

Imaging in TAVI

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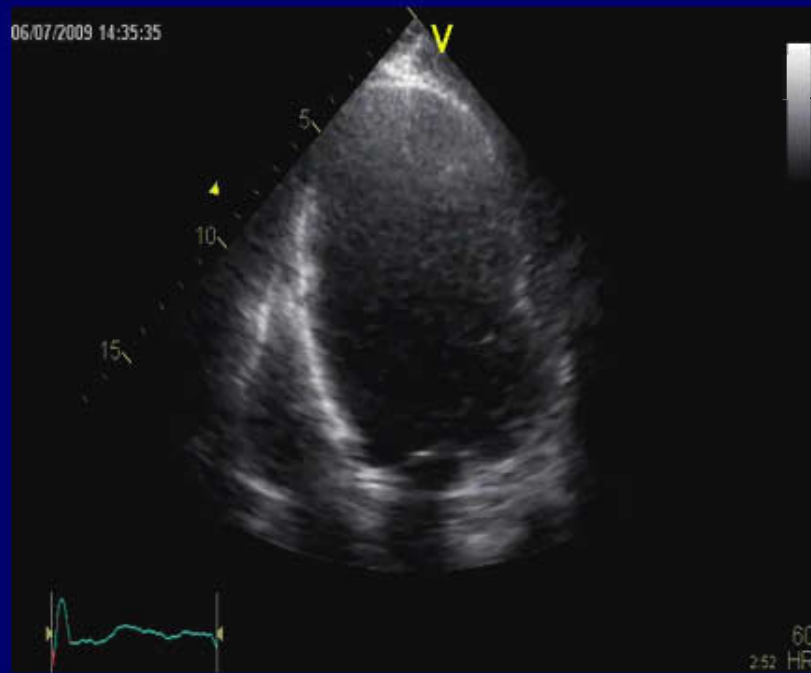
The Netherlands

Davos, feb 2013

Research grants: Medtronic, Biotronik, Boston Scientific,
St Jude, BMS imaging, GE Healthcare, Edwards
Lifescience

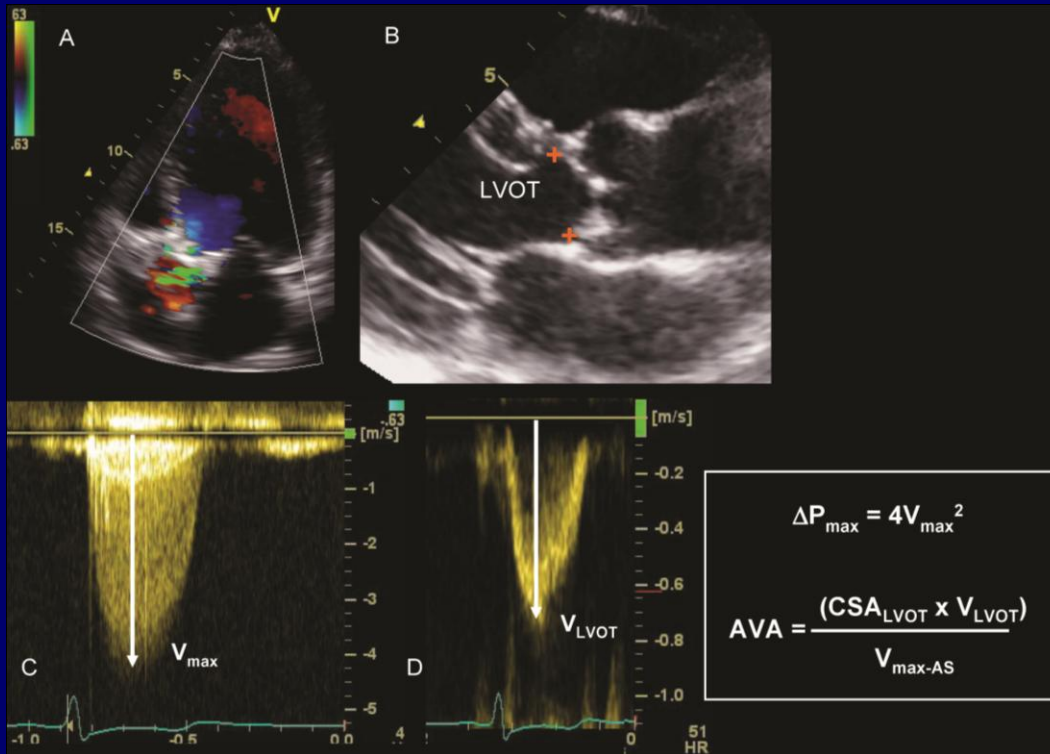
Case example:

- **87 year-old male**
 - **Ischemic cardiomyopathy (LVEF 30%). CABG.**
 - **Diabetes, hypercholesterolemia, hypertension**
 - **Peripheral vascular disease**
 - **COPD, GFR 48 ml/min**
- **Severe aortic stenosis**
 - **Dyspnoea NYHA III/IV, angina CCS 3.**
- **LogEUROSCORE 22%**



- 1. Confirmation of aortic stenosis severity**
- 2. Procedural feasibility:**
 - **Aortic valve and aortic root anatomy and dimensions**
 - **Peripheral artery anatomy**
- 3. Exclusion of contraindications**
- 4. Procedural approach selection**
 - **Transfemoral**
 - **Transapical**

Confirmation of aortic stenosis severity



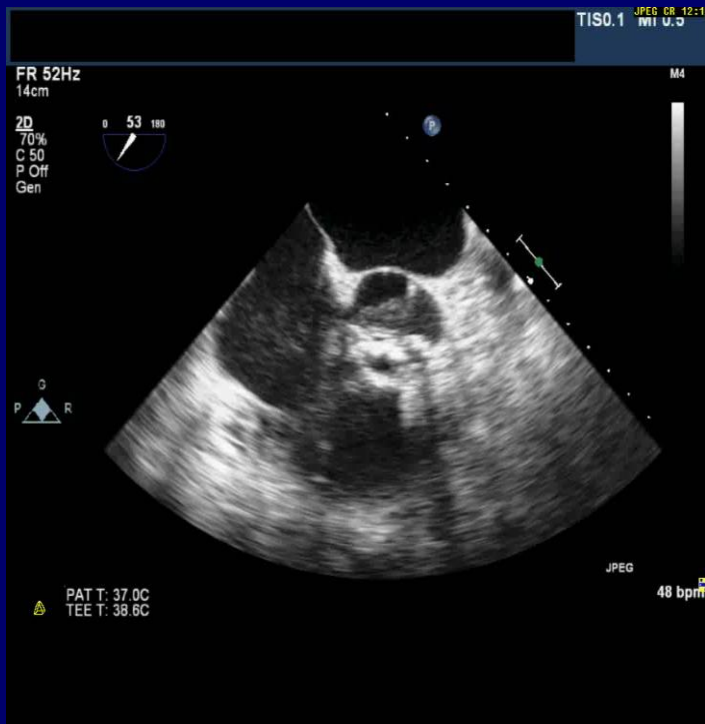
Jet velocity >4.0 m/s

Mean gradient >40-50 mmHg

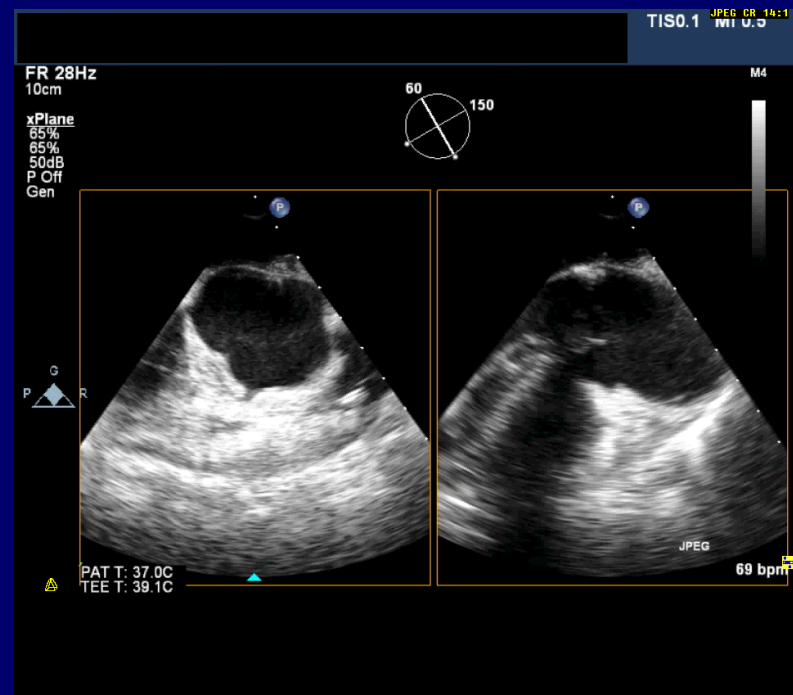
AVA <1.0 cm²

AVA indexed <0.6 cm²/m²

Feasibility: Aortic valve anatomy



Tricuspid

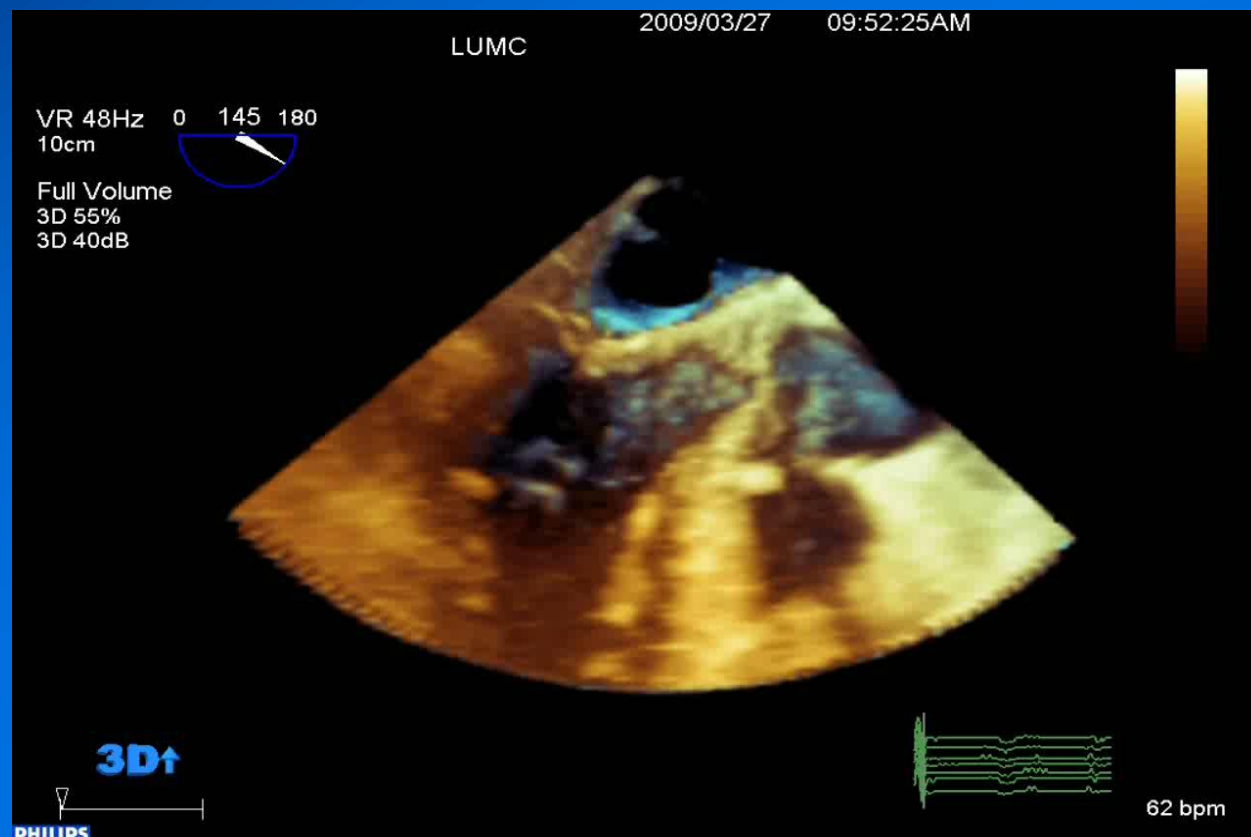


Bicuspid

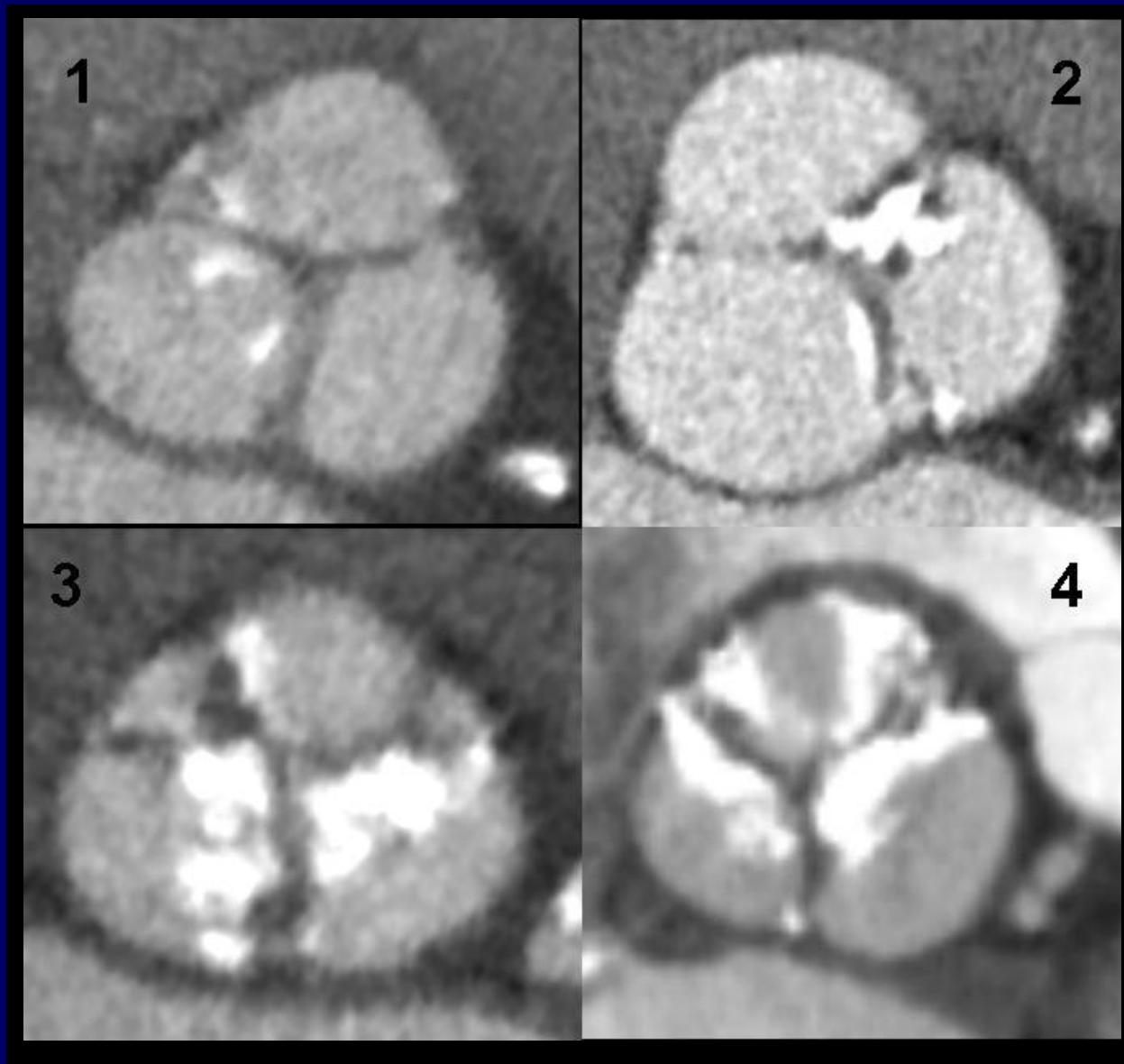
Feasibility: Aortic valve anatomy



Feasibility: Aortic valve anatomy

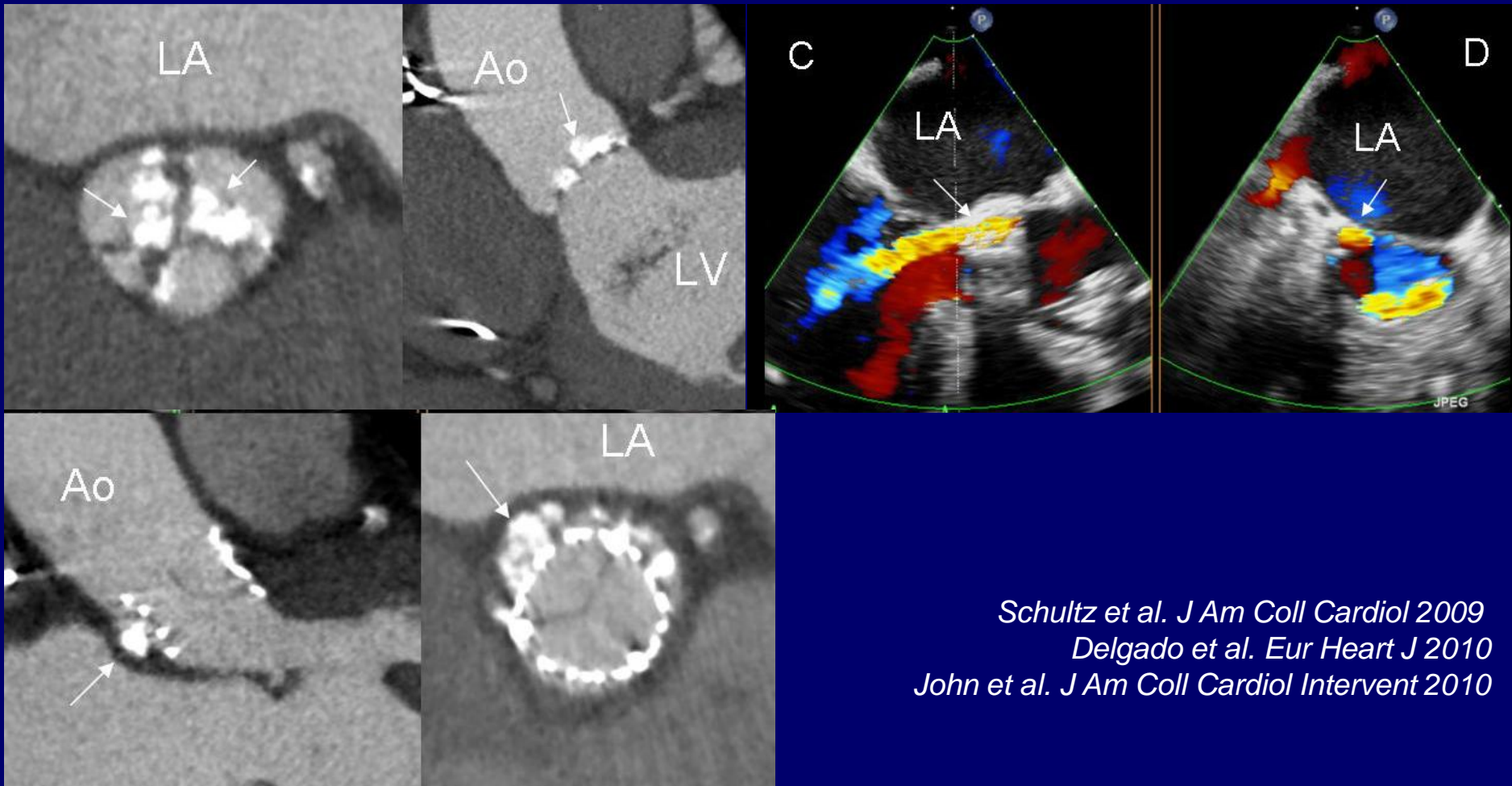


Feasibility: Aortic valve calcifications



Quantification of calcium score

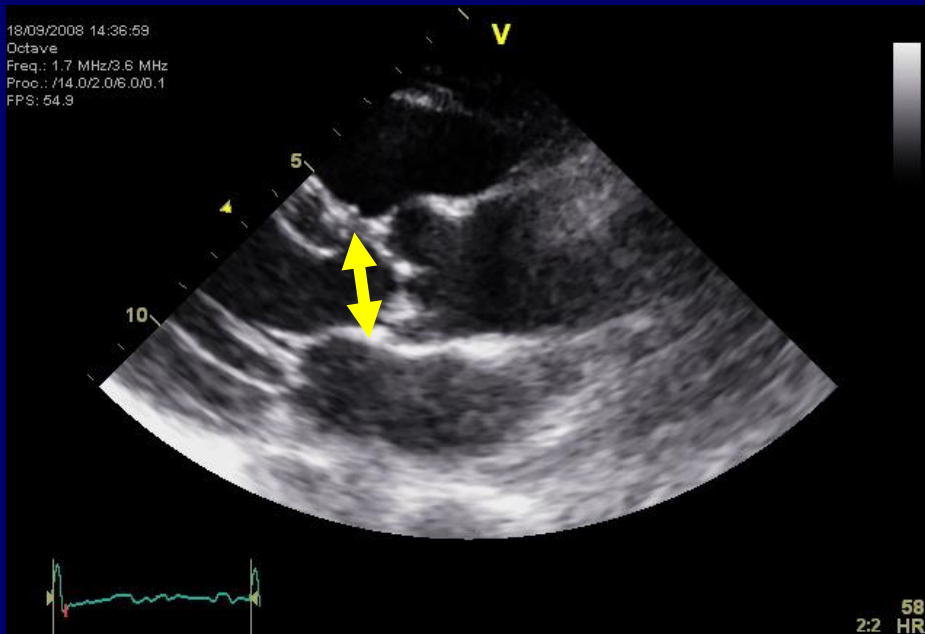
Feasibility: Aortic valve calcifications



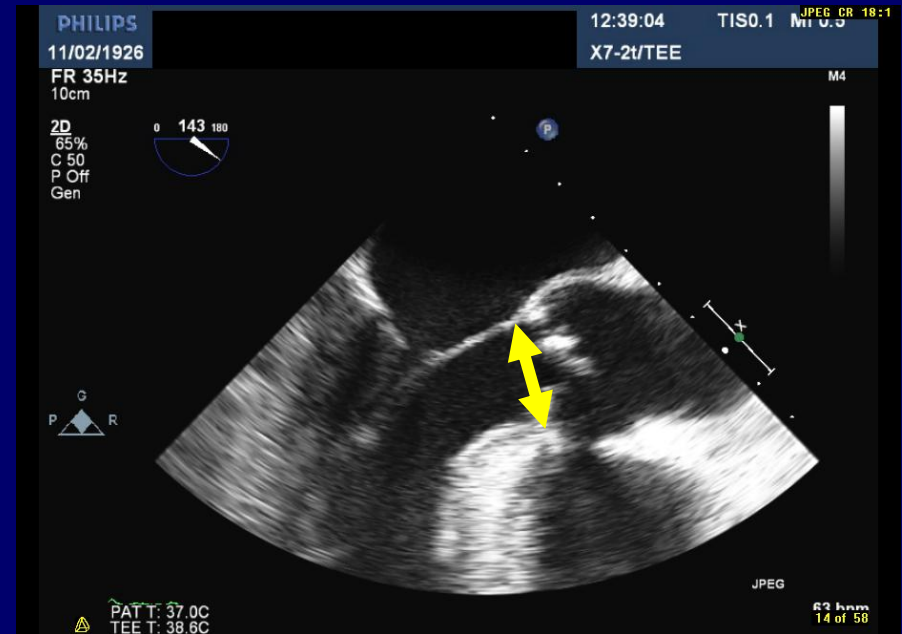
Schultz et al. *J Am Coll Cardiol* 2009
Delgado et al. *Eur Heart J* 2010
John et al. *J Am Coll Cardiol Intervent* 2010

Feasibility: Aortic valve annular size

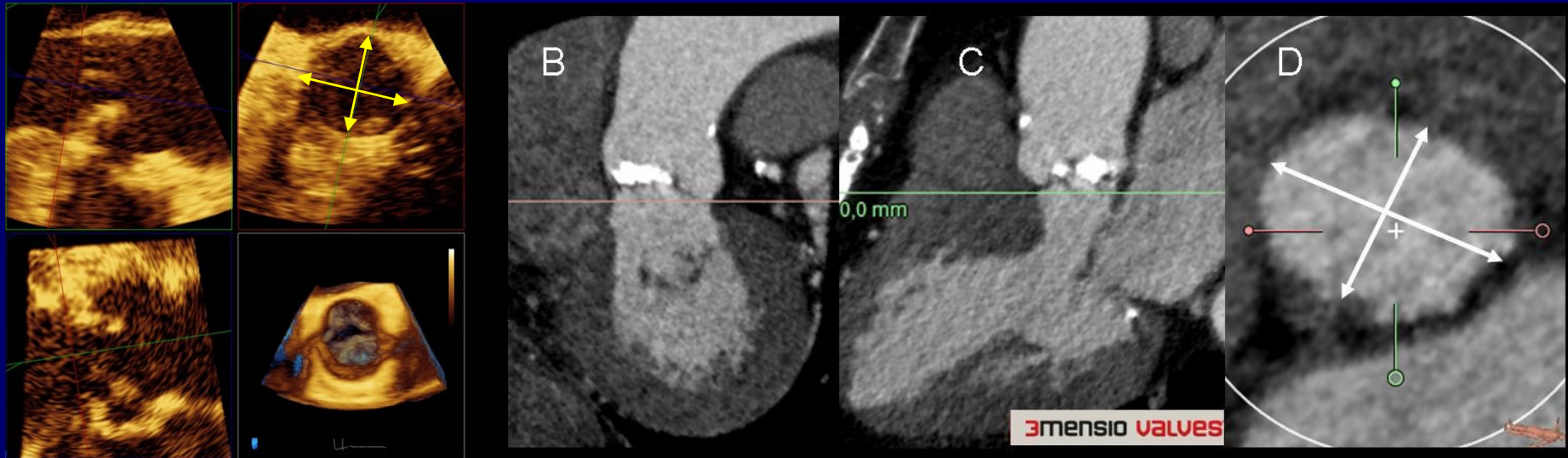
TTE



TEE



Feasibility: Aortic valve annular size



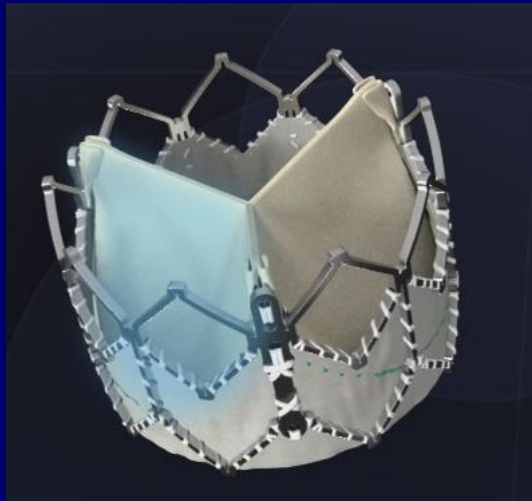
3-D imaging

Ng et al. Circ Cardiovasc Imaging 2010

Tops et al. J Am Coll Cardiol Imaging 2008

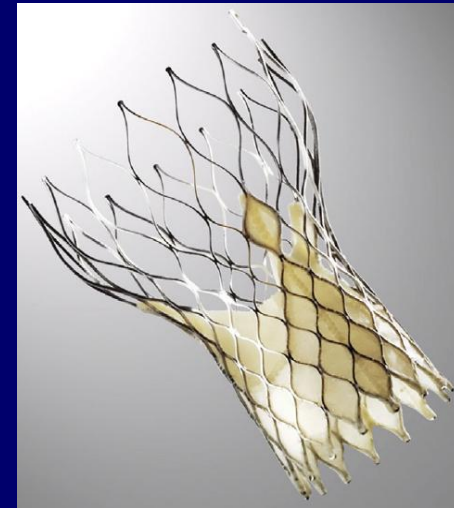
Messika-Zeitoun et al. J Am Coll Cardiol 2010

Anatomical requirements THV



Edwards SAPIEN XT

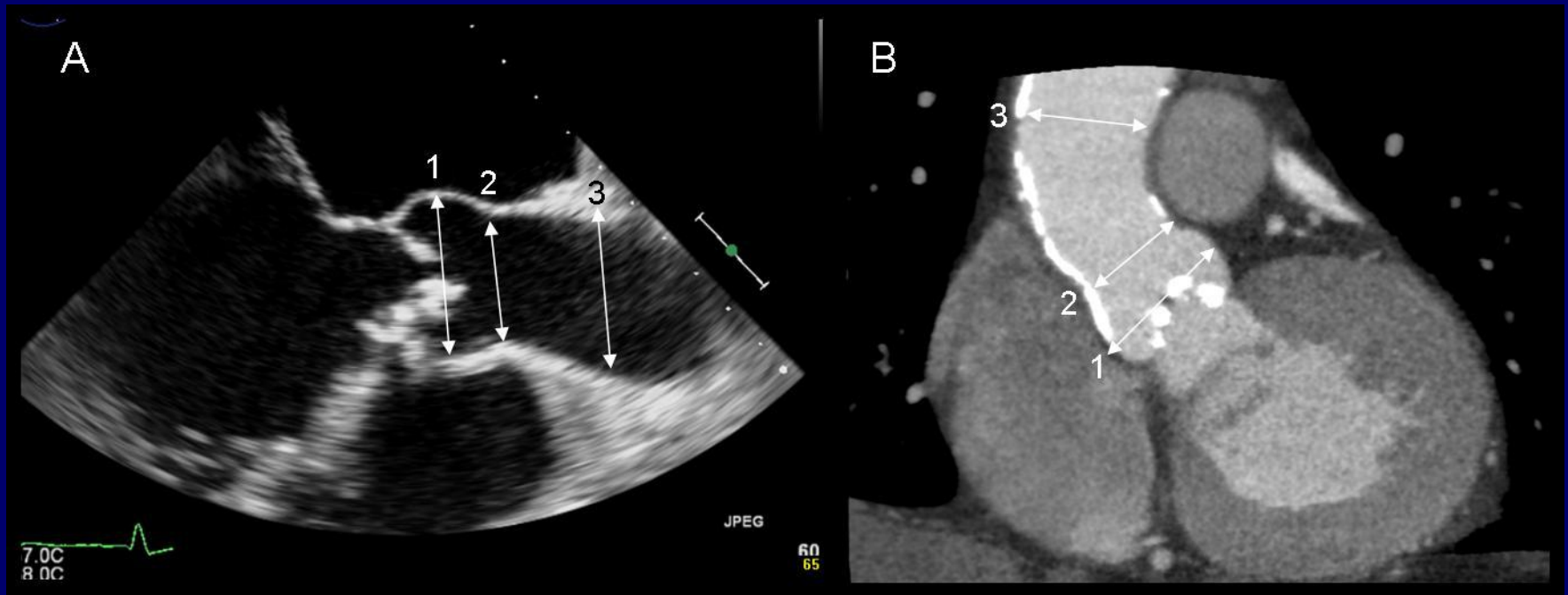
23-mm	18-22 mm
26-mm	22-25 mm
29-mm	25-28 mm



Medtronic CoreValve

26-mm	20-23 mm
29-mm	23-27 mm

Feasibility: Aortic root dimensions

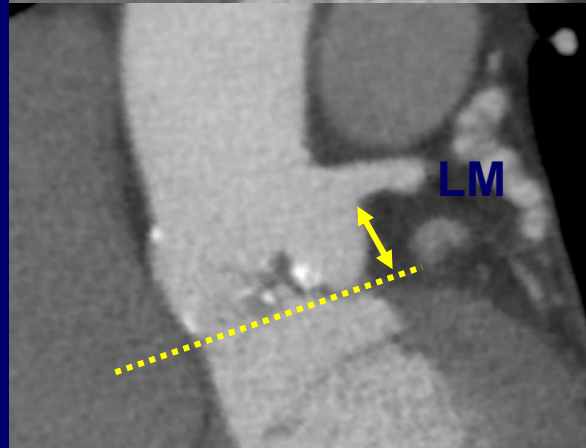
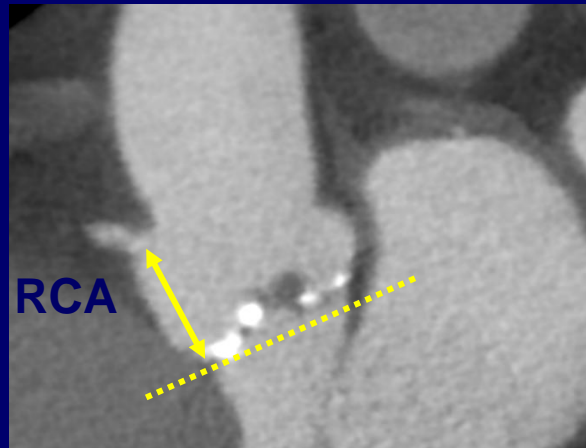
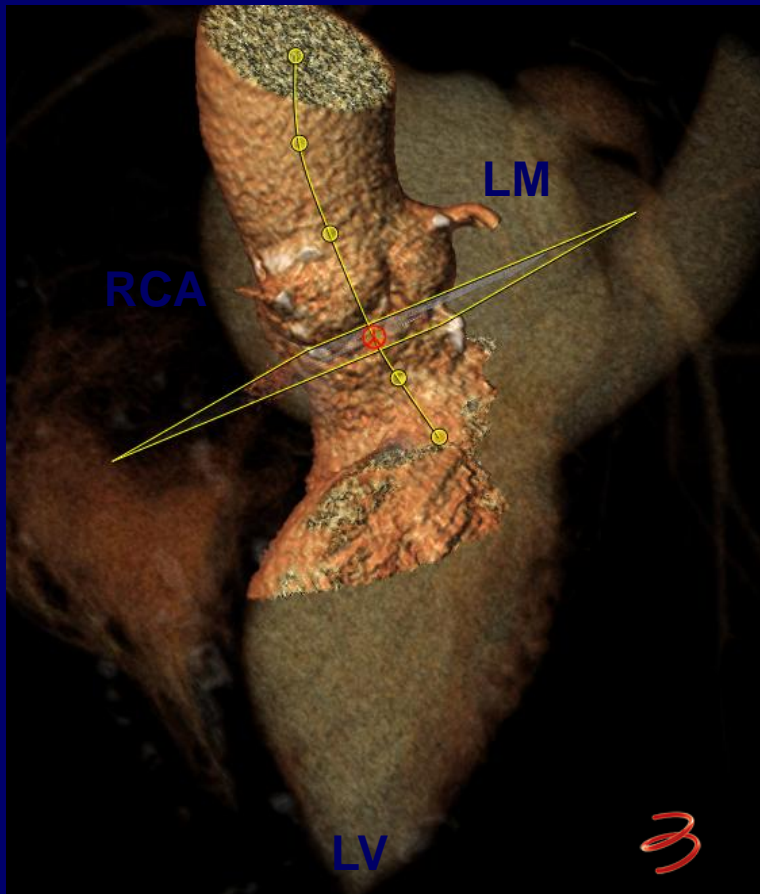


- 1.- Annulus
- 2.- Sinus of Valsalva
- 3.- Sino-tubular junction
- 4.- Ascending aorta

>28 mm?
≥27 mm
≤43 mm
<45 mm

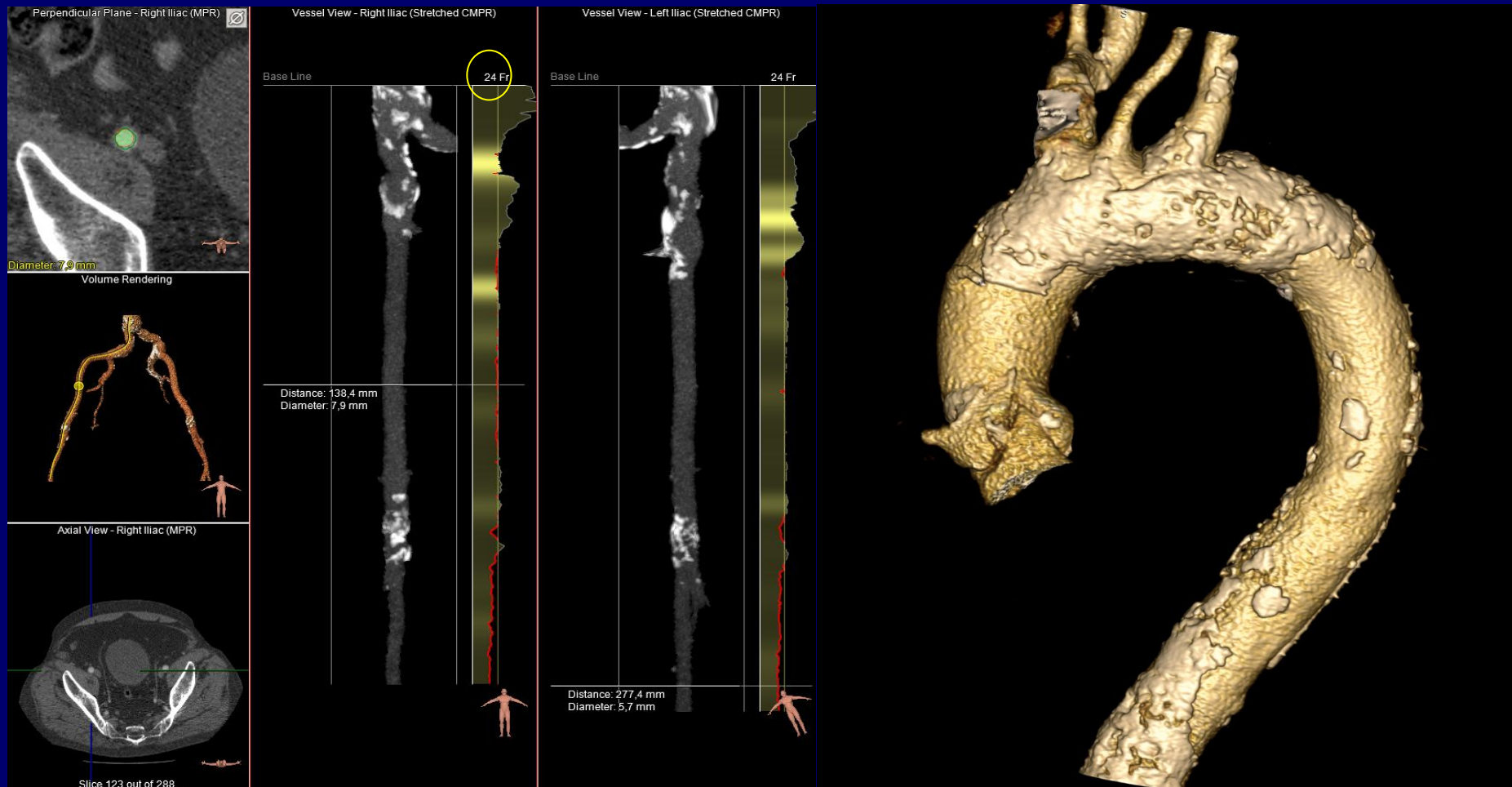
Vahanian et al. Eur Heart J 2008

Feasibility: Coronary ostia

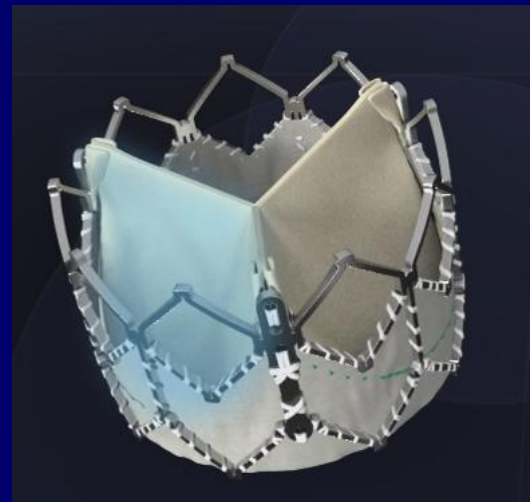
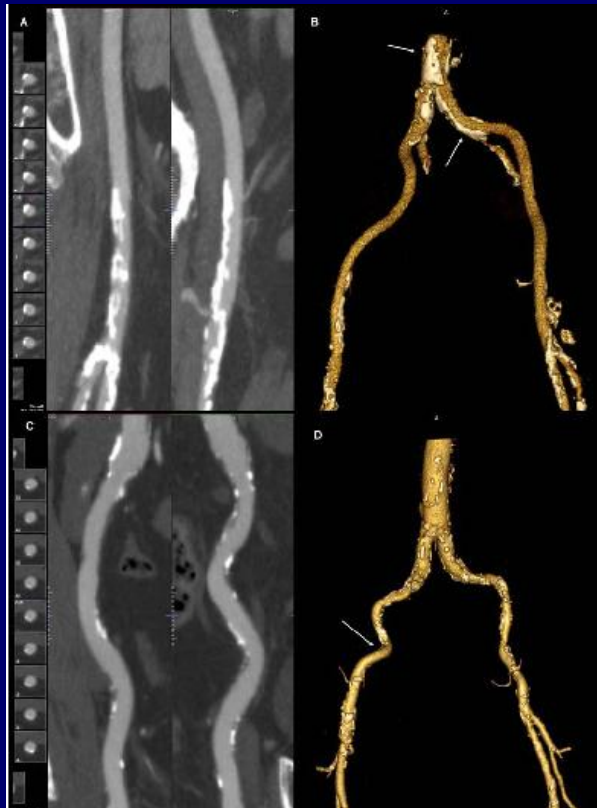


Distance relative to
the annular plane
 $\geq 10-11$ mm

Feasibility: Peripheral arteries and aorta



Anatomical requirements THV



Edwards SAPIEN XT

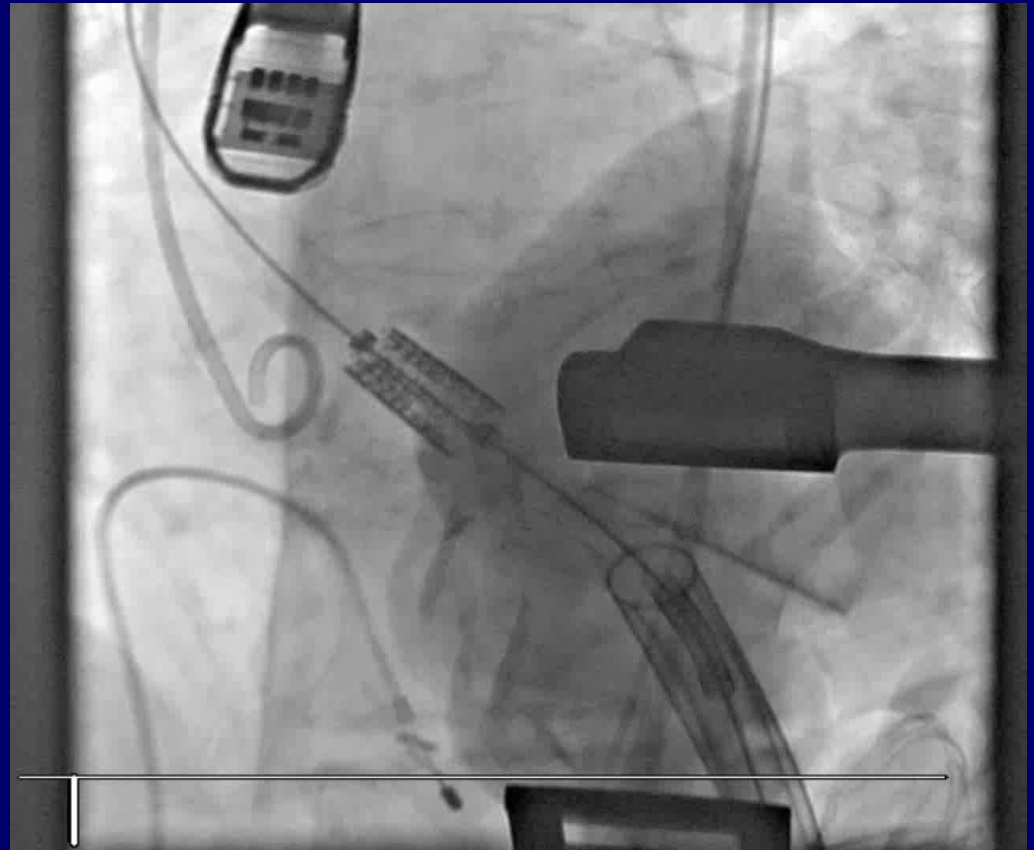
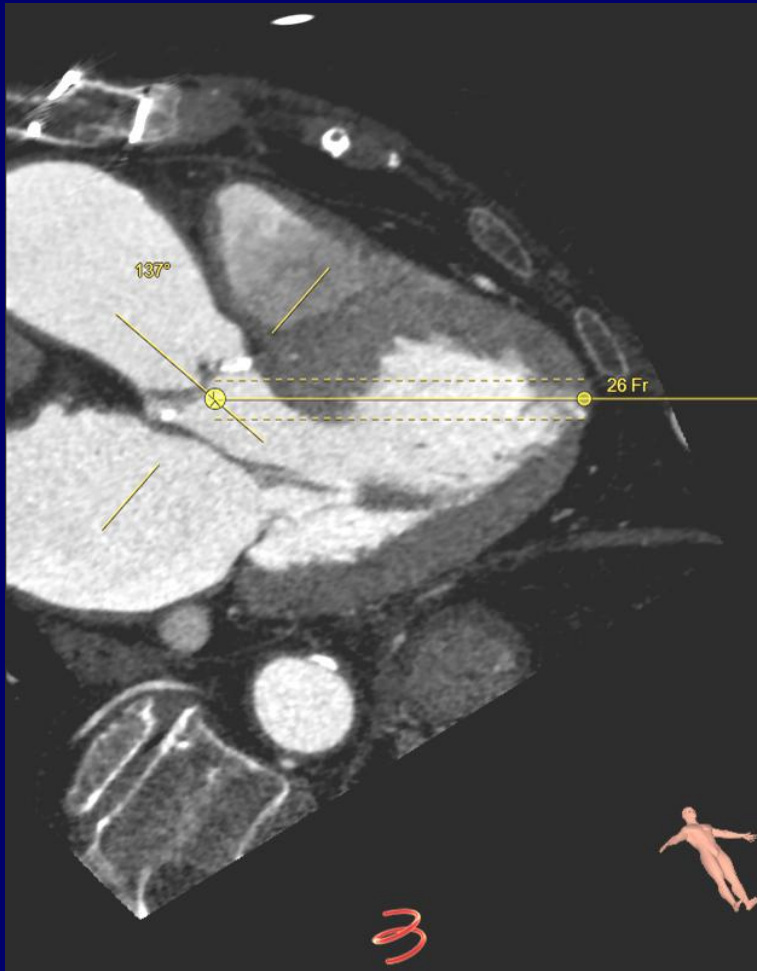
23-mm – 18F	>7 mm
26-mm – 19F	>8 mm



Medtronic CoreValve

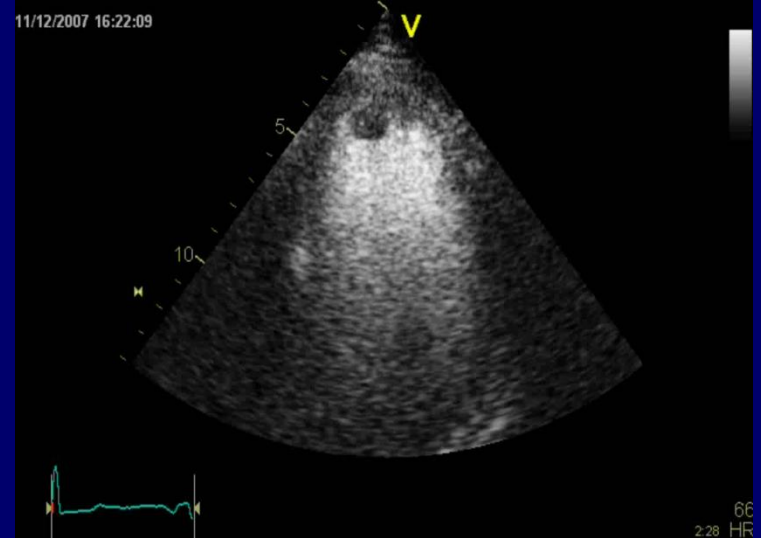
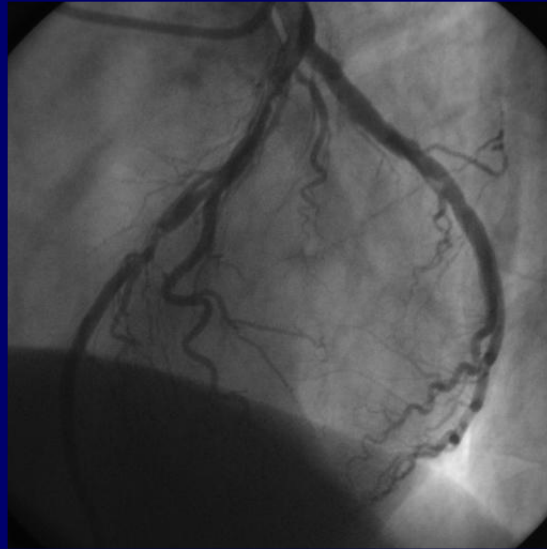
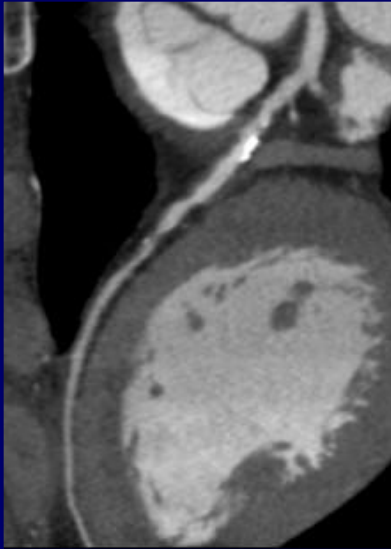
26-mm - 18F	≥6 mm
29-mm – 18F	

Feasibility: Left ventricular geometry



Exclusion of contraindications

1. Significant coronary artery stenosis



2. LV thrombus

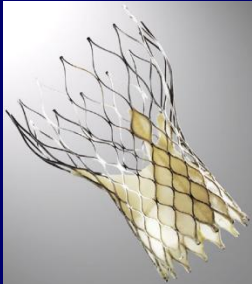
Procedural planning: check list

Severe aortic stenosis

Tricuspid anatomy and calcifications
Aortic root dimensions
Coronary ostia height

Aortic valve annular dimensions

Selection of prosthesis size

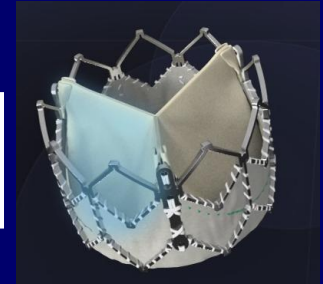


Medtronic CoreValve

26-mm	20-23 mm
29-mm	23-27 mm

Edwards SAPIEN XT

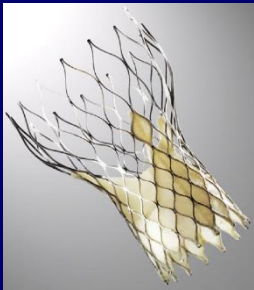
23-mm	18-22 mm
26-mm	22-25 mm



Procedural planning: check list

Procedural approach

Peripheral vascular access



Medtronic CoreValve

26-mm	≥6mm
29-mm	

Favourable?

Yes

No

Transfemoral

Trans-subclavian

Edwards SAPIEN XT

23-mm	>7mm
26-mm	>8mm

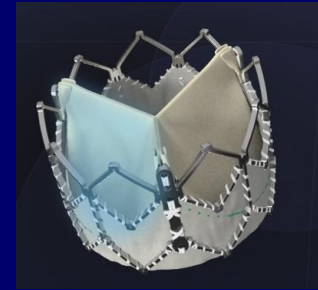
Favourable?

Yes

No

Transfemoral

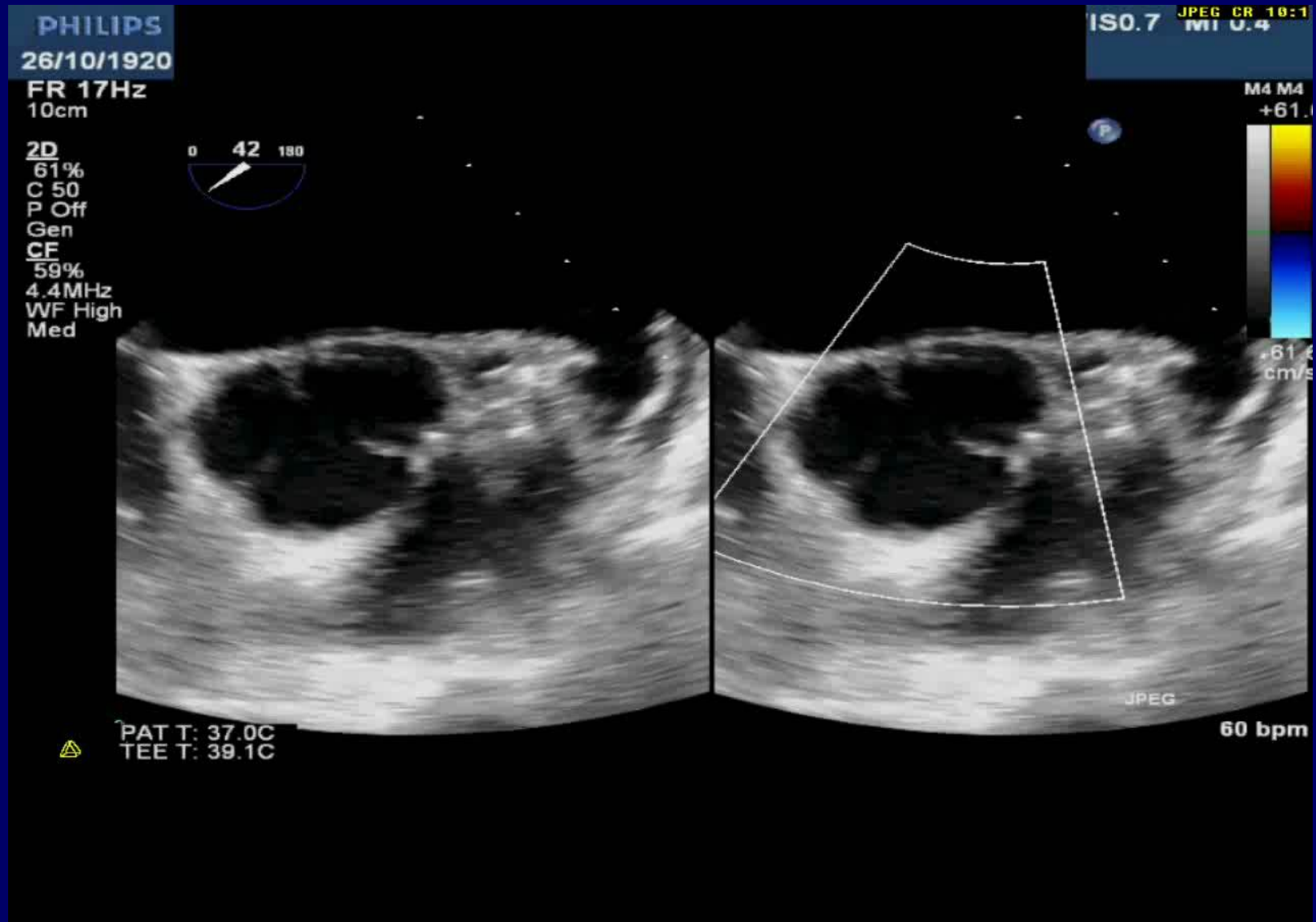
Transapical



Case 1

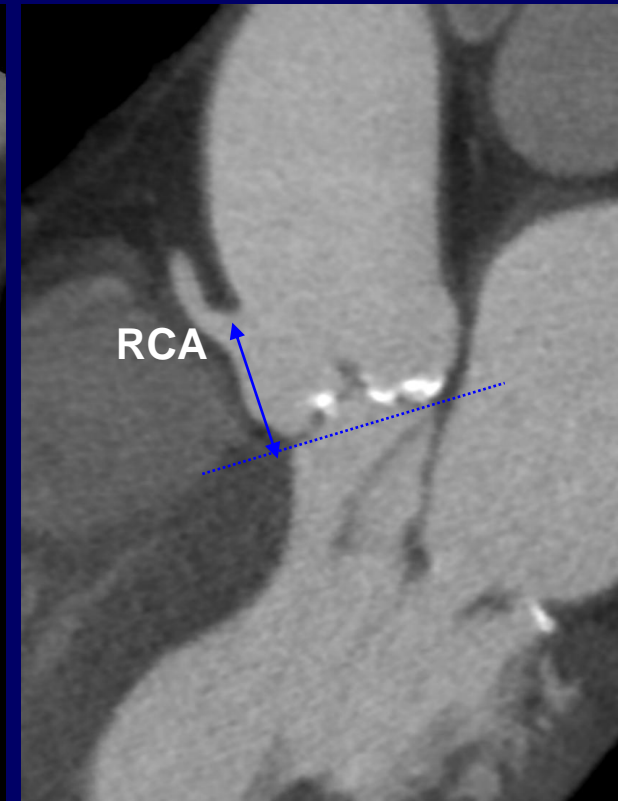
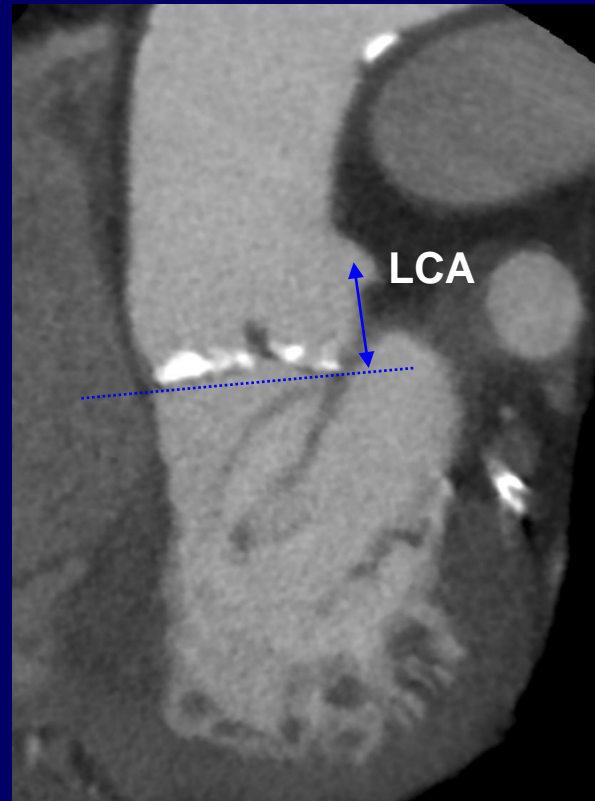
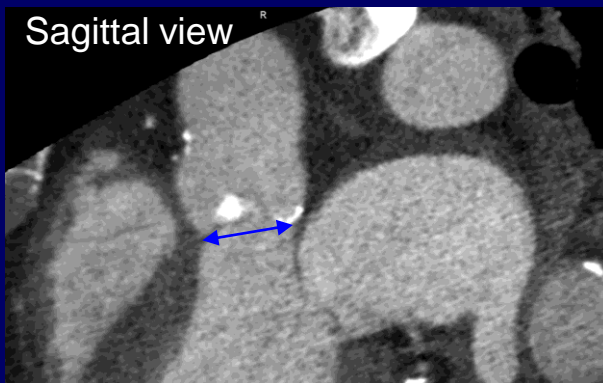
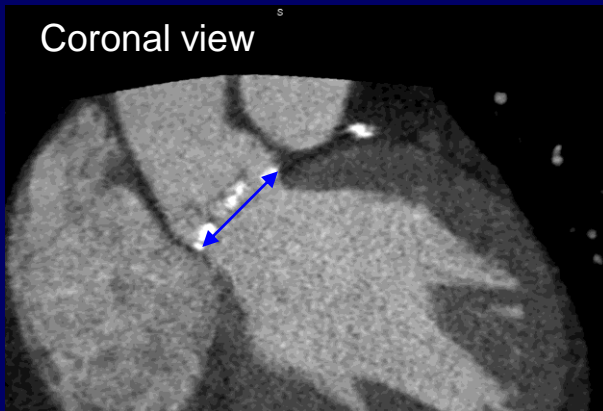
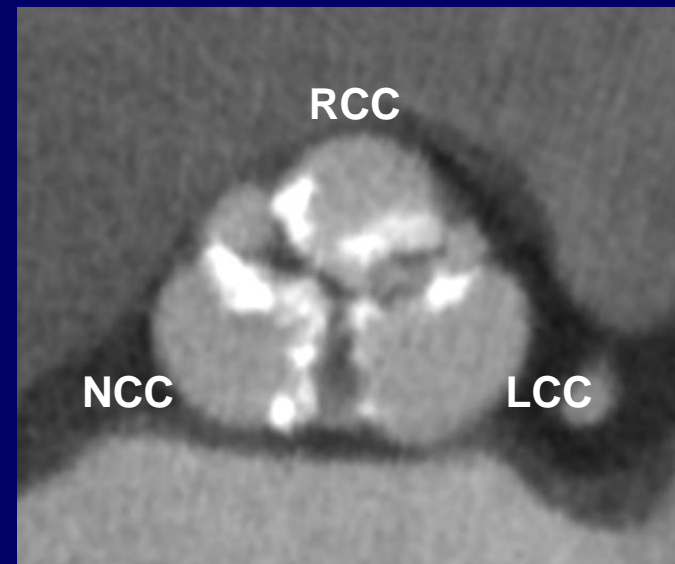
- 85 year-old man
- CV risk factors: Hypertension, hypercholesterolemia
- Comorbidities: COPD, prior myocardial infarction
- LogEuroscore: 23.4%
- Severe AS: Max/Mean gradient 96 / 50 mmHg, AVA 0.8 cm²
- Symptoms: Dyspnea NYHA III-IV

Confirmation of aortic stenosis severity



- **MSCT:**

- Morphology of the aortic valve
 - Tricuspid/Bicuspid
 - Calcifications
- Annulus sizing
- Distance from the coronary ostia to the annulus plane

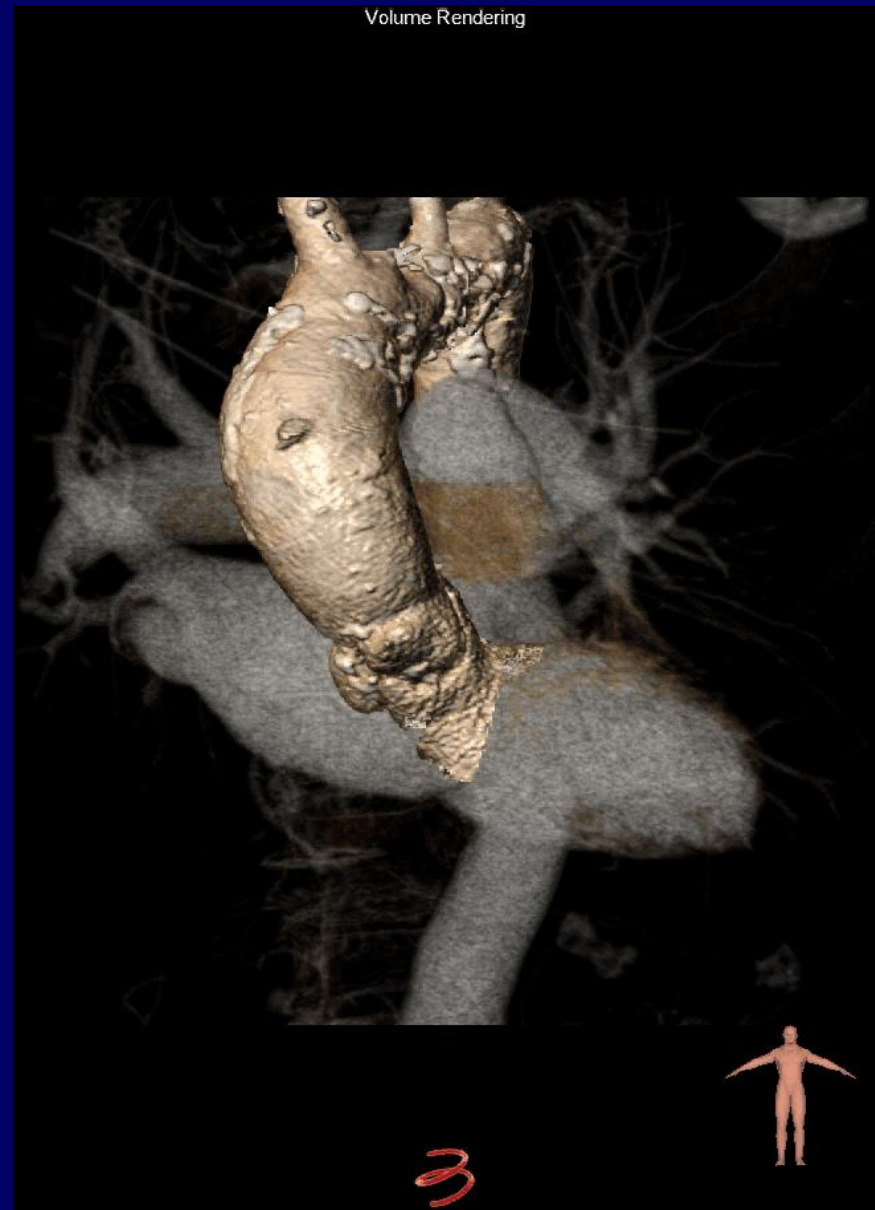


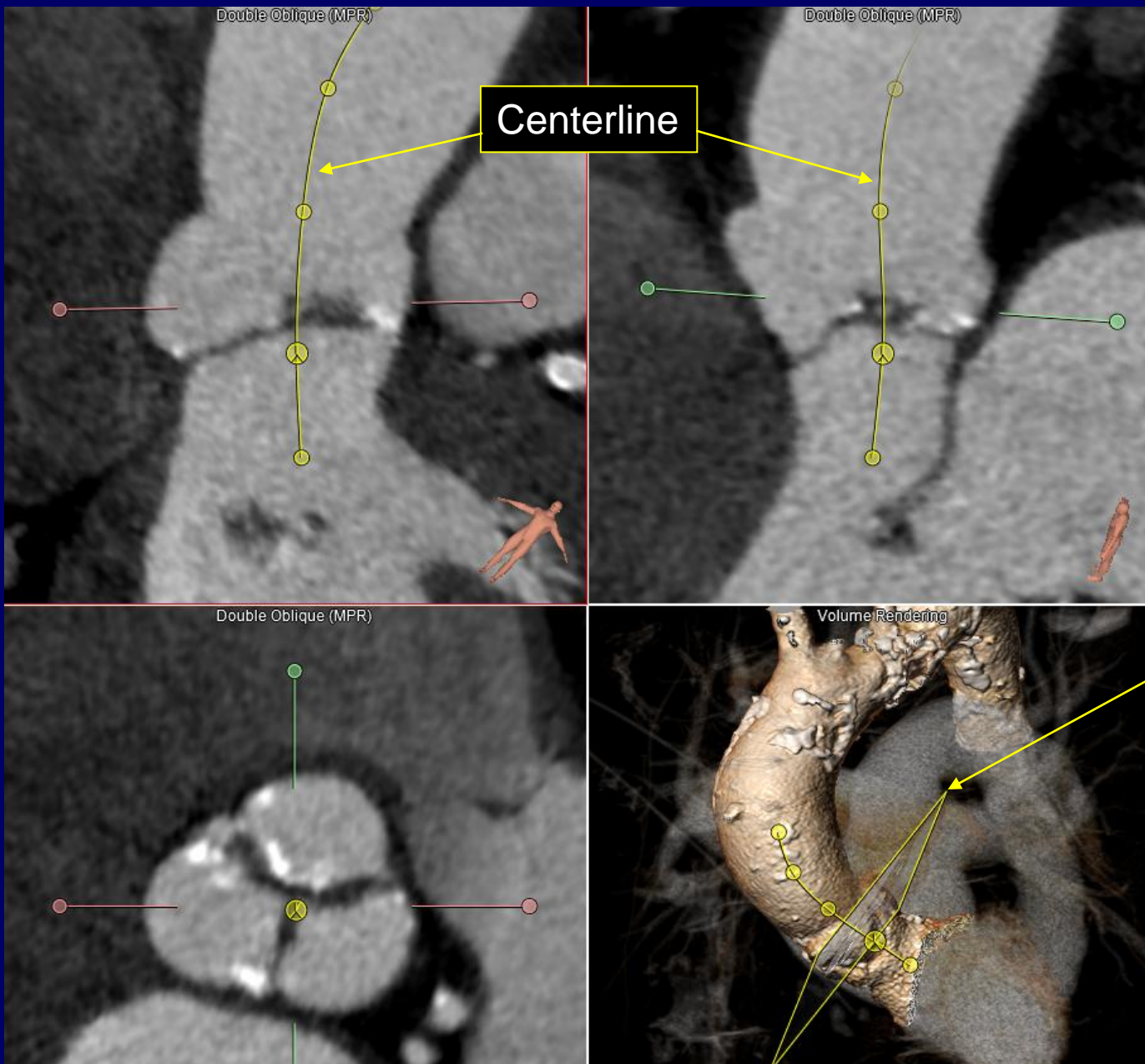
- **MSCT:**

Semiautomatic approach

1. Centerline across the aortic valve and aorta

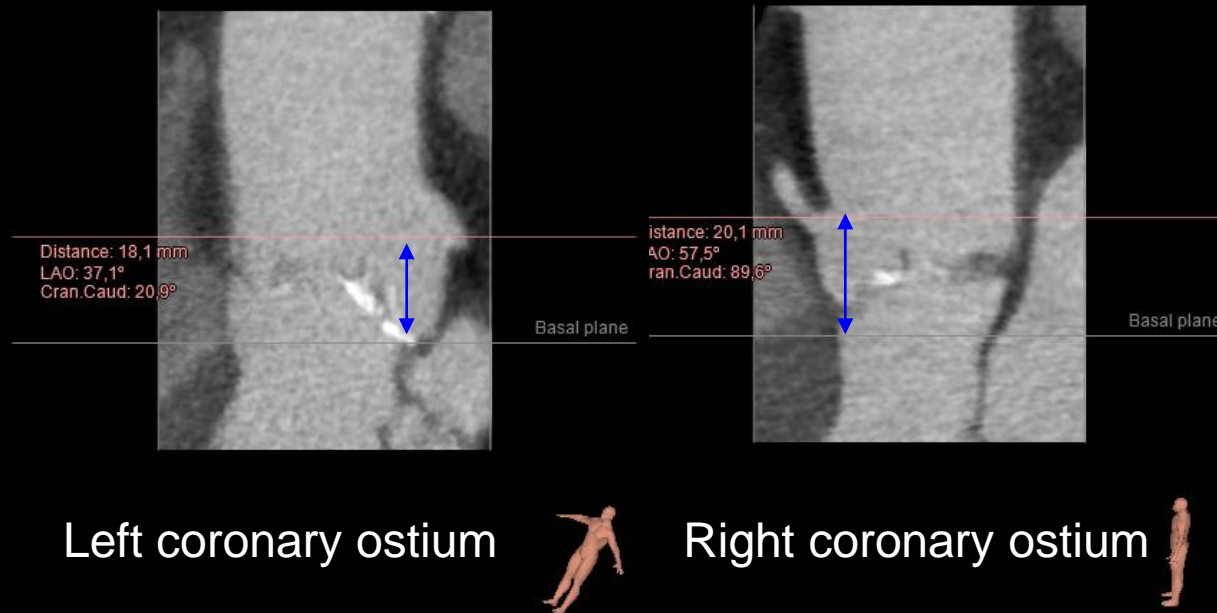
- Annulus sizing
- Distance from the coronary ostia to the annular plane





Annular plane

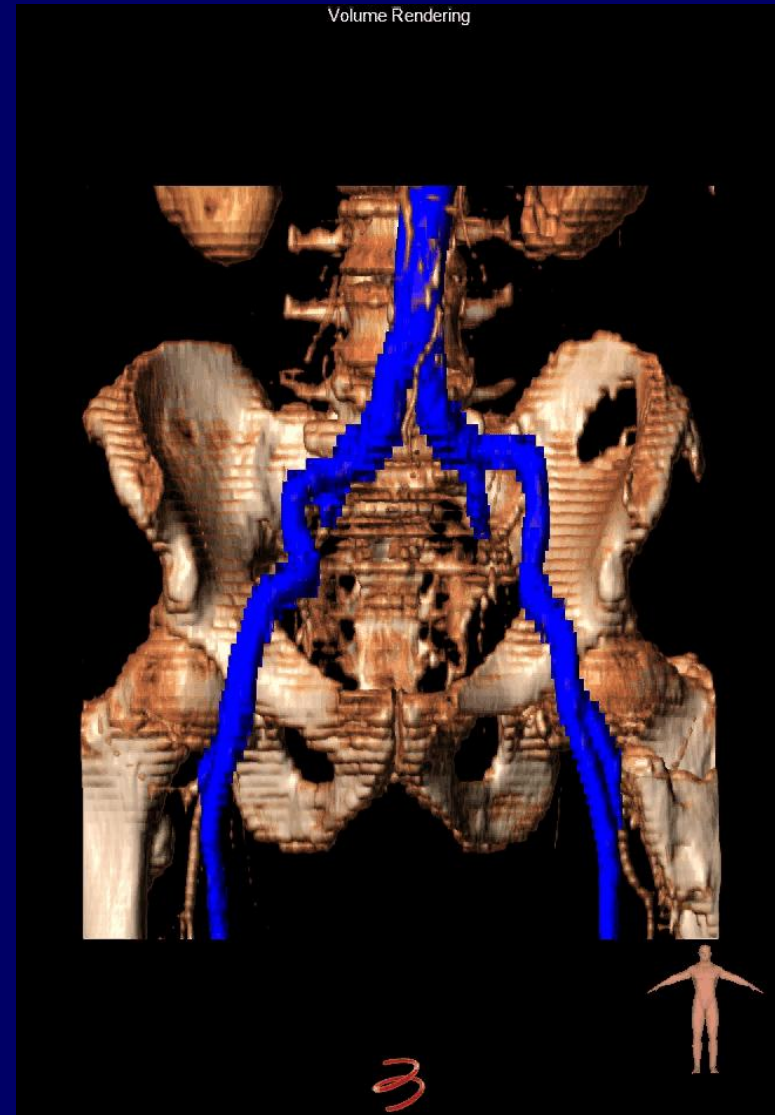
The annular plane displays a cross sectional view along the centerline.



- **MSCT:**

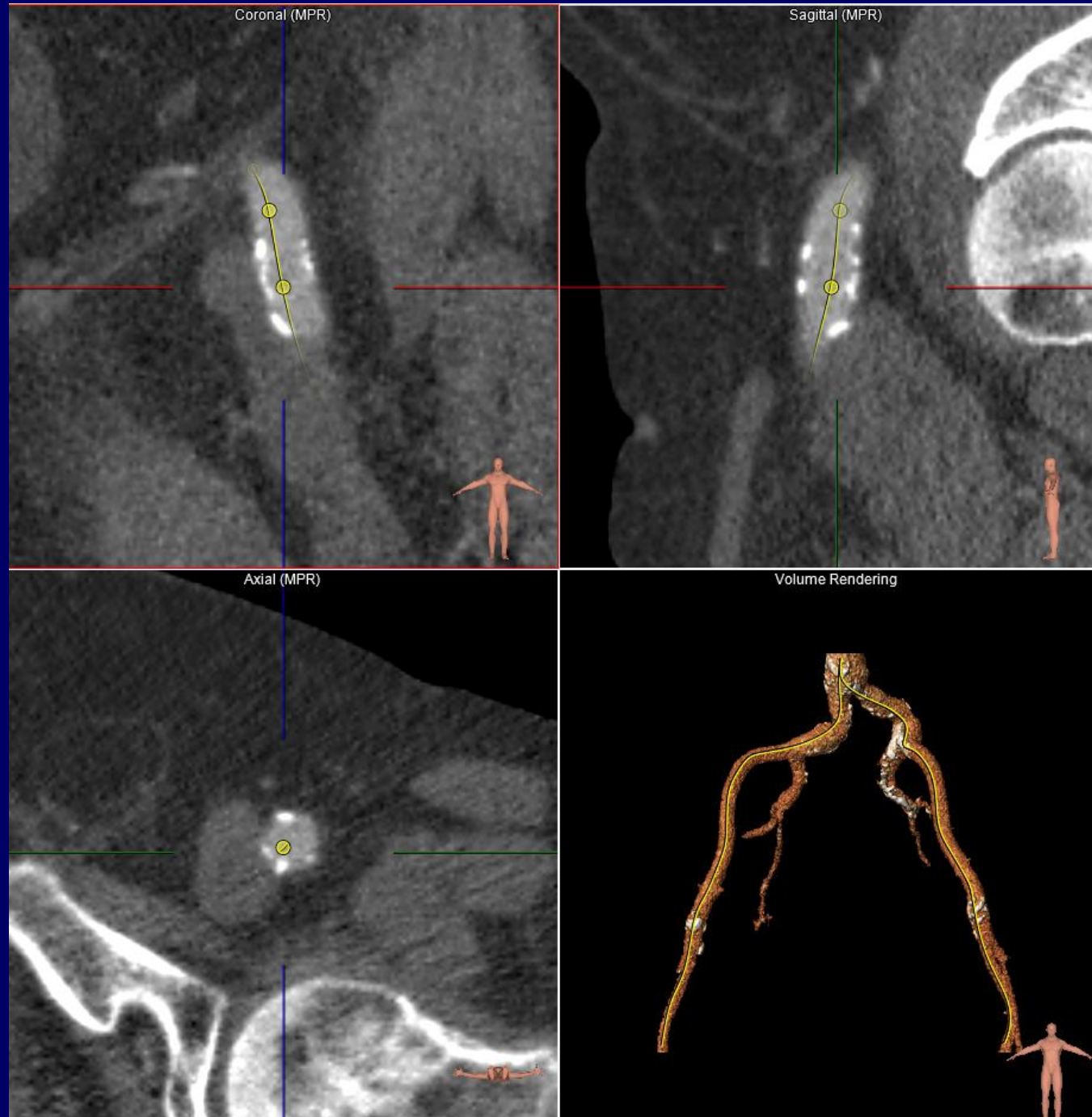
- 2. Evaluation of peripheral arteries (transfemoral approach)

- Calcifications and tortuosity



The centerline is placed automatically across the peripheral arteries.

The coronal, sagittal and axial views of the peripheral arteries permit the alignment of the centerline along the entire vessel.

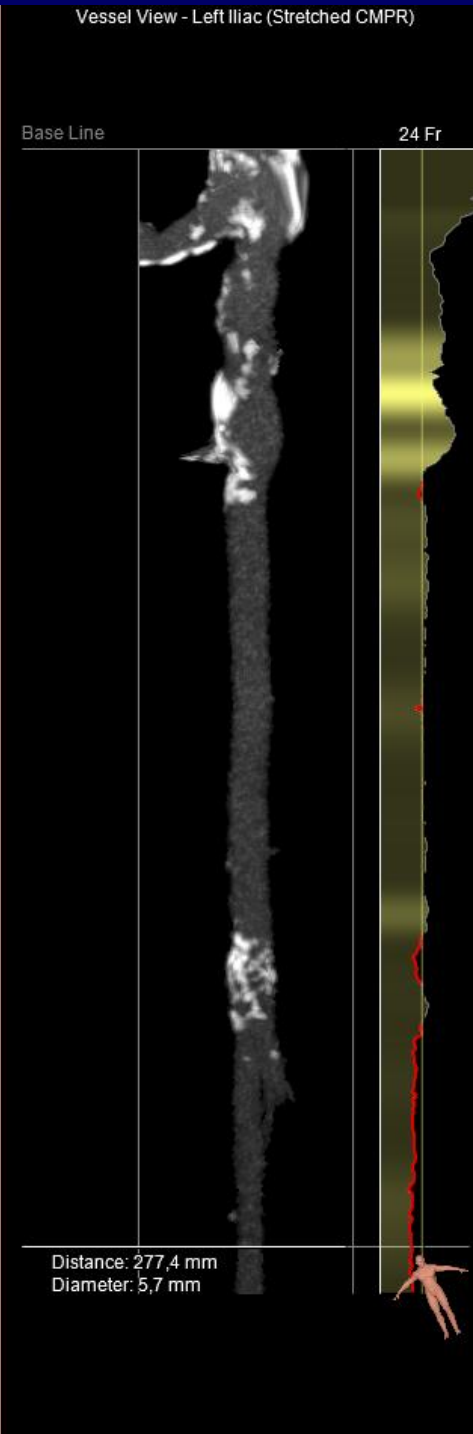
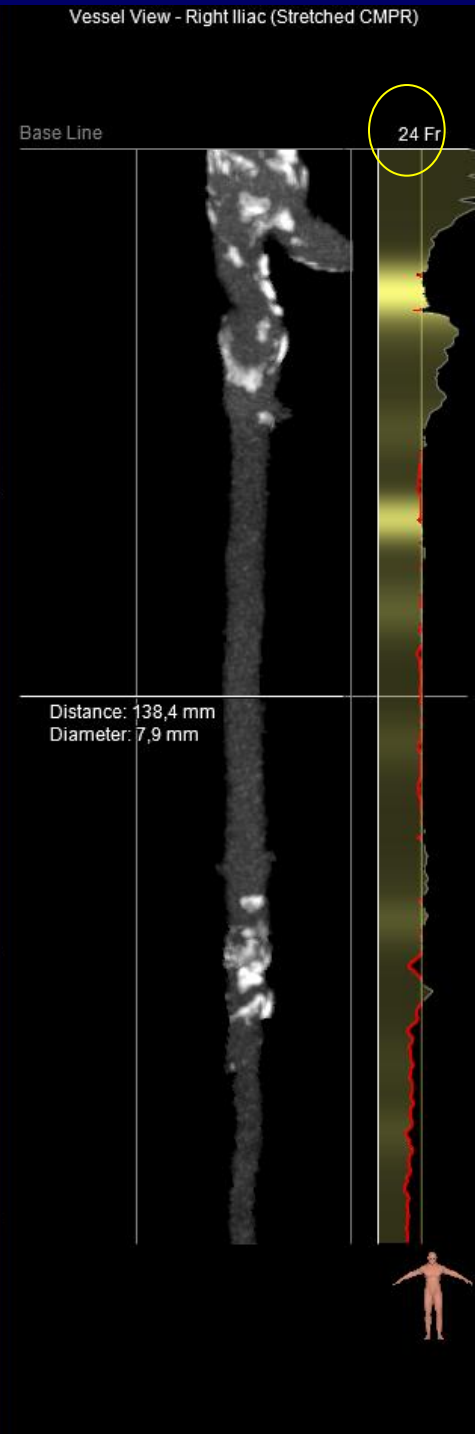
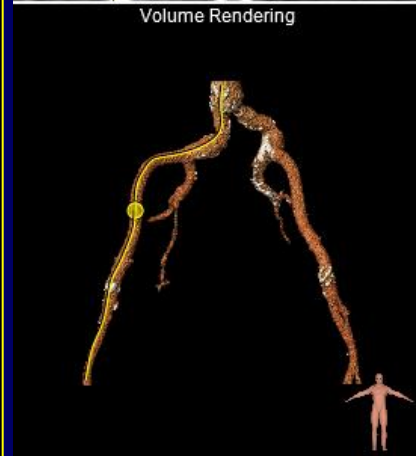
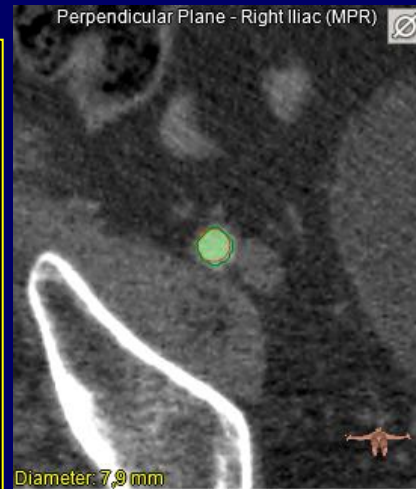


The software displays the vessel view of the arteries.

The internal diameter of the artery is measured and compared to the size of the delivery system.

A dimension smaller than the delivery system is coded in red surface.

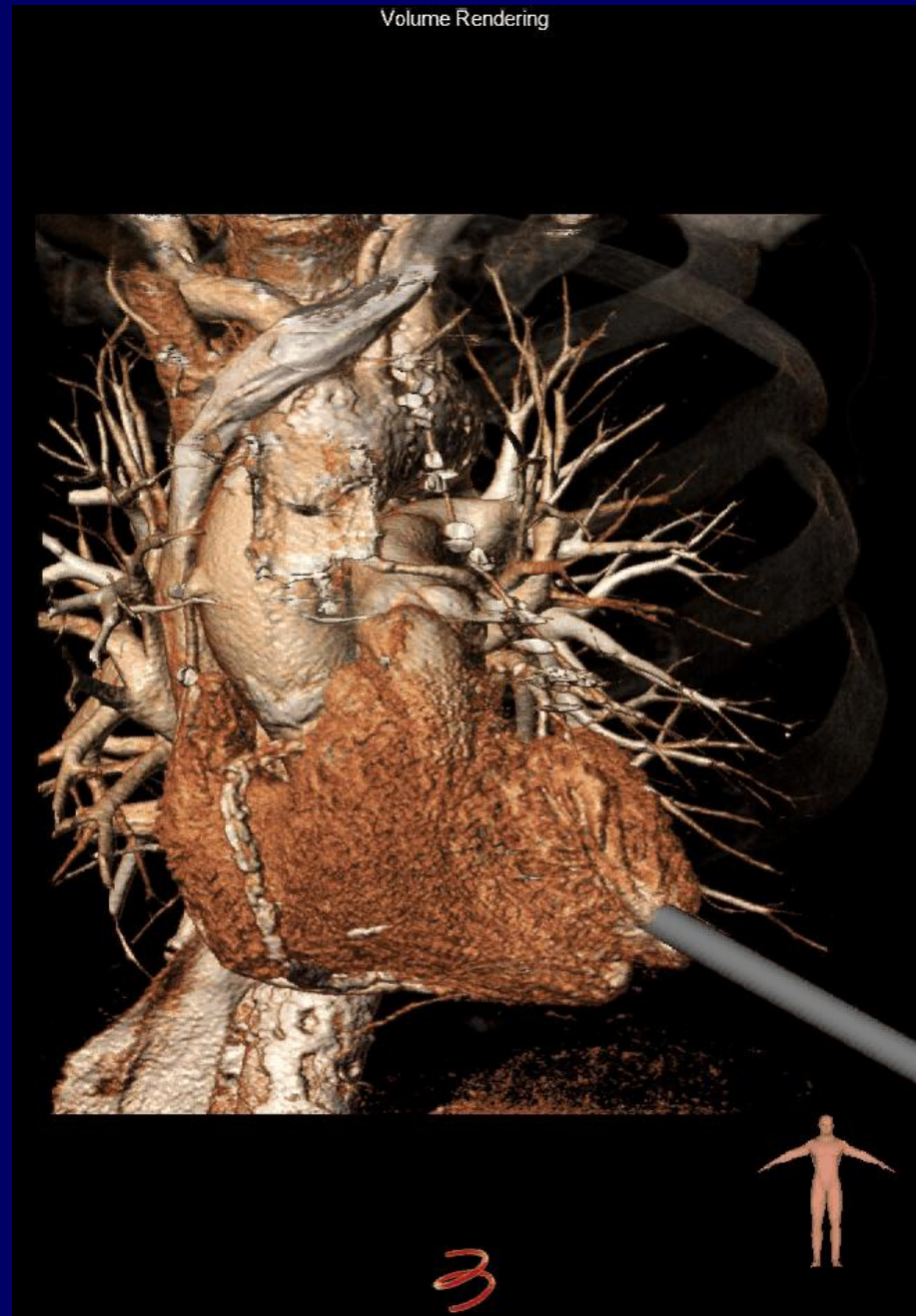
The tortuosity is color-coded in yellow shades. The brighter yellow, the more tortuous.



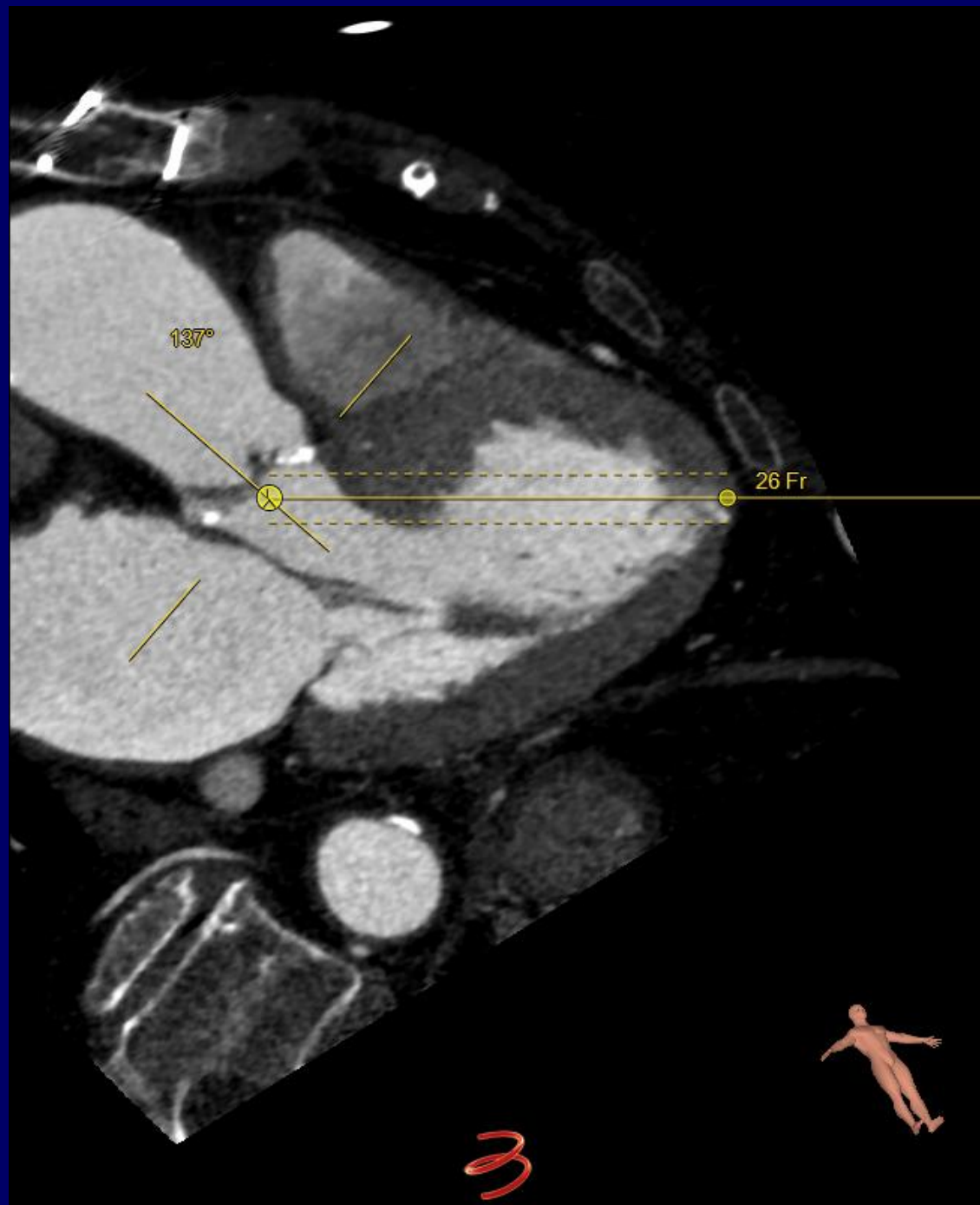
- **MSCT:**

3. Transapical approach:

- Evaluation of the LV apex
- LV sigmoid septum



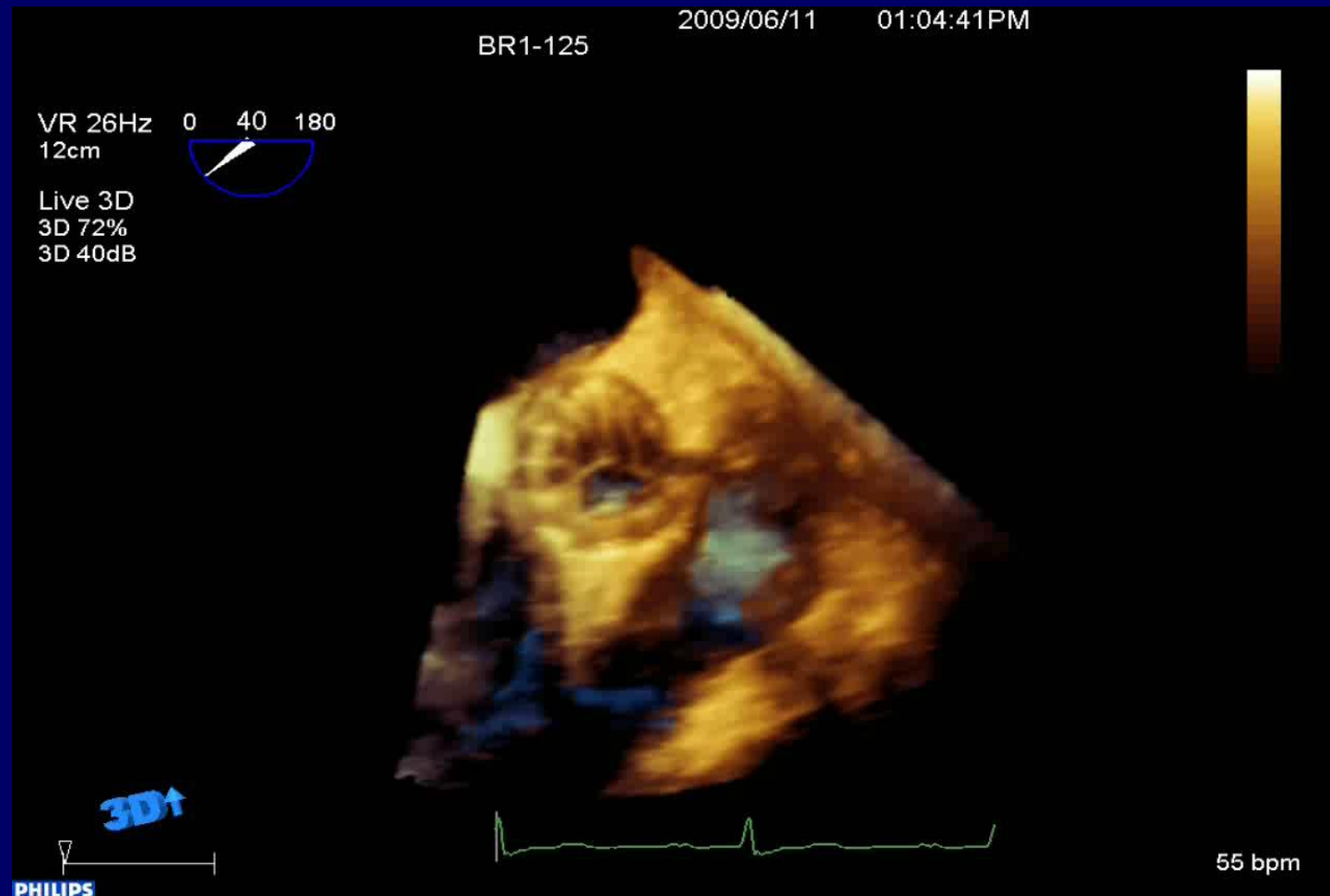
Patients with pronounced sigmoid septum may be more amenable for transapical approach since the positioning of the prosthesis (Edwards-Sapien) may be more stable.



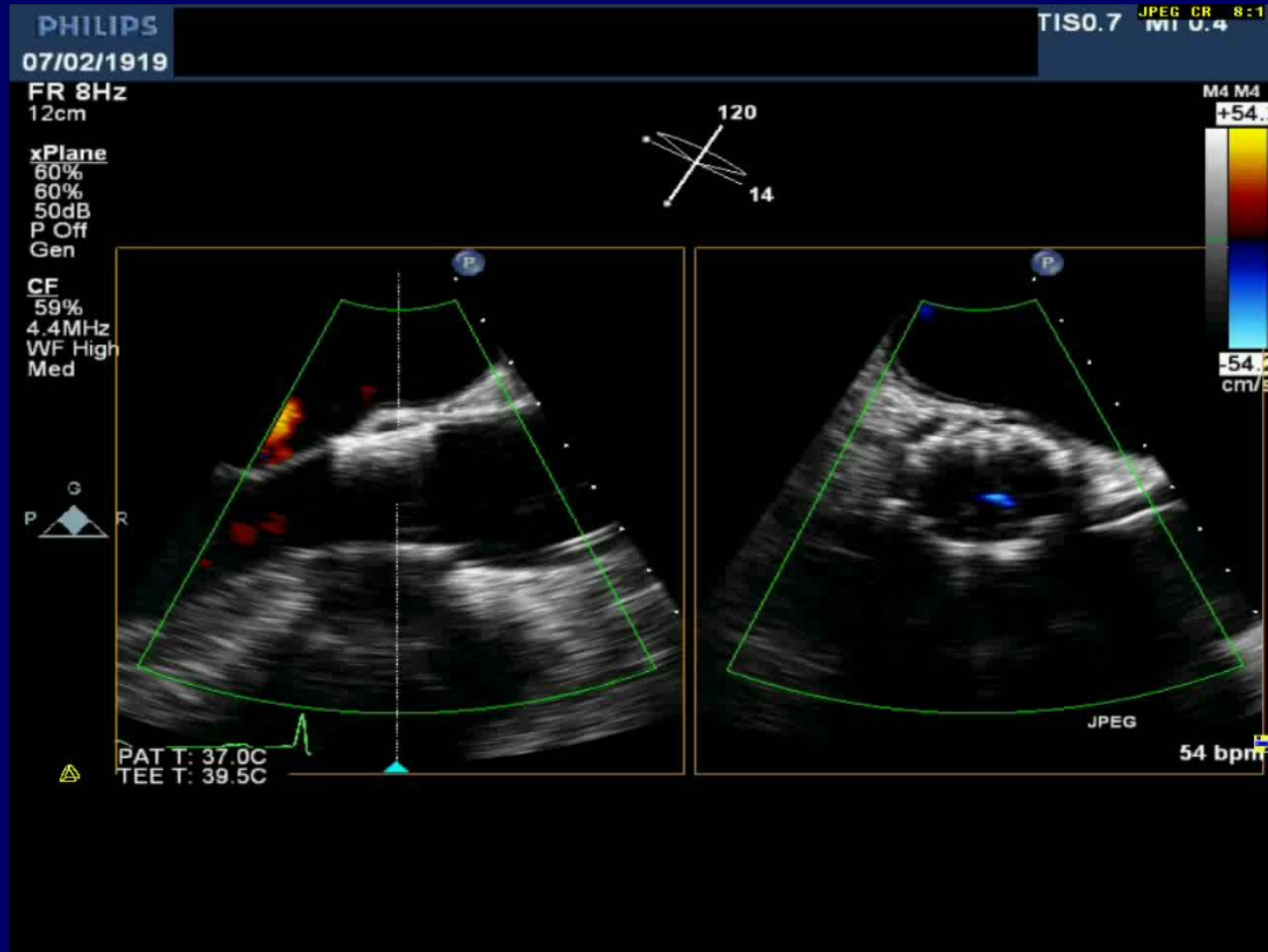
Transapical approach



Valve function after TAVI?

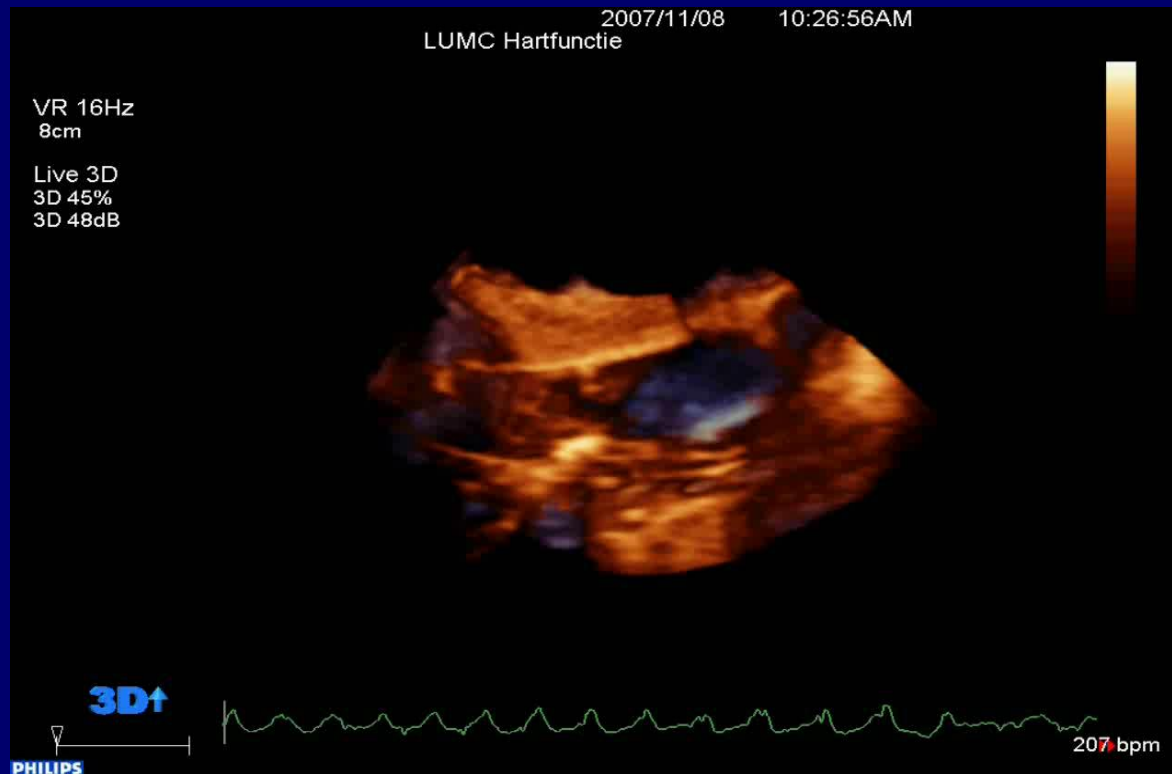


AR after TAVI?



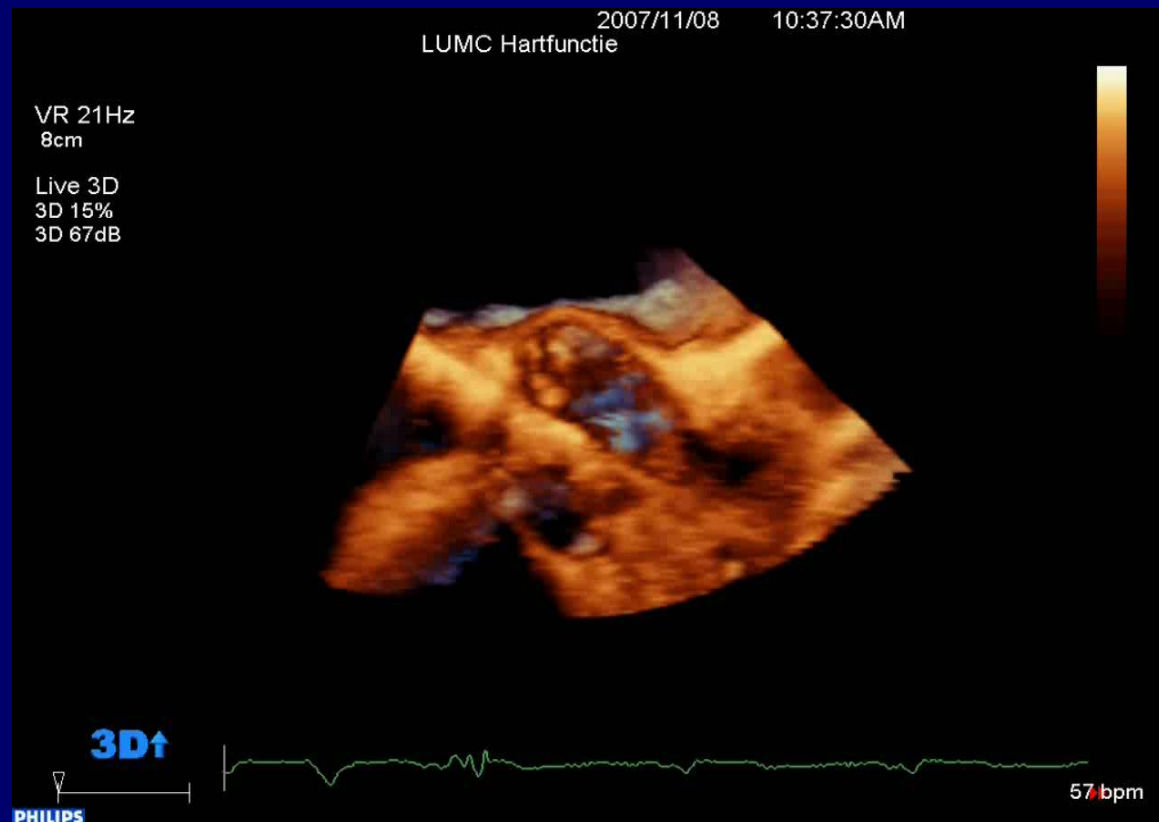
TEE during TAVI

Balloon inflation



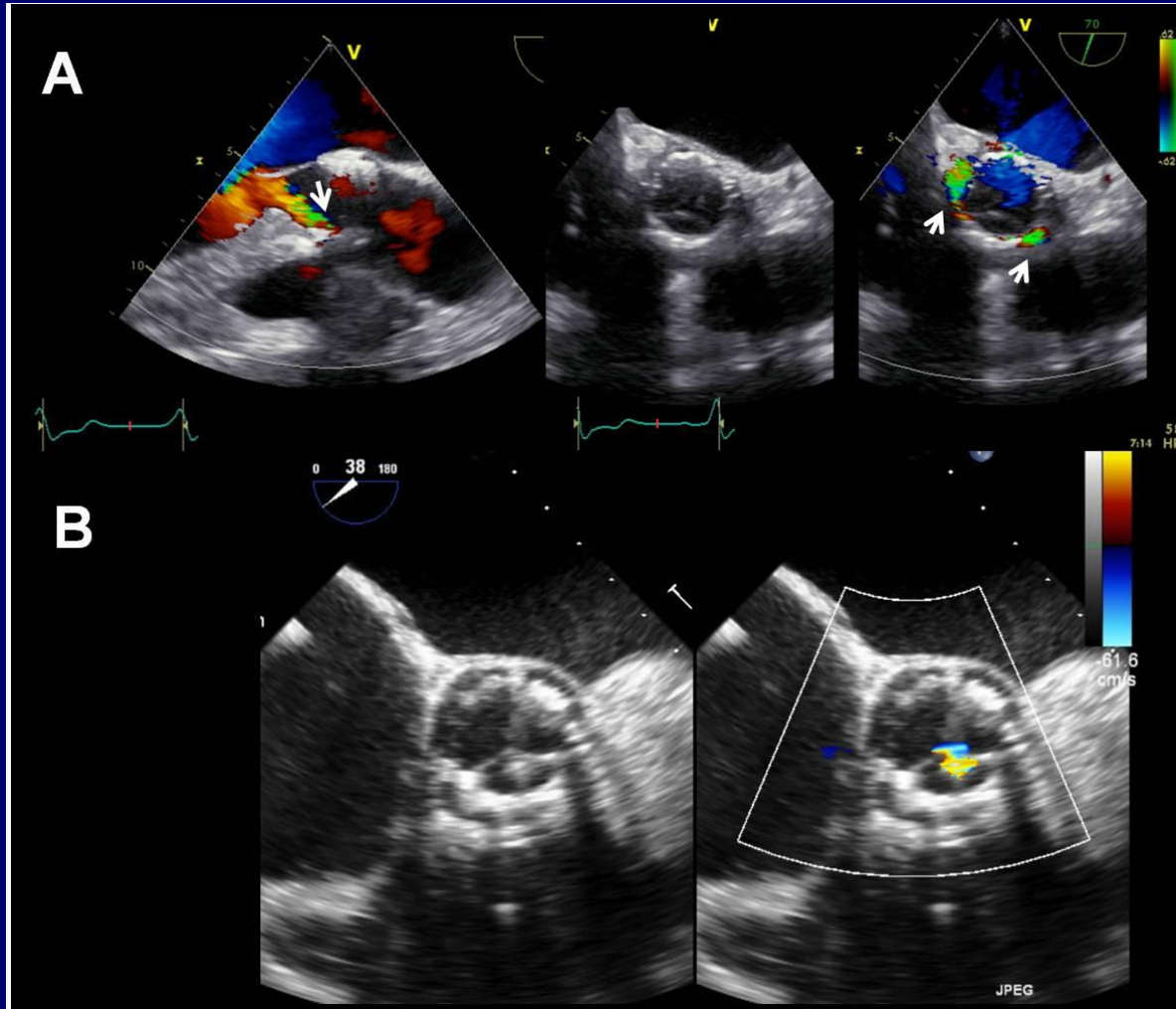
TEE during TAVI

Guiding of catheter position

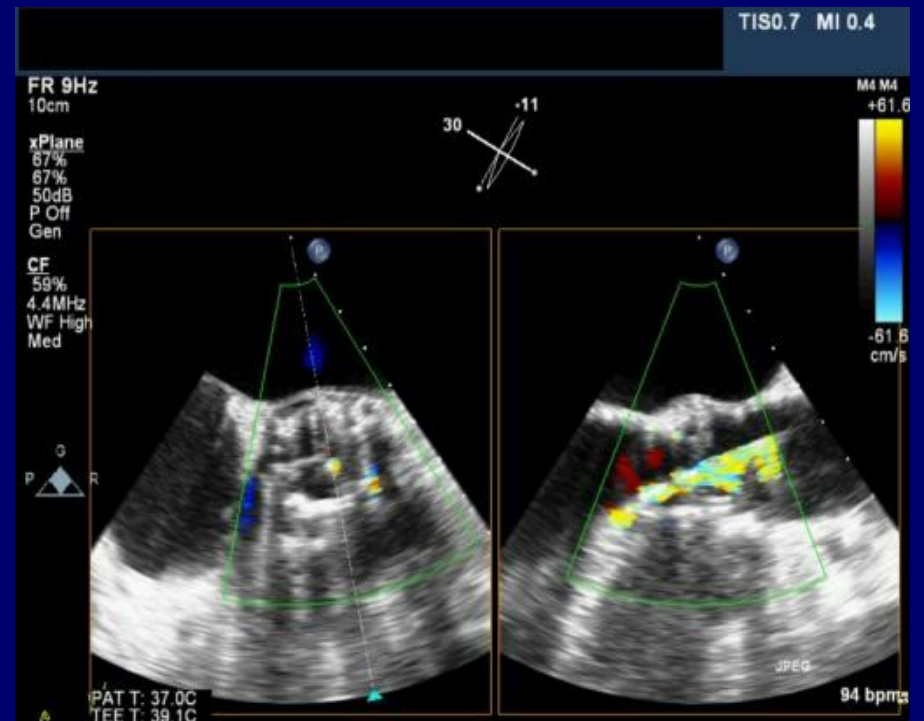
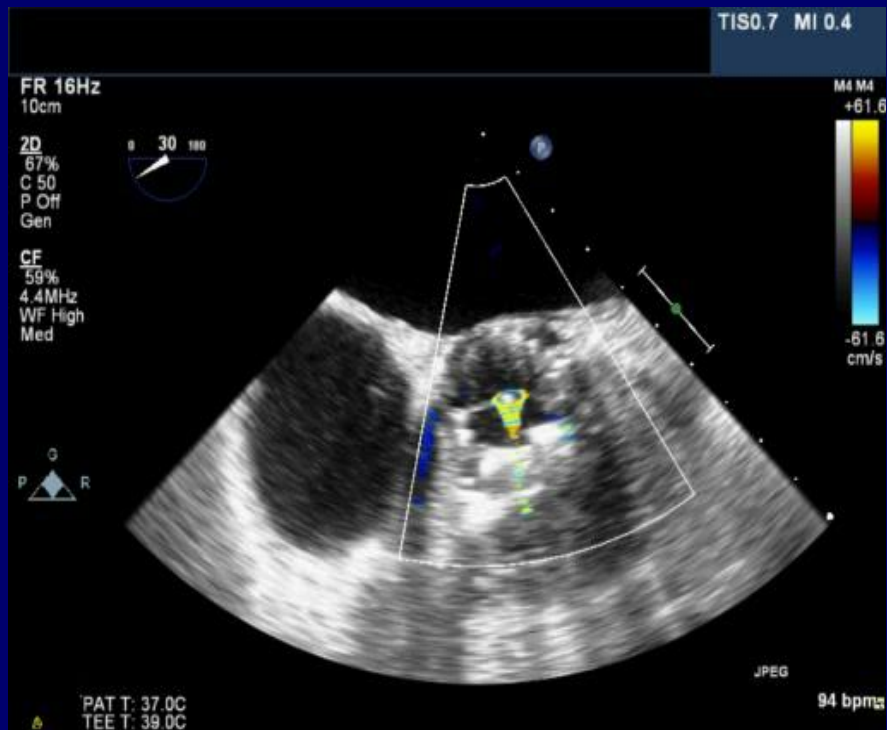


AR - mechanism?

Valvular or paravalvular?

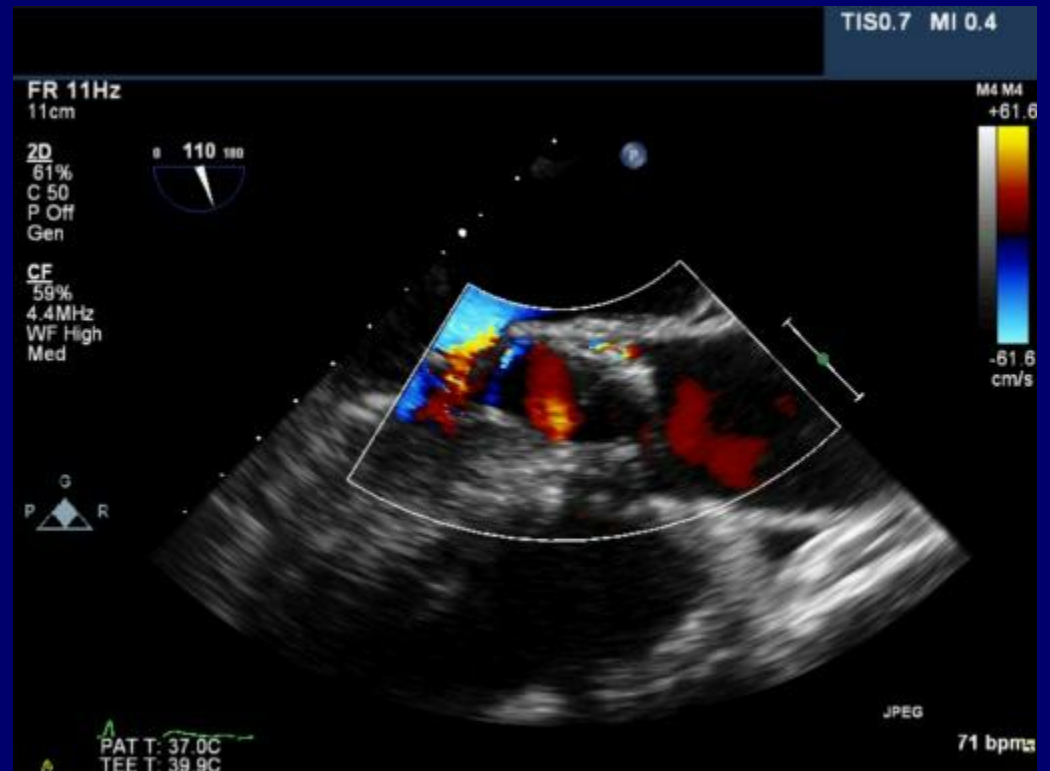
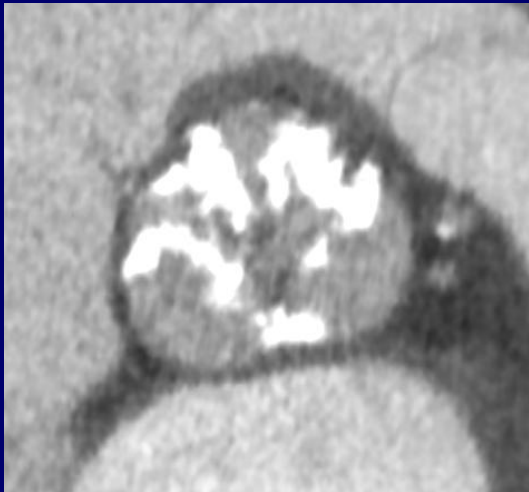
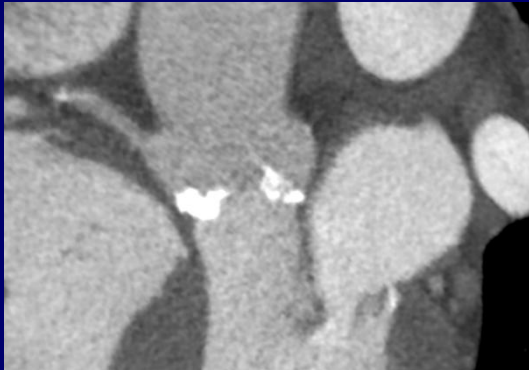


Mechanism: valvular (catheter in-situ)



Paravalvular AR post-TAVI

Severe aortic valve calcifications

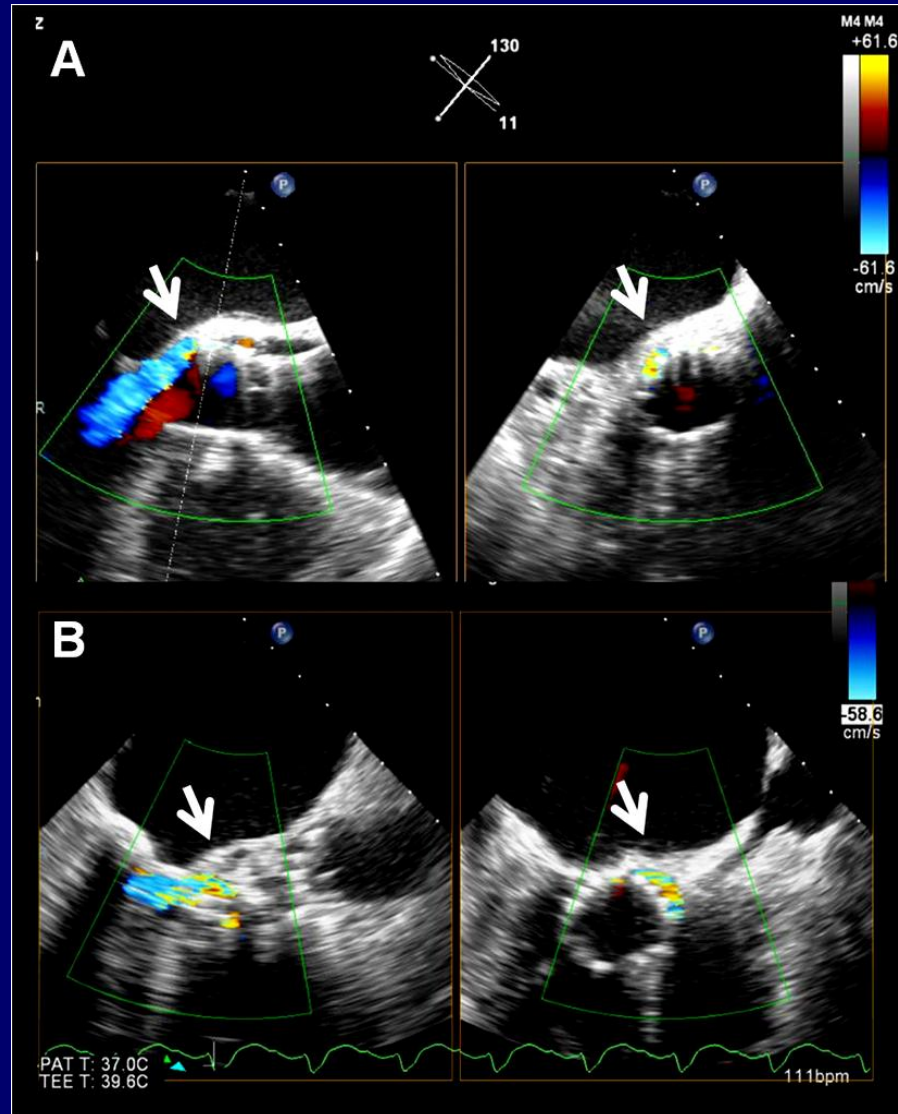


Mechanism?

1. V: Too small prosthesis – undersizing
2. V: After ballooning – damage to leaflet
3. V: Malfunction of leaflet (“frozen leaflet”)
4. PV: Valve / annular calcifications

Quantification paravalvular AR

<10% circumferential
extent



>20% circumferential
extent

Case 2

- 87 year-old woman
- CV risk factors: Hypertension, diabetes
- Comorbidities: Prior myocardial infarction (PCI), cerebral stroke
- LogEuroscore: 24.5%
- Severe AS: Max/Mean gradient 100 / 61 mmHg, AVA 0.9 cm²
- LVEF 55%
- Symptoms: Dyspnea NYHA III-IV

PHILIPS

20/06/1953

FR 28Hz

10cm

xPlane

65%

65%

50dB

P Off

Gen

09:43:51

TIS0.1

JPEG CR 14:1

MI 0.5

X7-2t/TEE

M4



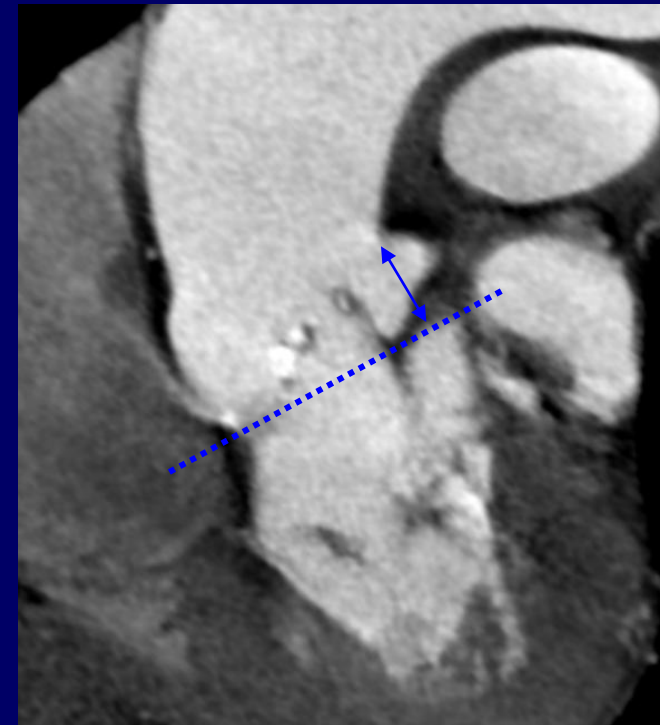
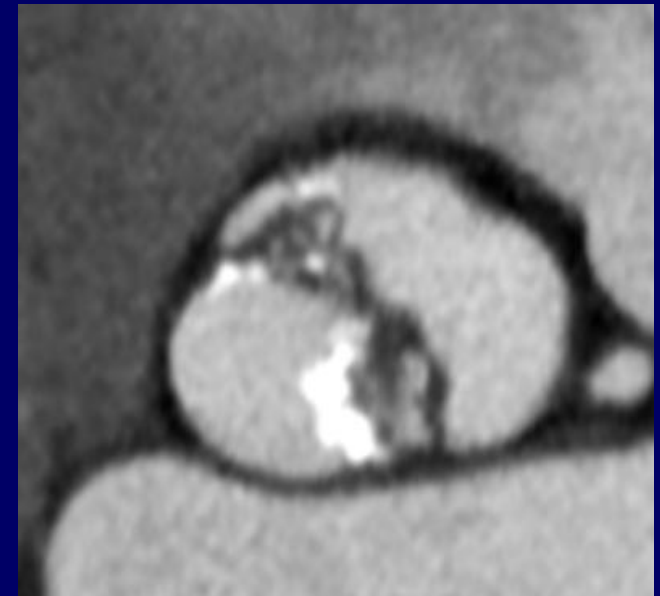
PAT T: 37.0C
TEE T: 39.1C

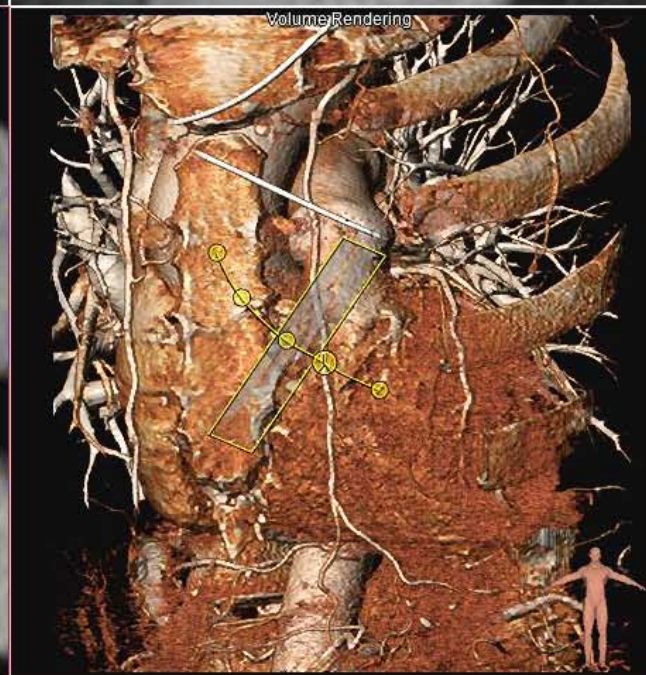
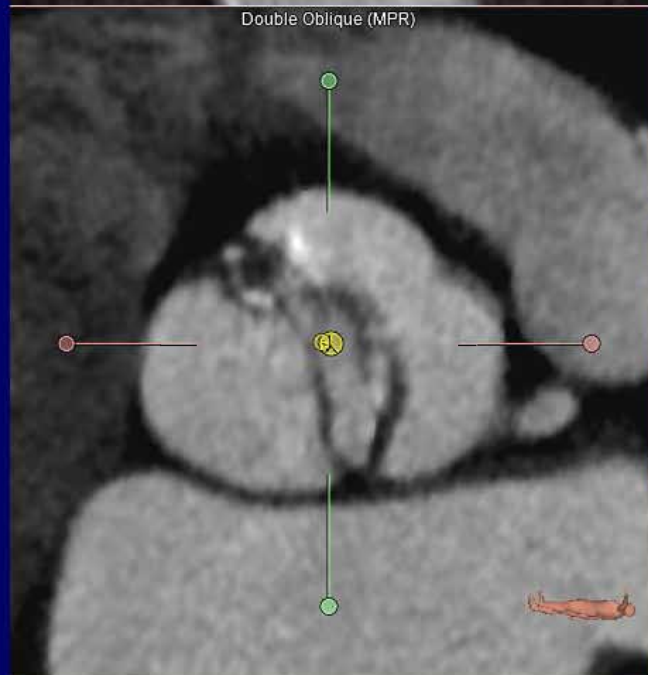
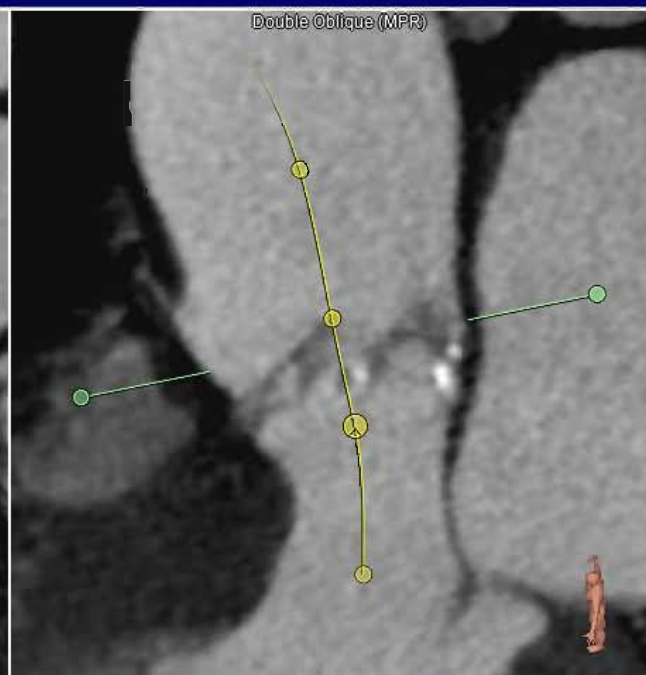


69 bpm

- **MSCT:**

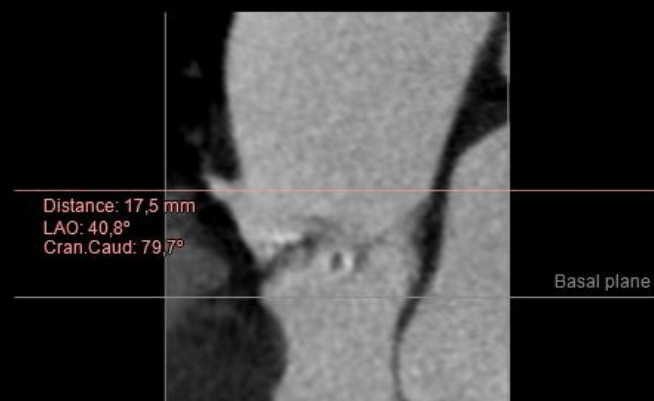
- Morphology of the aortic valve
 - Tricuspid/Bicuspid
 - Calcifications
- Annulus sizing
- Distance from the coronary ostia to the annulus plane







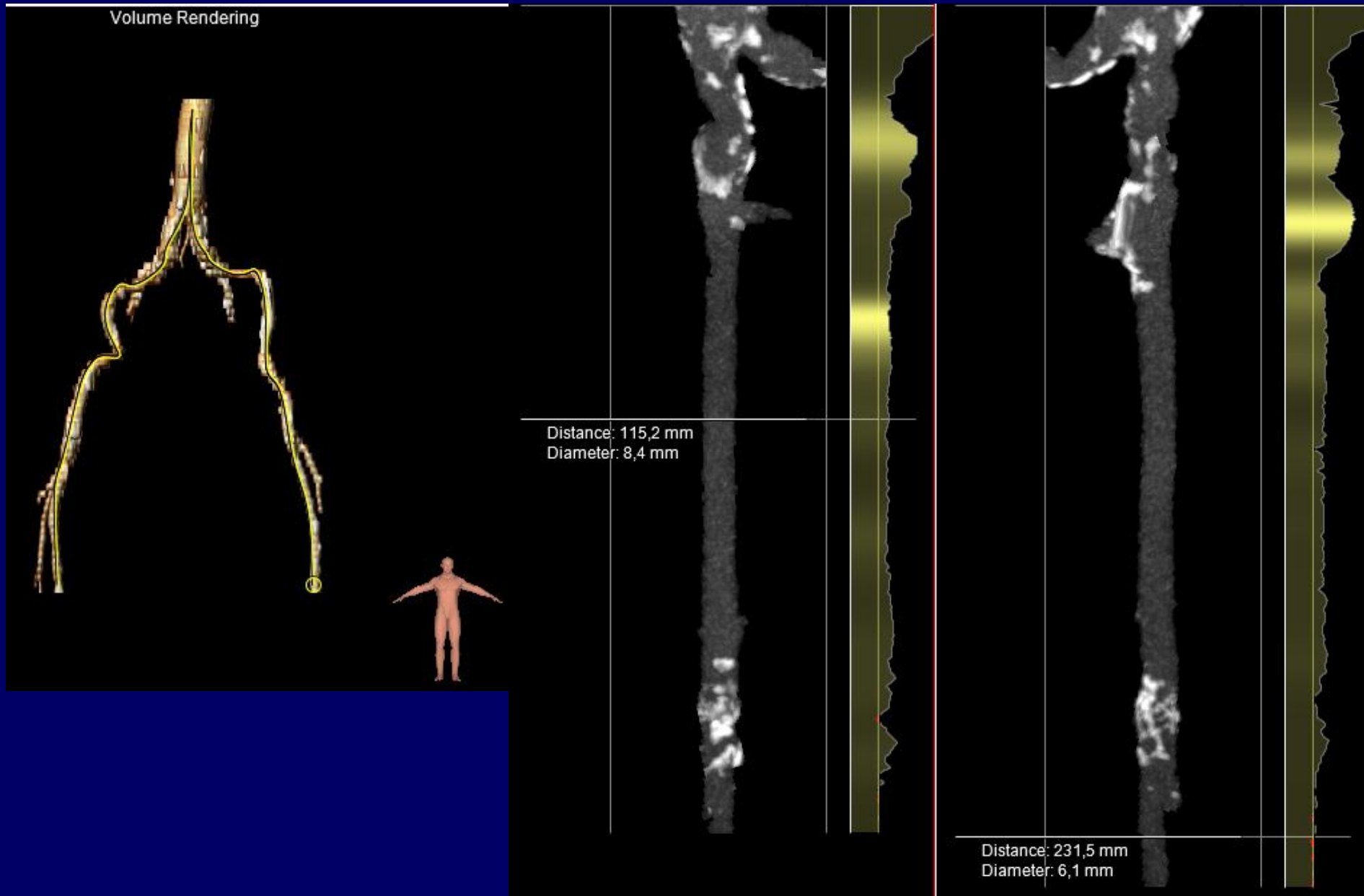
Left coronary ostium



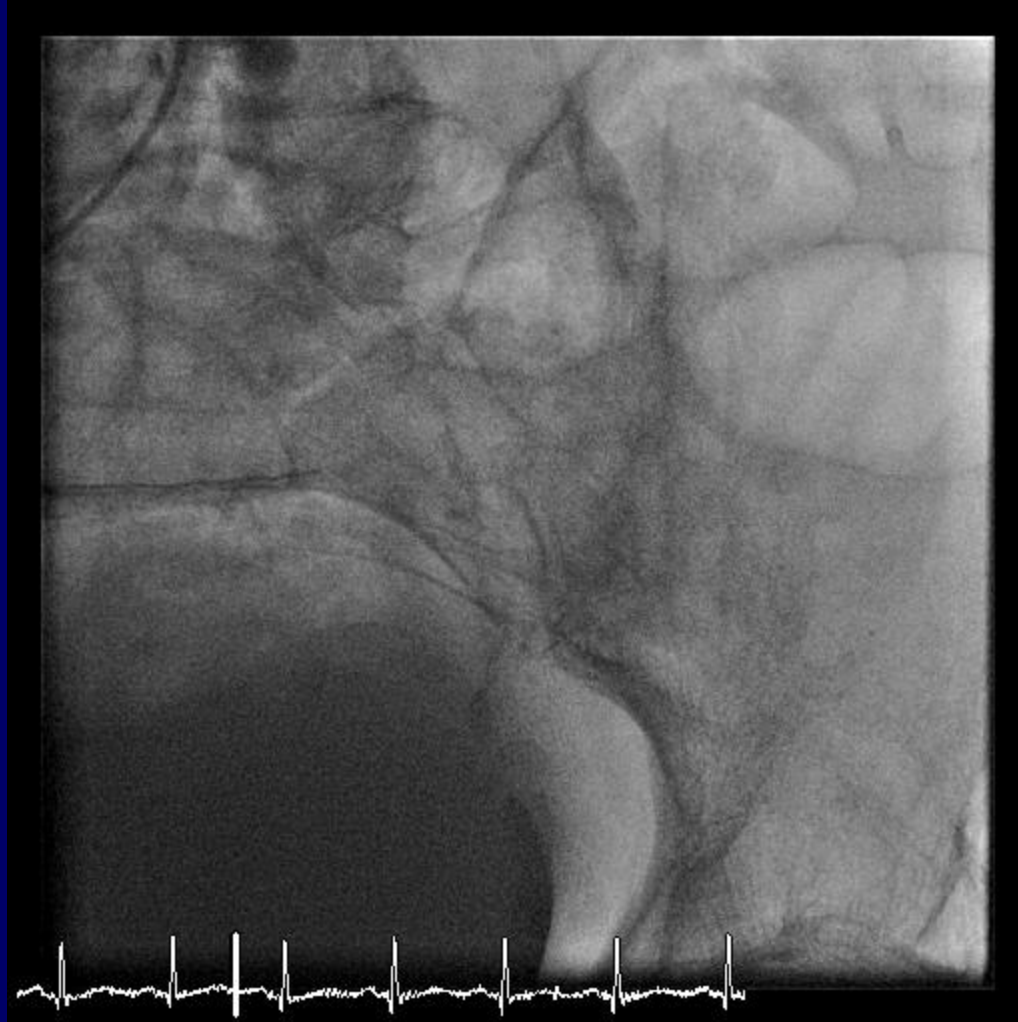
Right coronary ostium



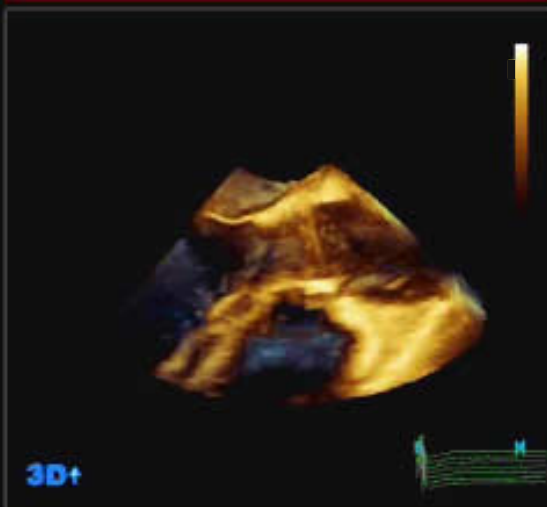
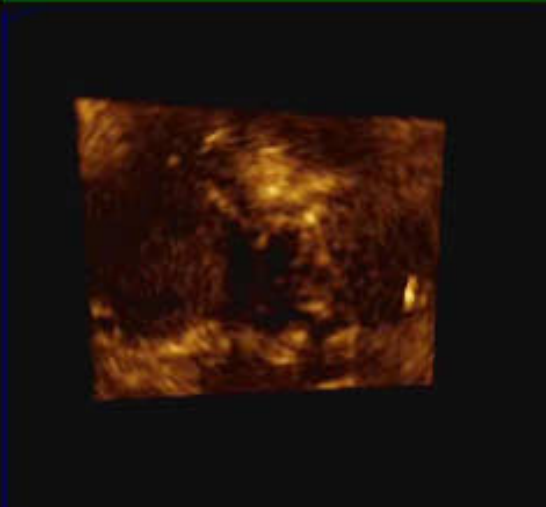
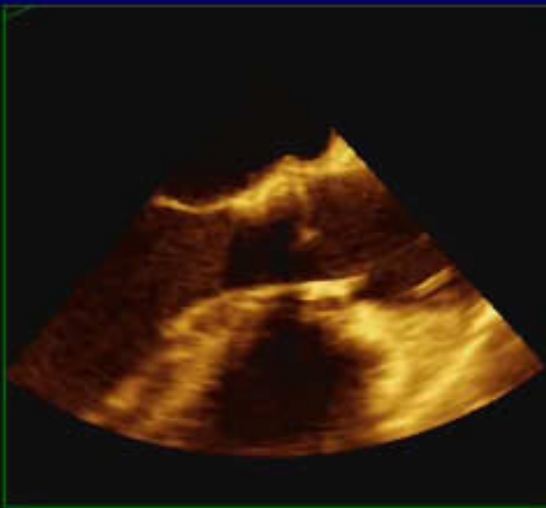
- **MSCT: Transfemoral approach**



- **Angiography: Transfemoral approach**







PHILIPS

3D↑

10:22:20

TIS0.8

JPEG CR 11:1

X7-2t/TEE

FR 6Hz

9.0cm

xPlane

69%

69%

50dB

P Off

Res

CF

63%

4.4MHz

WF High

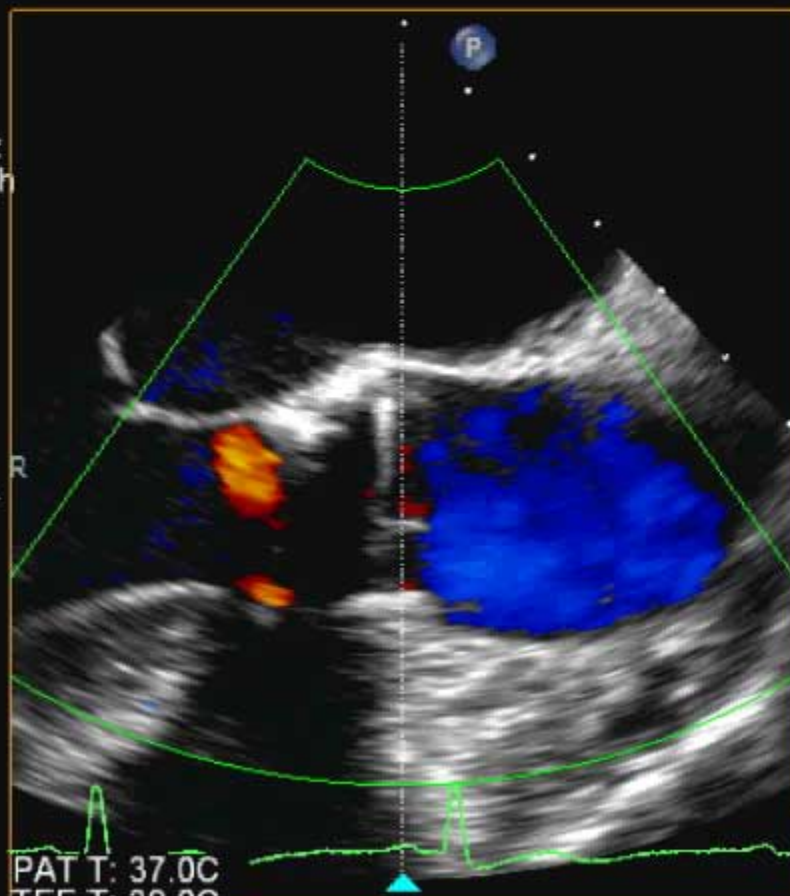
Med



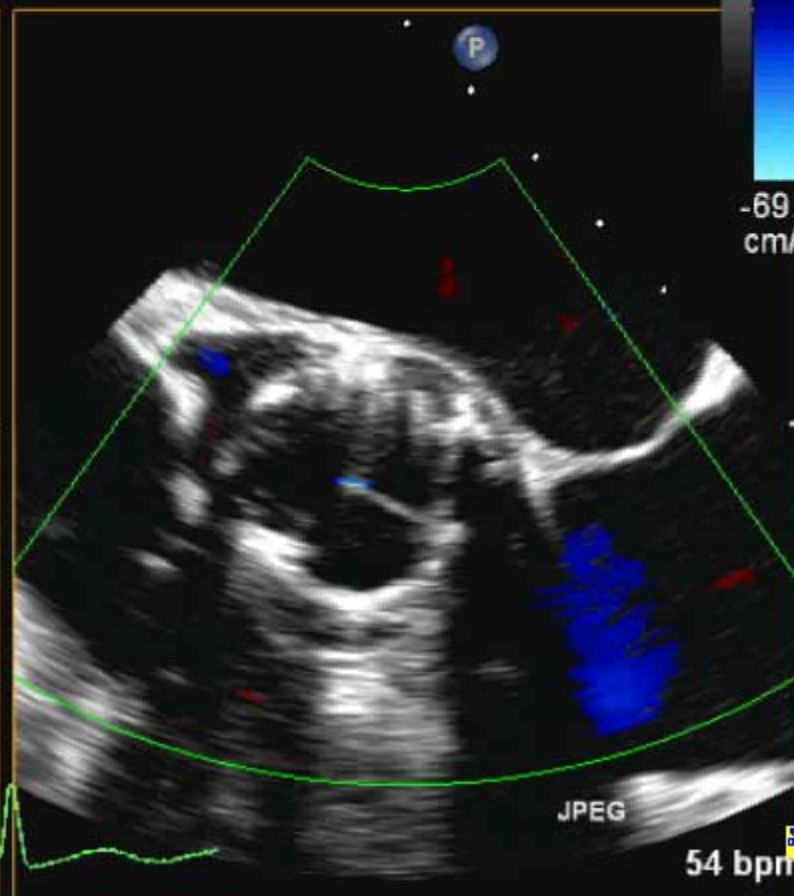
M4 M4

+53.9

-69.3
cm/s



PAT T: 37.0C
TEE T: 39.0C



54 bpm

- **MSCT: 1-month follow-up**
 - Evaluation of prosthesis deployment and position

