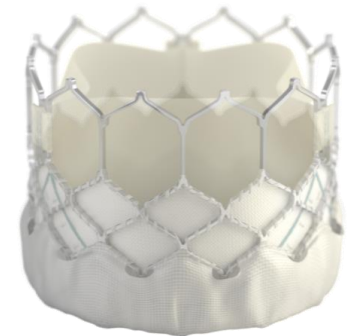
Circulation:

Balloon Versus Self-Expandable Valve for the Treatment of Bicuspid Aortic Valve Stenosis

Insights From the BEAT International Collaborative Registry

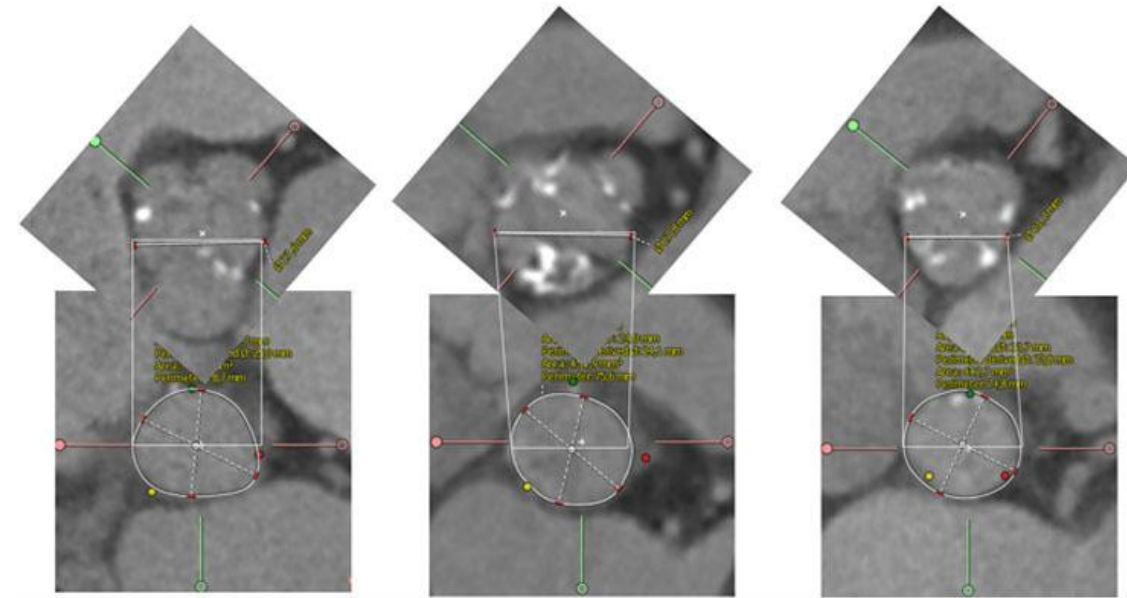
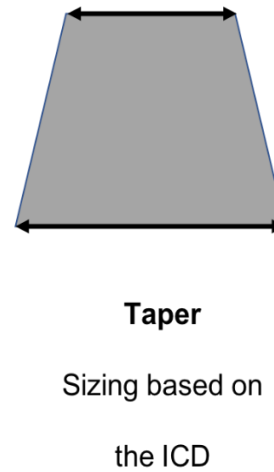
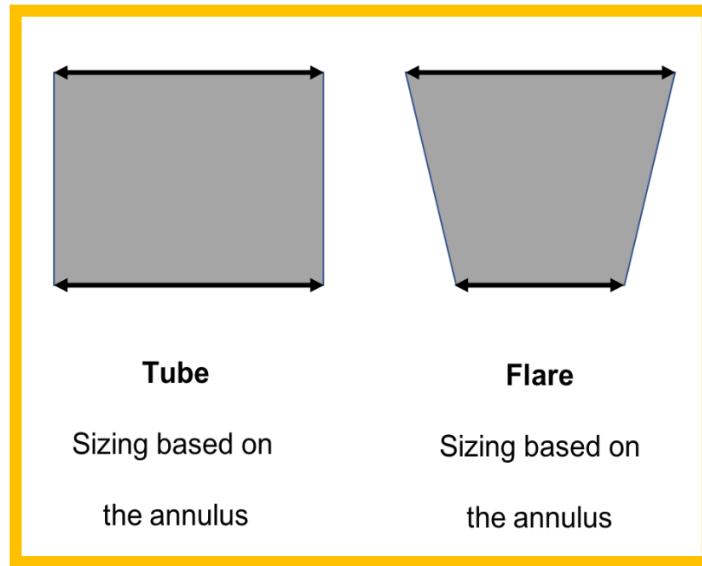
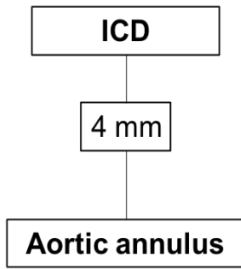
higher rate of moderate-severe **paravalvular aortic regurgitation** was observed in the Self-Expandable Valve

although patients treated with balloon-expandable valve had a higher rate of **annular rupture**.



Measurement

BAVARD sizing strategy



Annular sizing in 88 % of the patients

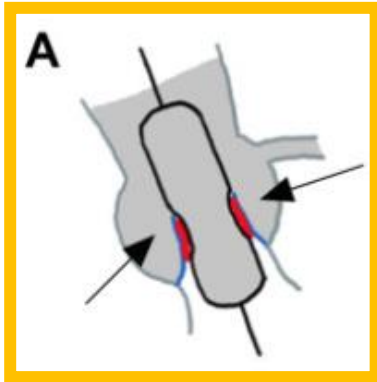
Tube

Flare

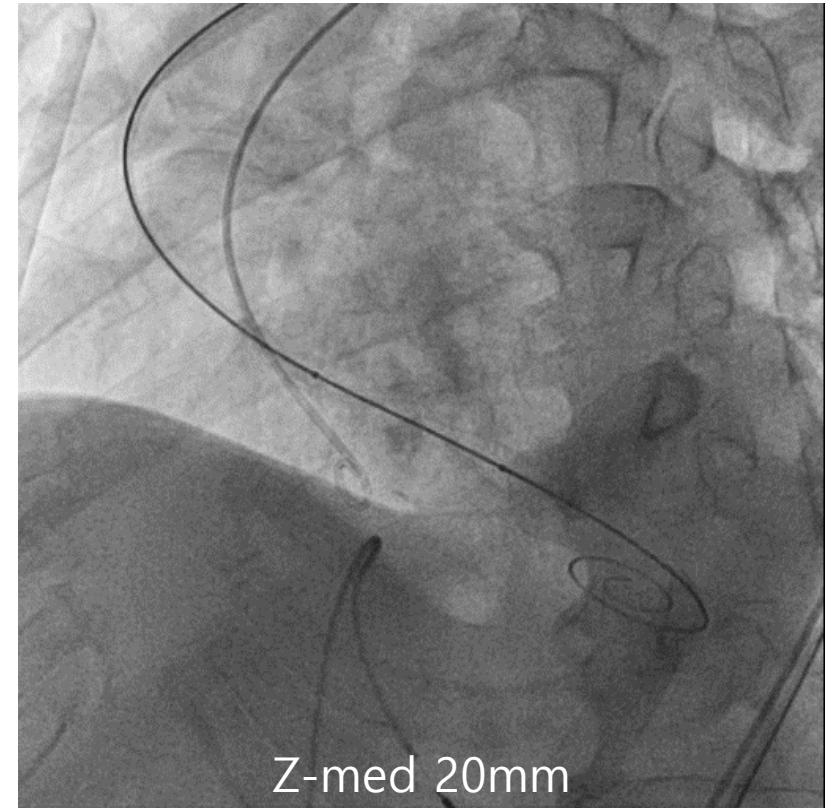
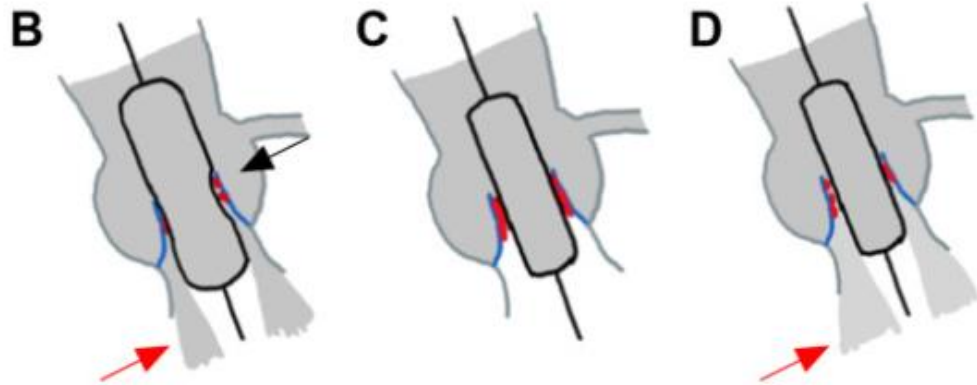
Taper

* ICD : Inter-comissural distance

Balloon Sizing

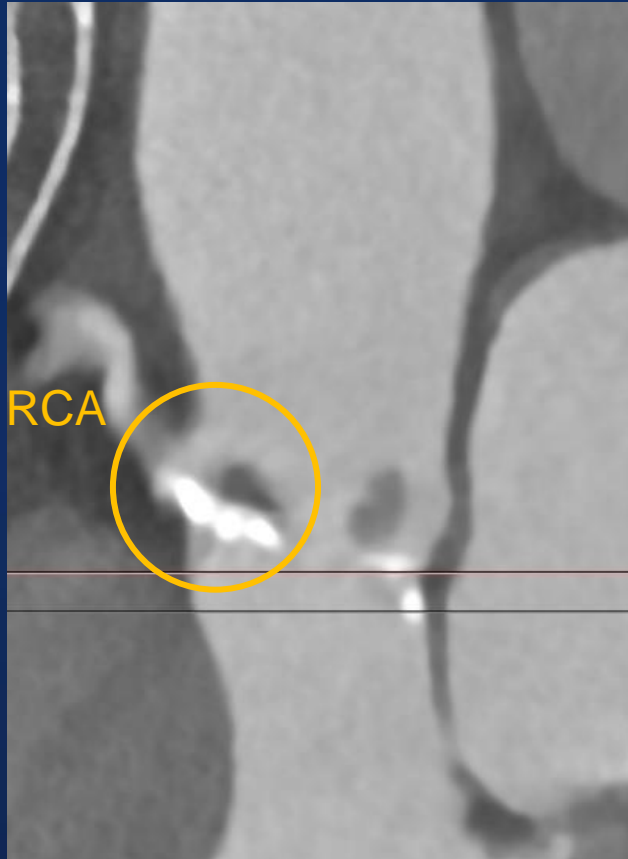


Calculated average diameter =
(final balloon size + perimeter
derived diameter of annulus) / 2

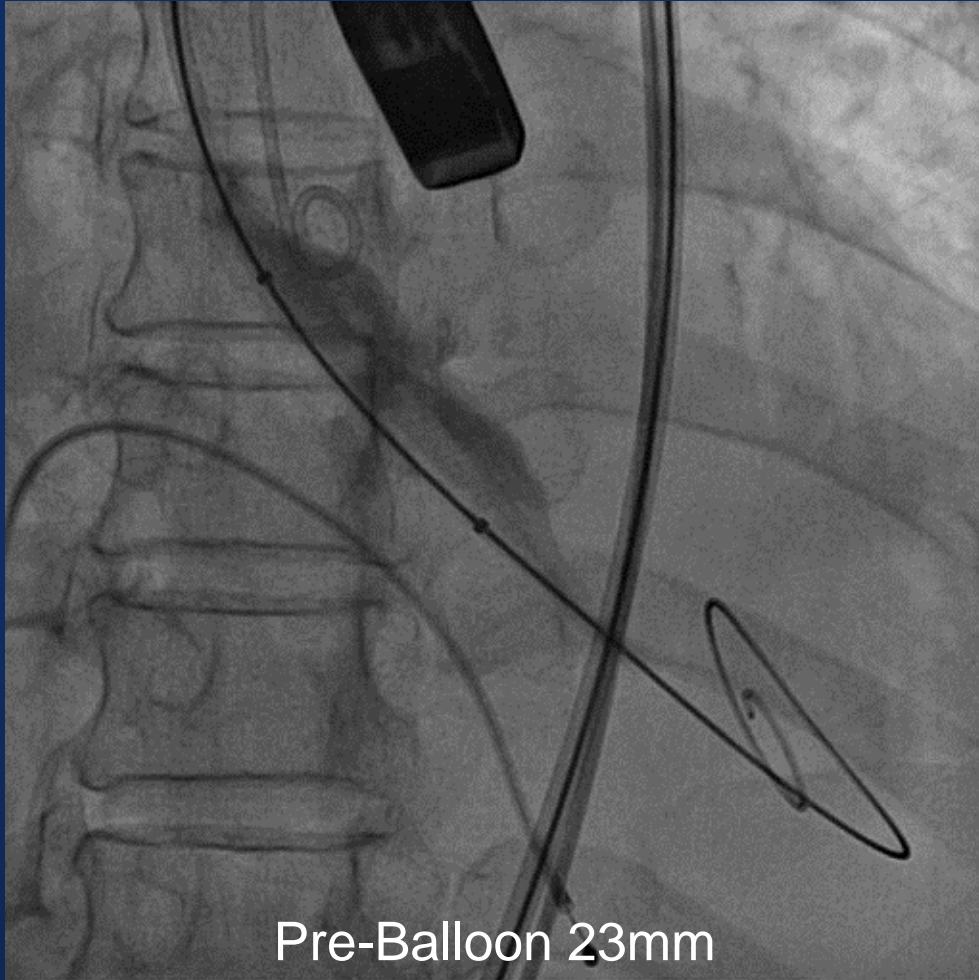


Sequential balloon aortic valvoplasty was performed in every **2mm increments until waist sign occurred with less than mild regurgitation.**

Balloon Sizing



Balloon Sizing



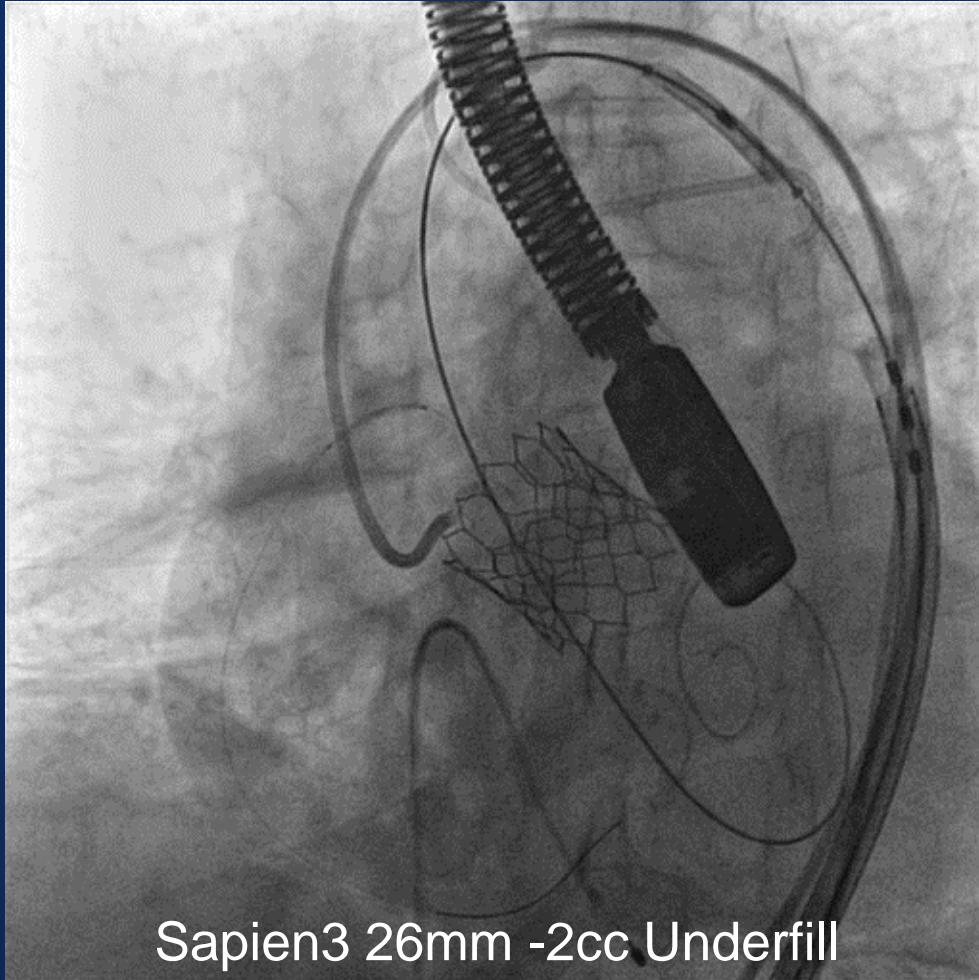
Balloon behavior

Coronary Obstruction Risk

Calcification Movement

Regurgitation

Balloon Sizing



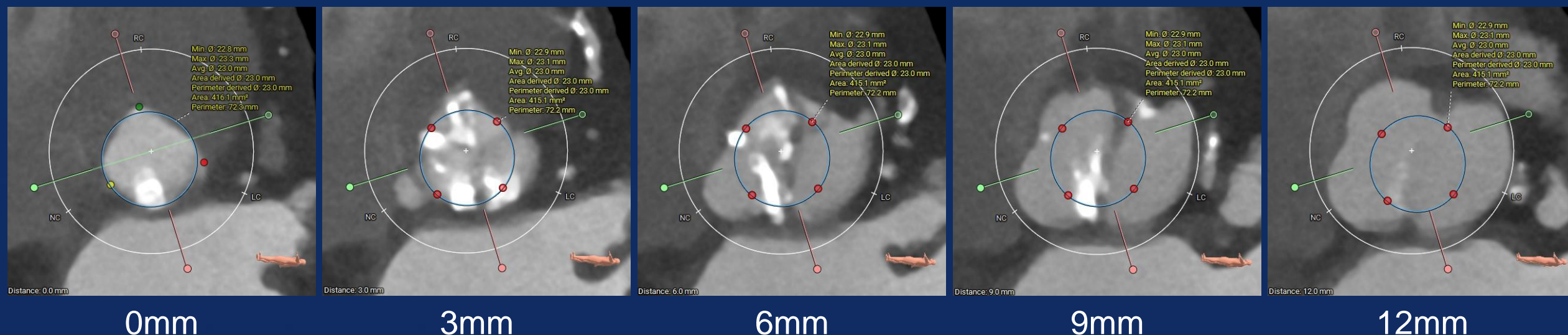
Balloon behavior

Coronary Obstruction Risk

Calcification Movement

Regurgitation

Circle method



The circle method uses CT scans to project circles at **0, 3, 6, and 9 mm** from the **annulus** to interrogate the anatomy for sizing, positioning, and predicting potential complications; these circles are **equal in diameter to SAPIEN 3/Ultra**.

Consideration in BAV TAVR

1. The length and extend of Calcification of the raphe and its height
: perforation and reduce valve expansion, **recommend relative under sizing**
2. Volume and distribution of bulky leaflet calcification
: coronary obstruction or Valsalva rupture and will enhance anchoring valve in supra-annular space, **favor relative under sizing**

Relatively passive treatment recommended

Conclusion

- Bicuspid valve anatomy is very complex, so a strategy tailored to the patient is needed.
- CT provides insight into procedural risk with TAVR, Careful CT analysis is required for the success of the procedure.
- Bicuspid Valve has a lot of young patients, It is essential to consider Durability and Valve-in-Valve.

Thank you for your attention