Hemodynamic Crash during PCI and TAVI in a low EF patient

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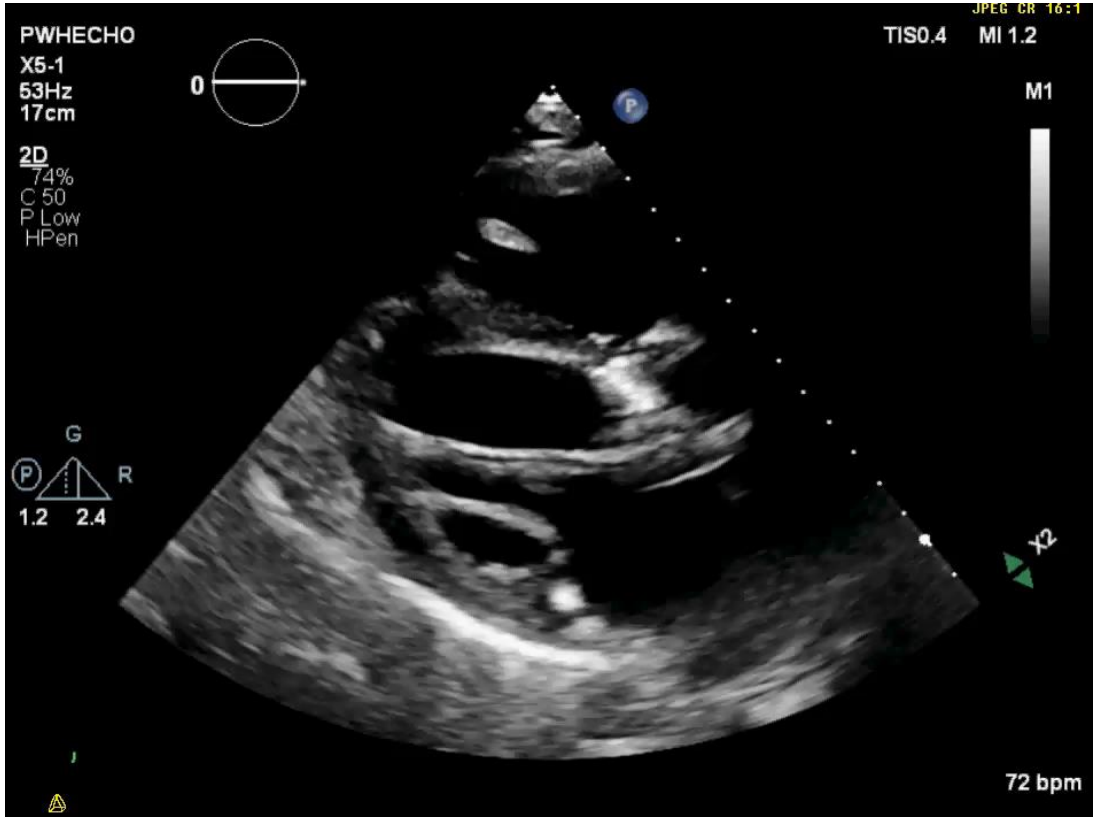
Case history

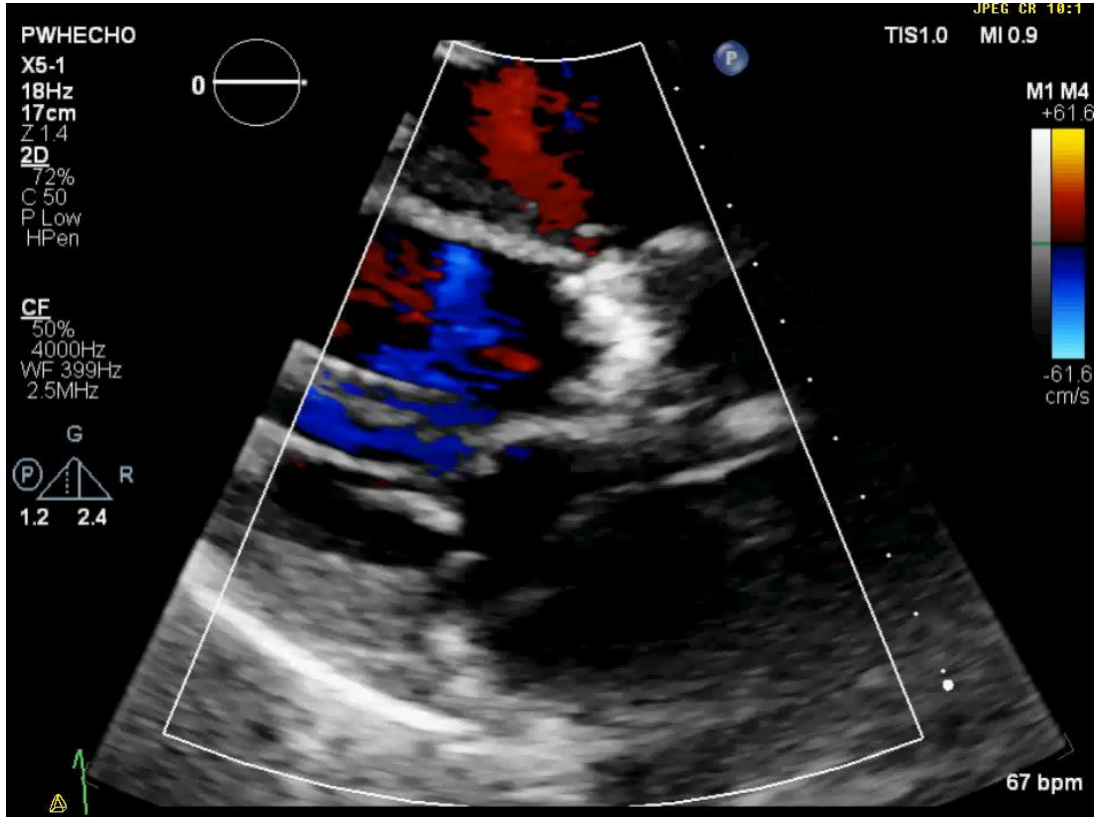
- M/70, Ex-chronic smoker (1ppd x 30 years)
- PMH
  - Hyperlipidemia
  - AF
  - Left MCA infarct in Dec 2018
  - Small bowel angiodysplasia with iron deficiency anemia
  - IHD
    - PCI to LCx 1996 (BMS)
    - PCI to LAD 1999 (BMS)
    - PCI to RCA in 2001 (BMS)
  - ACS in 5/2020, bicuspid AV with moderate AS on Echo at that time, EF 45%
    - Coro showed LM normal, heavily calcified and tortuous LAD, pLAD 70%, m-dAD diffuse 50%, heavily calcified LCx 80%, heavily calcified RCA, mid RCA 70% followed by 80%.
    - PCI to o-mRCA with Rota-shock and 4 DES
    - Stage PCI to pLCx-OM1 with Rota + 1 DES in 6/2020, wiring of LAD is difficult due to tortuosity and calcium, patient cannot tolerate the procedure, hence decided for reangio +/- PCI later.

History of present illness

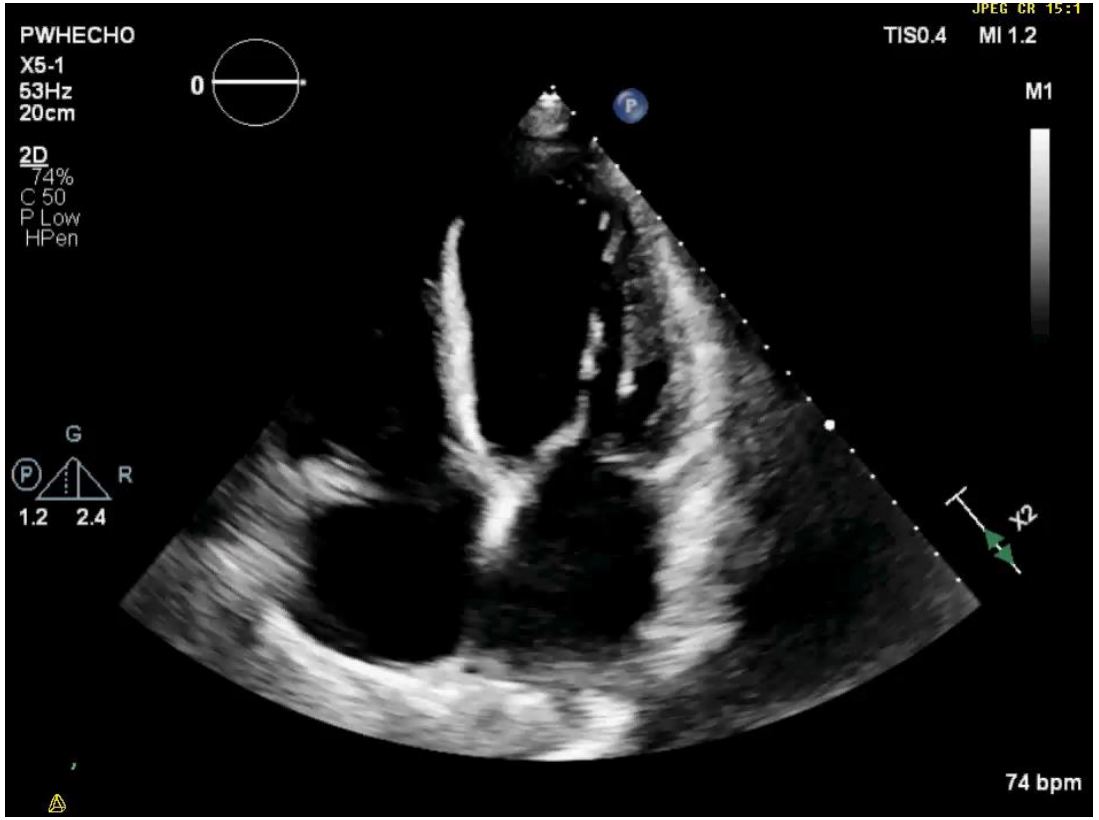
- Admitted for CHF in Sept 2021
  - Echo 9/2021 showed severe impaired LVEF 27%, mean AV gradient 33mmHg
  - Restudy coronary angiogram showed LM normal, LAD calcified and tortuous LAD, p-mLAD diffuse 80%, distal LAD diffuse 50% for medical therapy, LCx stent patent, RCA stent patent with diffuse 50% ISR.
  - Developed cardiogenic shock requiring urgent BAV in Oct 2021
  - Pre-TAVI CT performed and AV calcium score > 2000, indicating severe AS
  - STS score = 11% (mortality), 52% (morbidity and mortality)

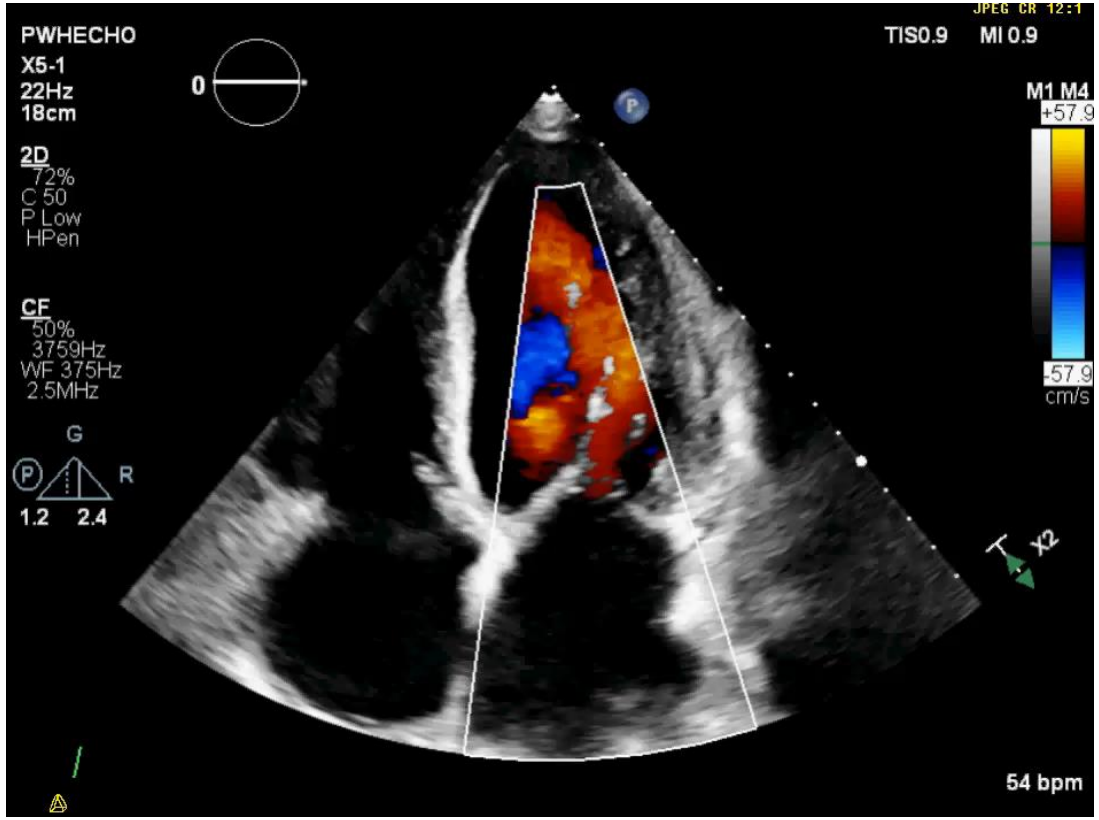
Pre-op Echo (EF 20%)





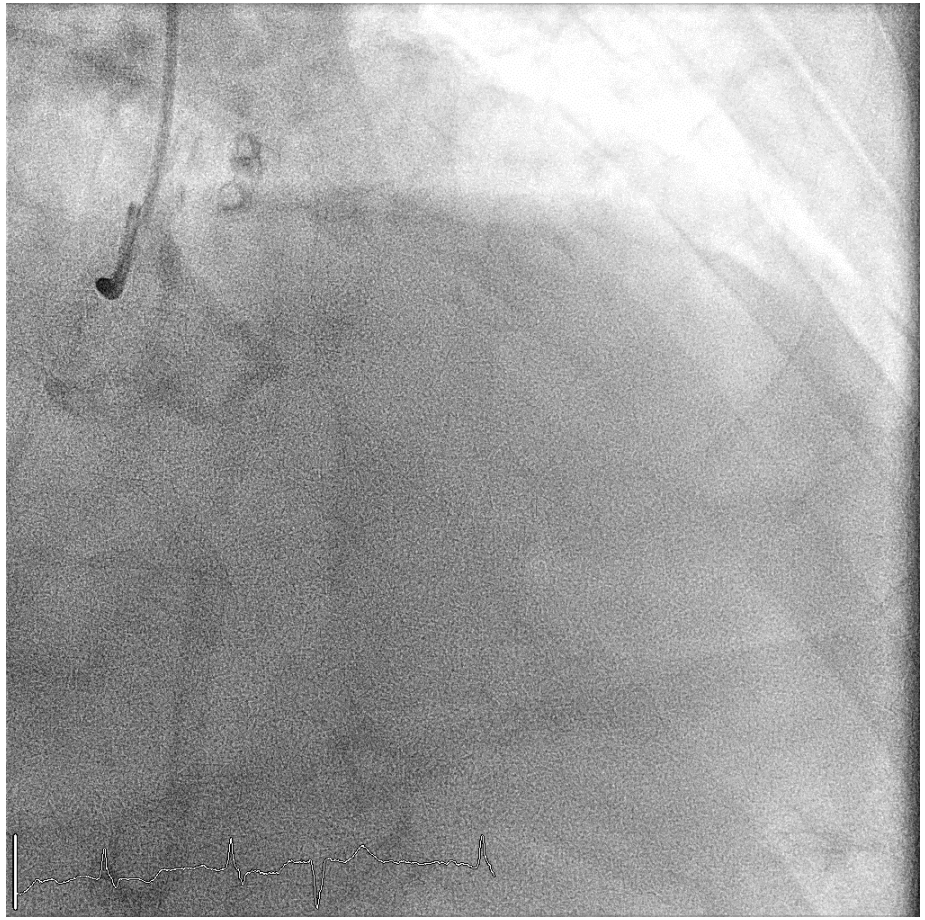
Pre-Echo Echo (EF 20%)



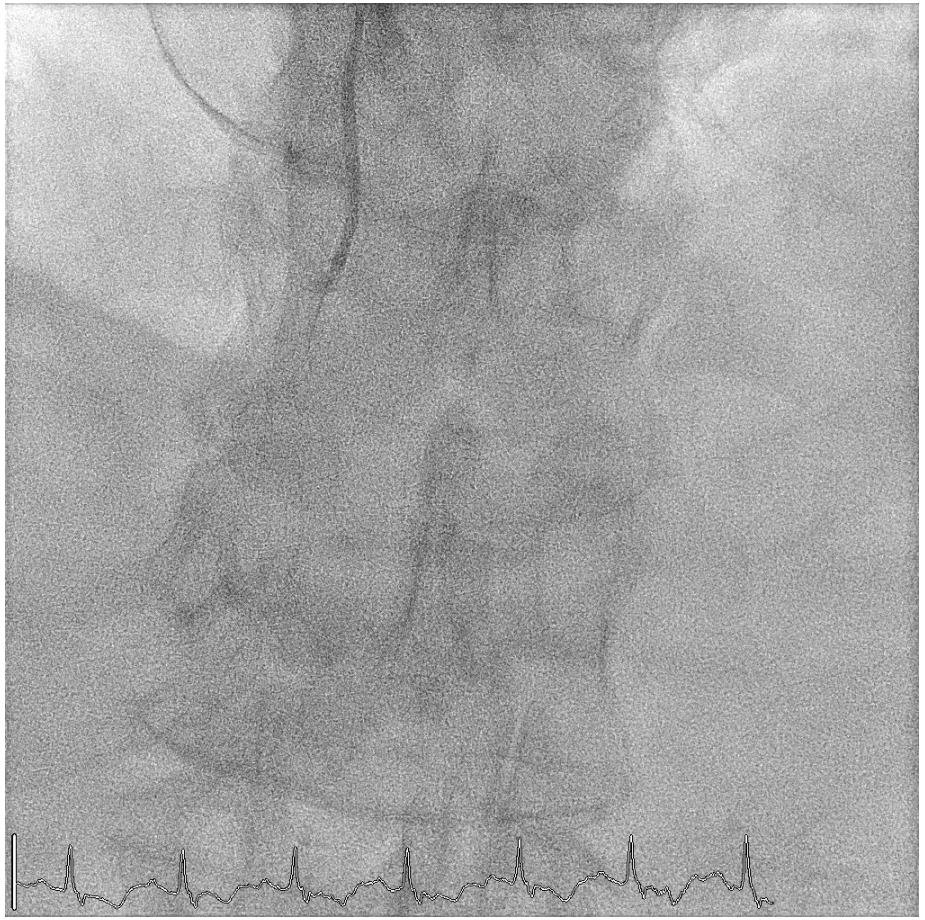


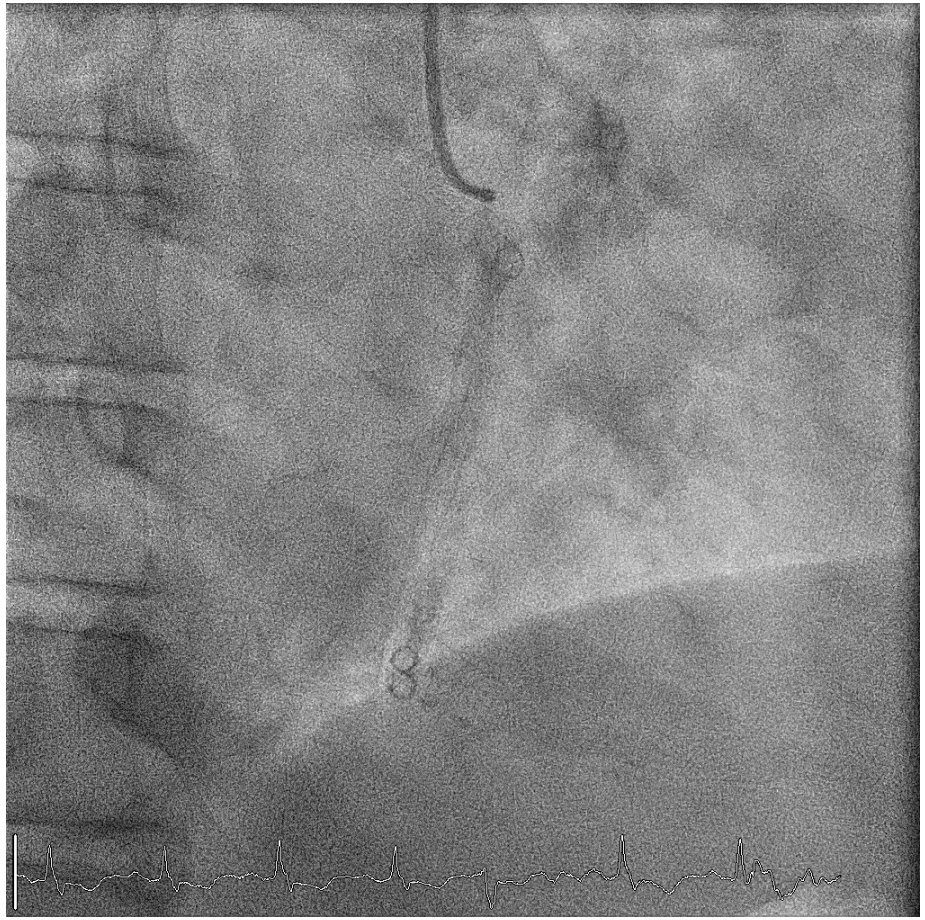
Coronary angiogram

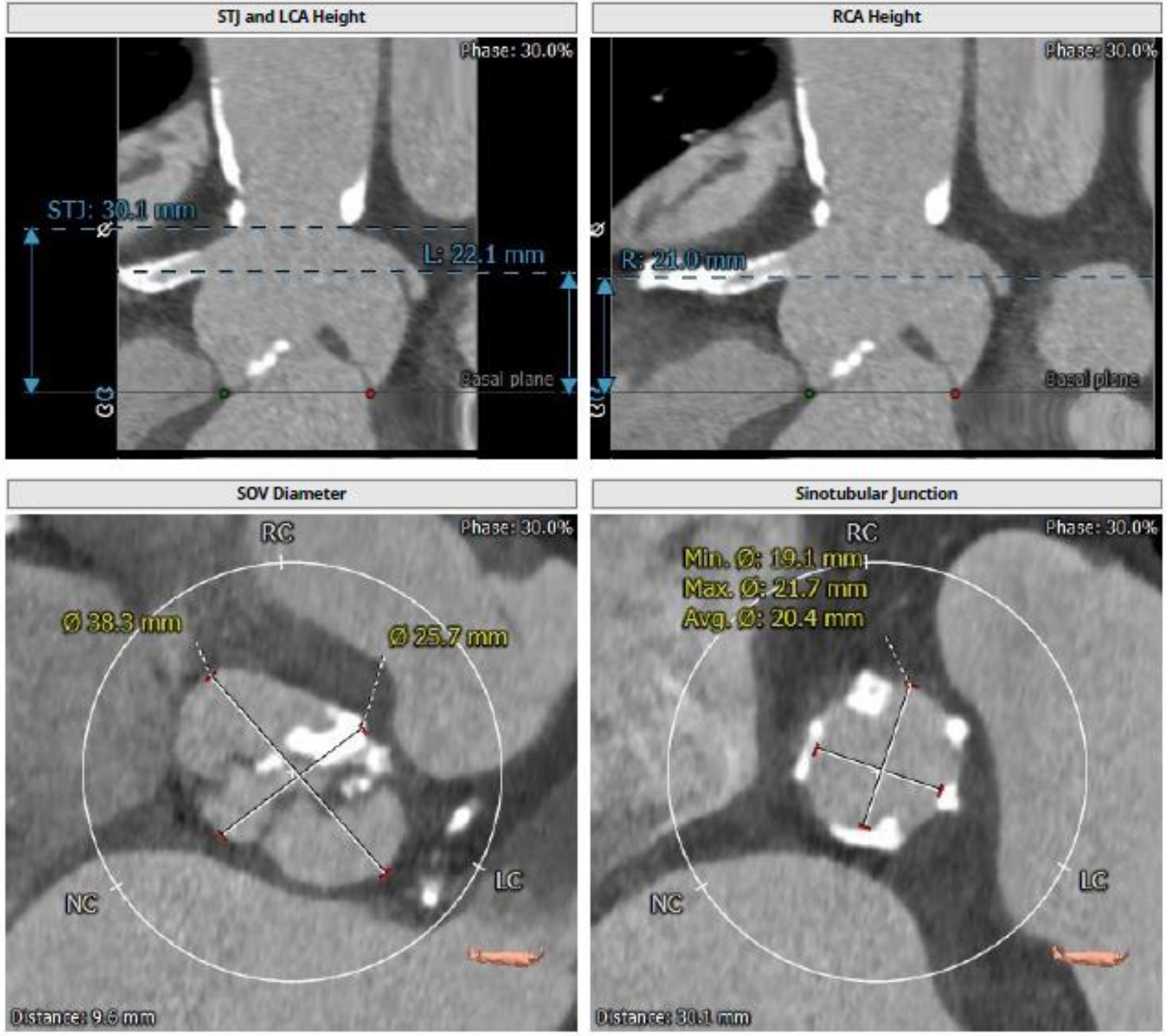
Coronary angiogram



Coronary angiogram






STJ and LCA Height
Phase: 30.0%
STJ: 30.1 mm
L: 22.1 mm
Basal plane
RCA Height
Phase: 30.0%
R: 21.0 mm
Basal plane
SOV Diameter
RC
Phase: 30.0%
Ø 38.3 mm
Ø 25.7 mm
NC
LC
Distance: 9.6 mm
Sinotubular Junction
RC
Phase: 30.0%
Min. Ø: 19.1 mm
Max. Ø: 21.7 mm
Avg. Ø: 20.4 mm
NC
LC
Distance: 30.1 mm

Aortic Annulus Area

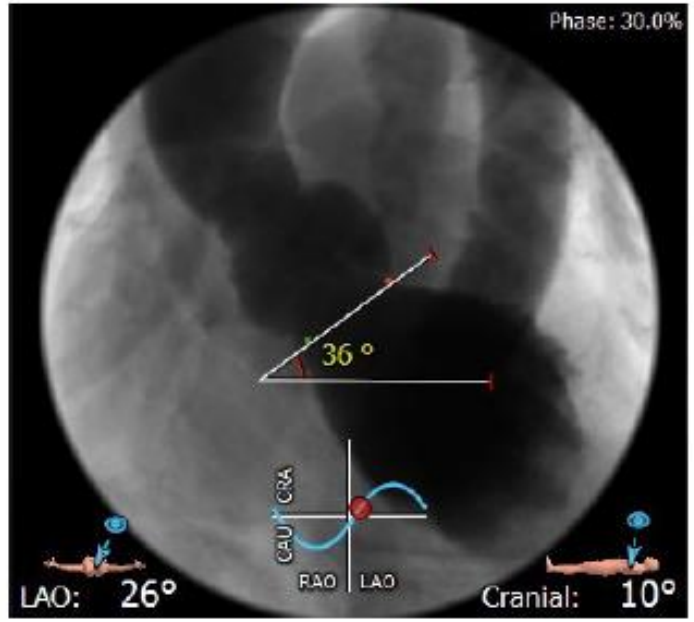
ID	Type	Label	Value
1	Polygon	Annulus Dimensions - Min. Ø	24.0 mm
		Annulus Dimensions - Max. Ø	30.6 mm
		Annulus Dimensions - Avg. Ø	27.3 mm
		Annulus Dimensions - Area	581.4 mm²
		Annulus Dimensions - Perimeter	87.1 mm

LVOT

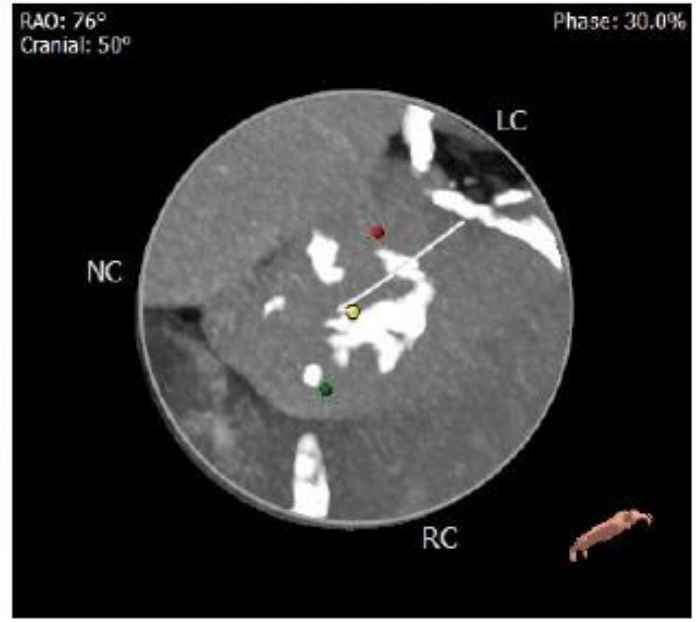
ID	Type	Label	Value
1	Polygon	Min. Ø	27.2 mm
		Max. Ø	36.2 mm
		Avg. Ø	31.2 mm
		Area	725.4 mm²
		Perimeter	97.1 mm

Annulus Sizing		20 mm	23 mm	26 mm	29 mm
Native Valve Annulus Size (CT)	Area	273 - 345 mm²	338 - 430 mm²	430 - 546 mm²	540 - 683 mm²
	Area Derived Diameter	18.6 - 21 mm	20.7 - 23.4 mm	23.4 - 26.4 mm	26.2 - 29.5 mm
Native Valve Annulus Size TEE		16 - 19 mm	18 - 22 mm	21 - 25 mm	24 - 28 mm

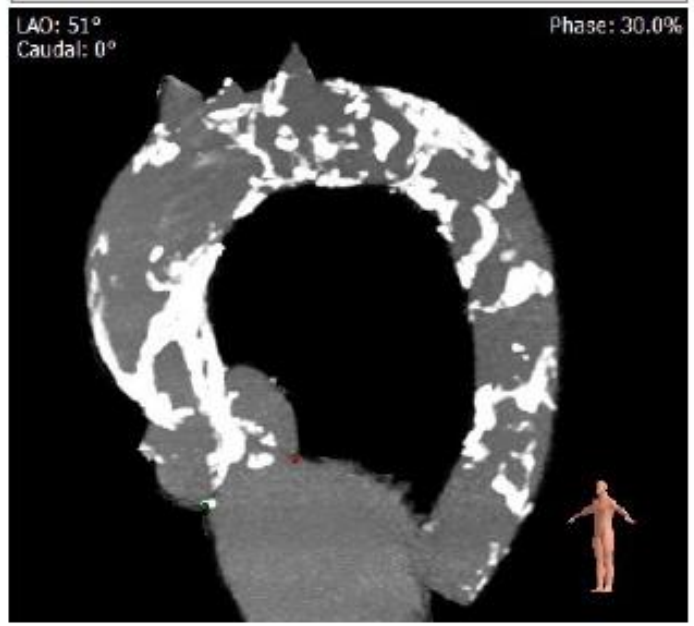
Coplanar View Angio



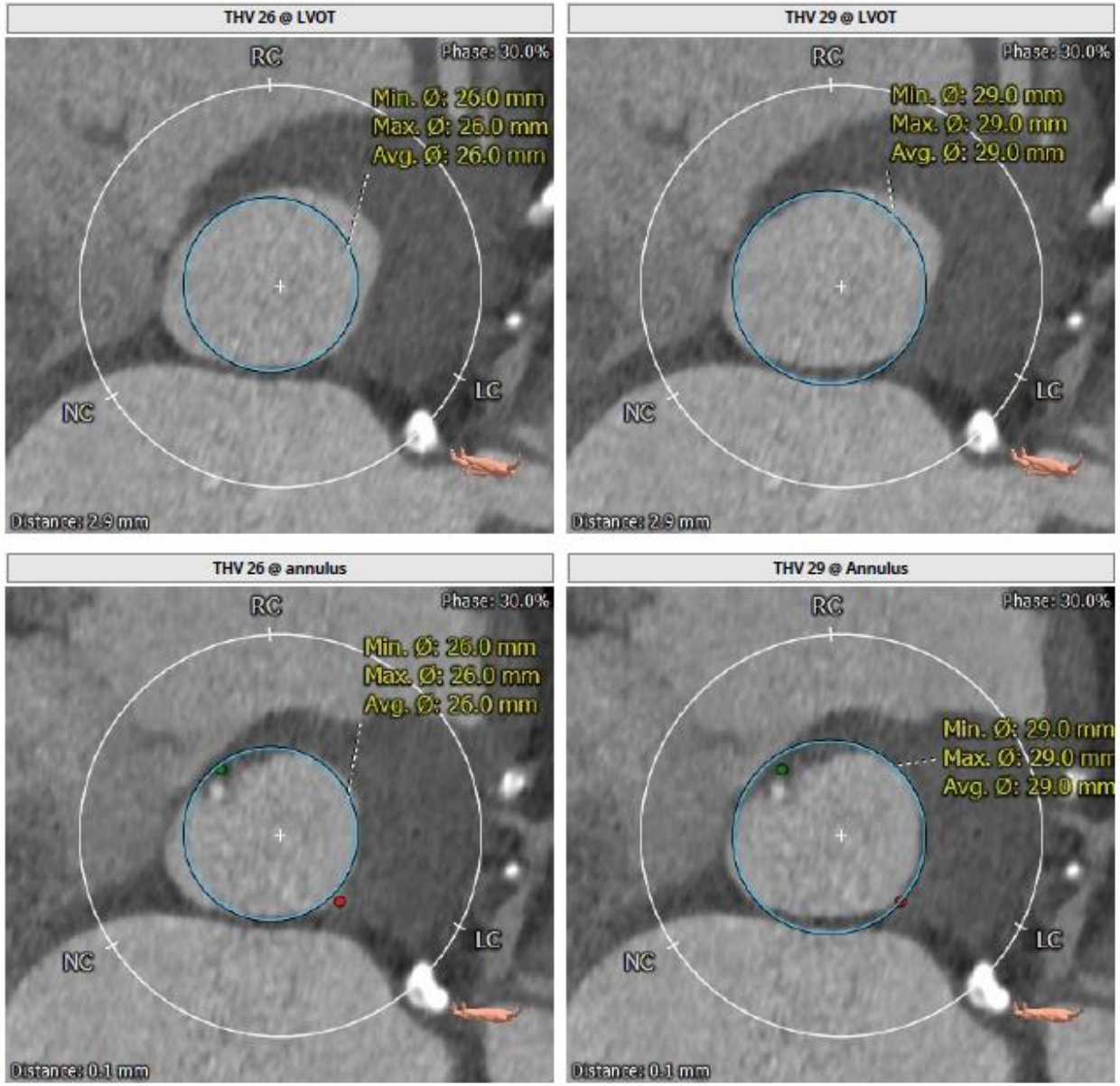
Hockey Puck (MIP)



Calcifications

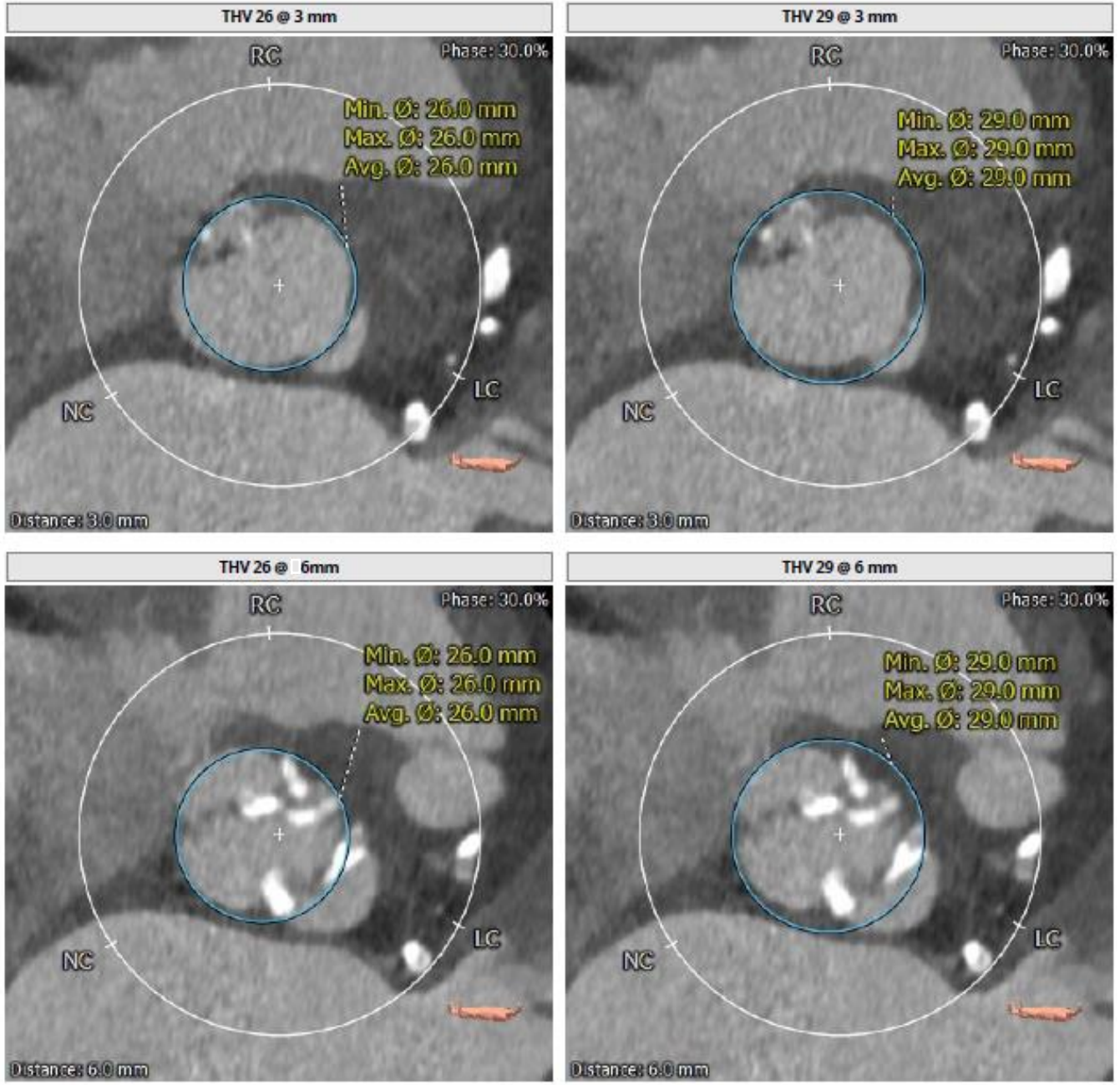


Delivery balloon working length: 32mm



29mm valve (nominal filled) = 11.7% oversize; -2ml 5% oversize

26mm valve (nominal filled) = -11% oversize; +2ml -3% undersize



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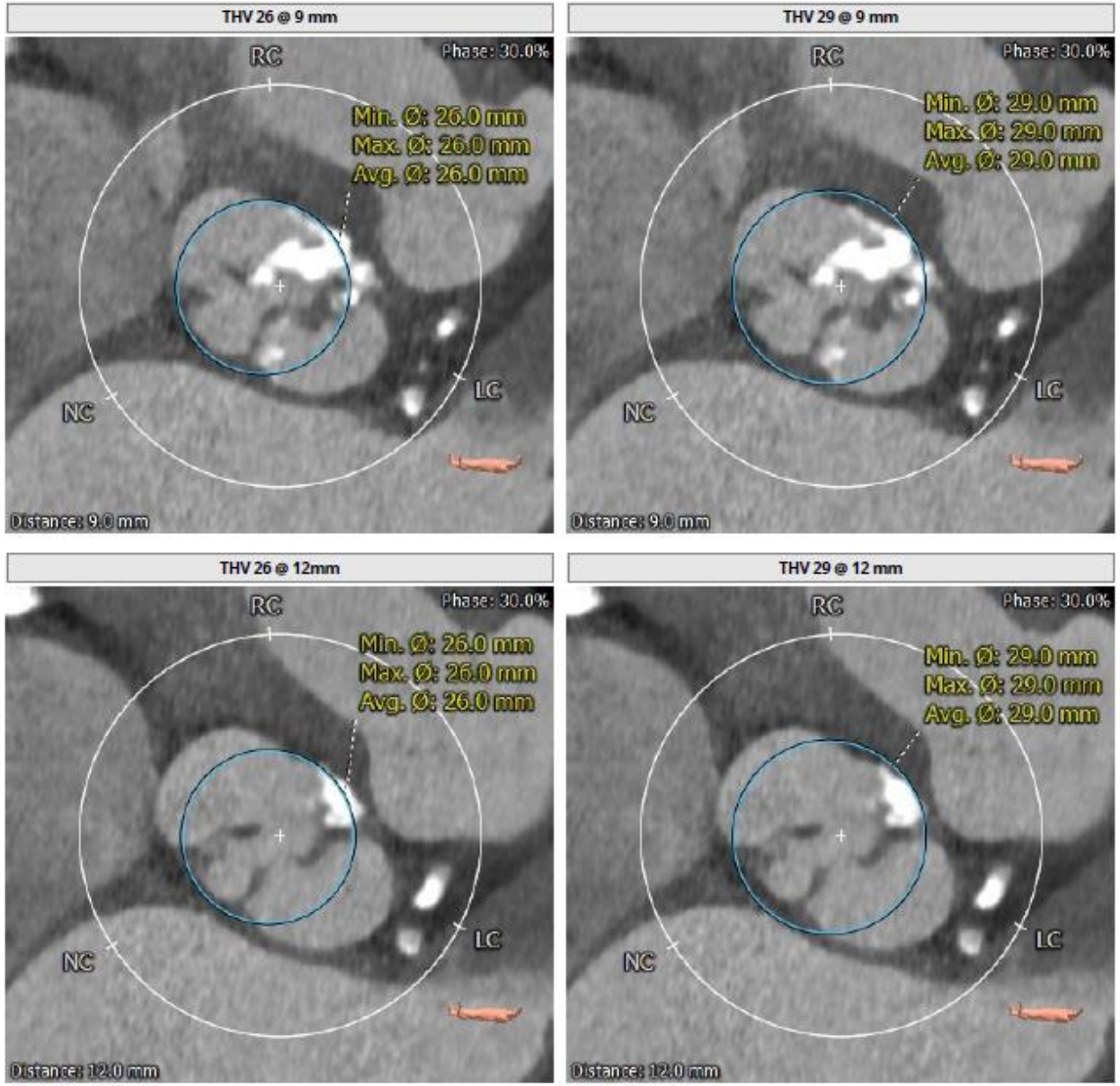

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Circle Method

1. Circle is too large and beyond the commissure: potential risk Of rupture

2. Circle is large enough to touch the commissure: sealing is expected

3. Circle is undersized and does not touch the commissures, there is risk Of PVL or valve embolization

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REVIEW

Expert Consensus on Sizing and Positioning of SAPIEN 3/Ultra in Bicuspid Aortic Valves

Daniel Blackman · Davide Gabbieri · Bruno García Del Blanco · Jörg Kempfert · Mika Laine · Julia Mascherbauer · Radoslaw Parma · Didier Tchétché

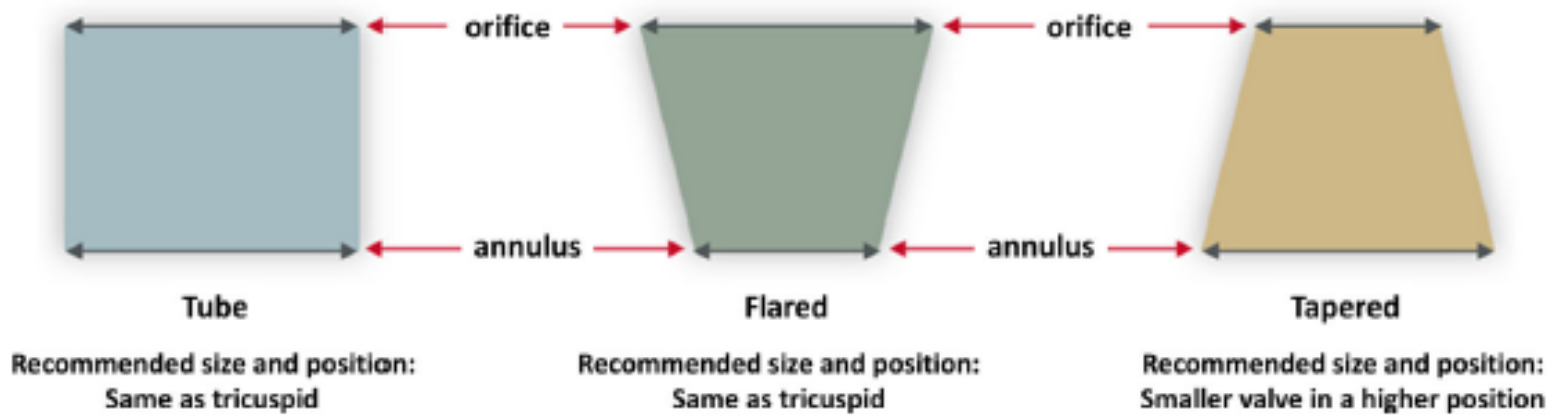
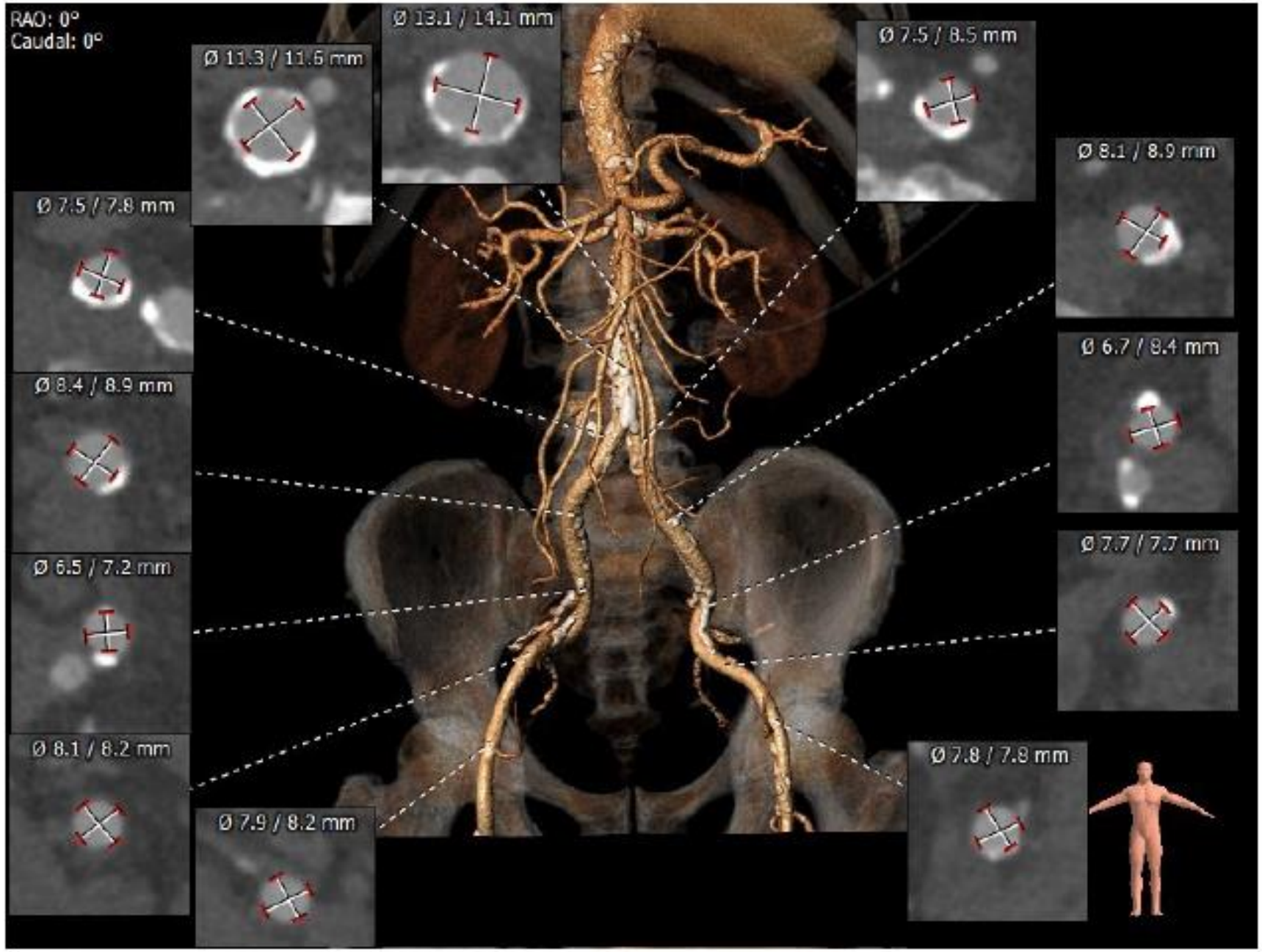


Fig. 2 Aortic root configurations. The orifice is the perimeter created by the free edge of the leaflets, whereas the annulus is the virtual ring formed by linking the basal attachments of the aortic leaflets. As defined in the BAVARD Registry [8], bicuspid landing zone may present with three different configurations: tubular (both annulus and orifice have the same size), flared (annulus smaller than the orifice), or tapered (annulus larger than the orifice)

Peripheral Arteries Overview



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Native Valve Annulus Size TEE		16 - 19 mm	18 - 22 mm	21 - 25 mm	24 - 28 mm

Transcatheter heart valve size recommendations are based on native valve annulus size, as measured by transesophageal echocardiography (TEE) or computed tomography (CT). Patient anatomical factors and multiple imaging modalities should be considered during the transcatheter heart valve size selection. Risks associated with under-sizing and oversizing should be carefully considered.

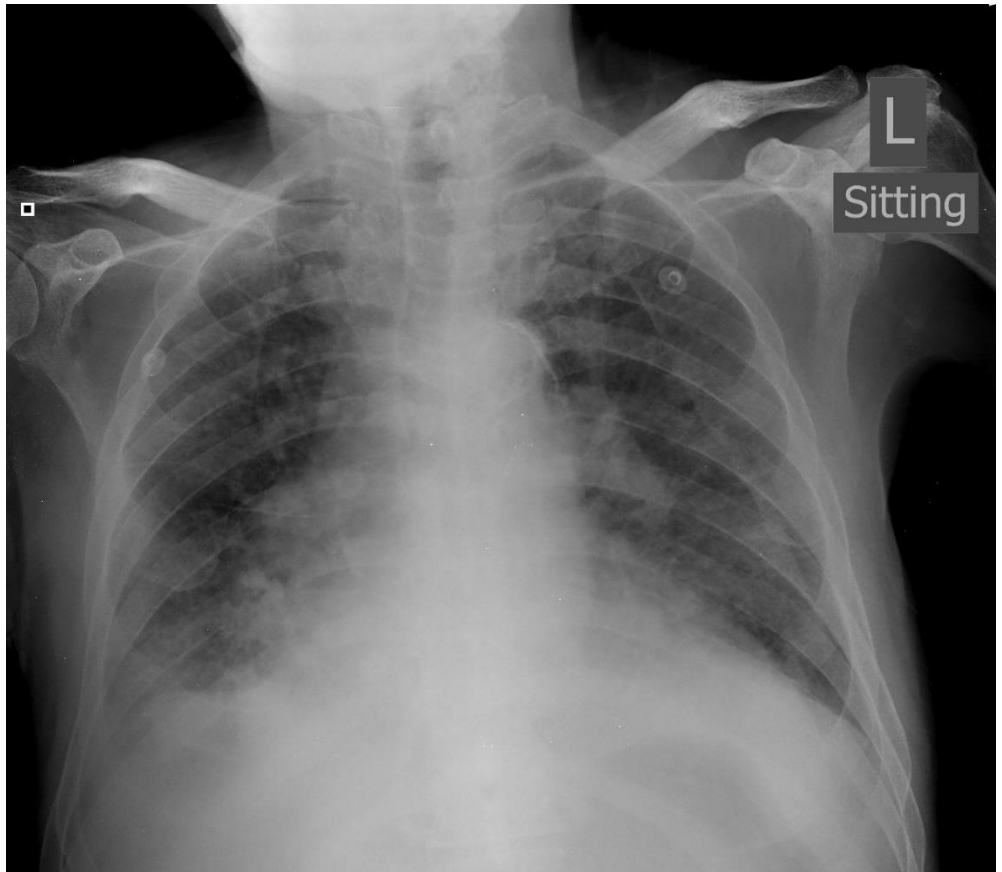
Area = 581.4mm2

29mm valve (nominal filled) = 11.7% oversize; -2ml 5% oversize

26mm valve (nominal filled) = -11% oversize; +2ml -3% undersize

Progress

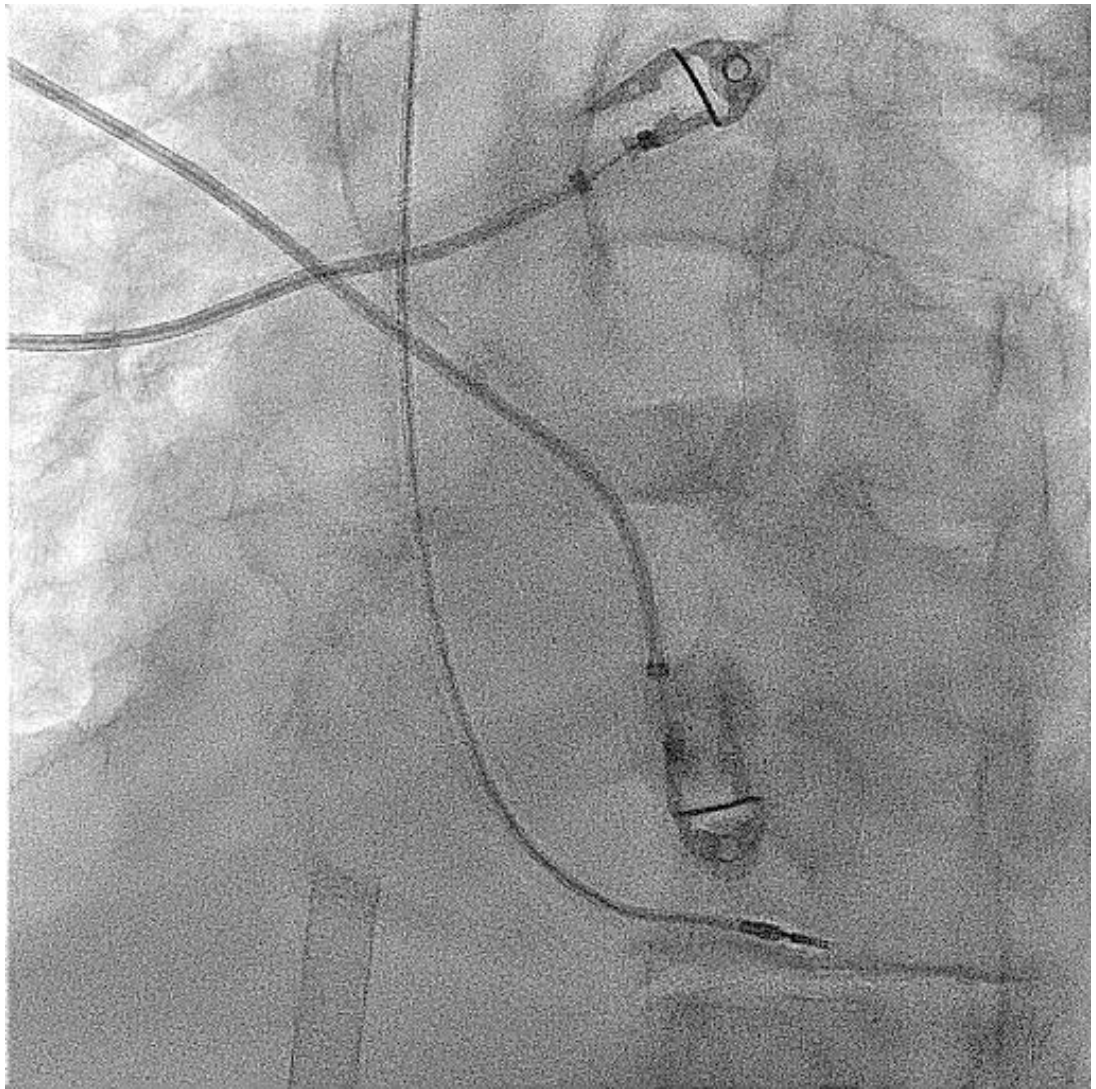
- NYHA class IV with SOB at rest
- Even unable to lie flat for the procedure
- BP 100/40

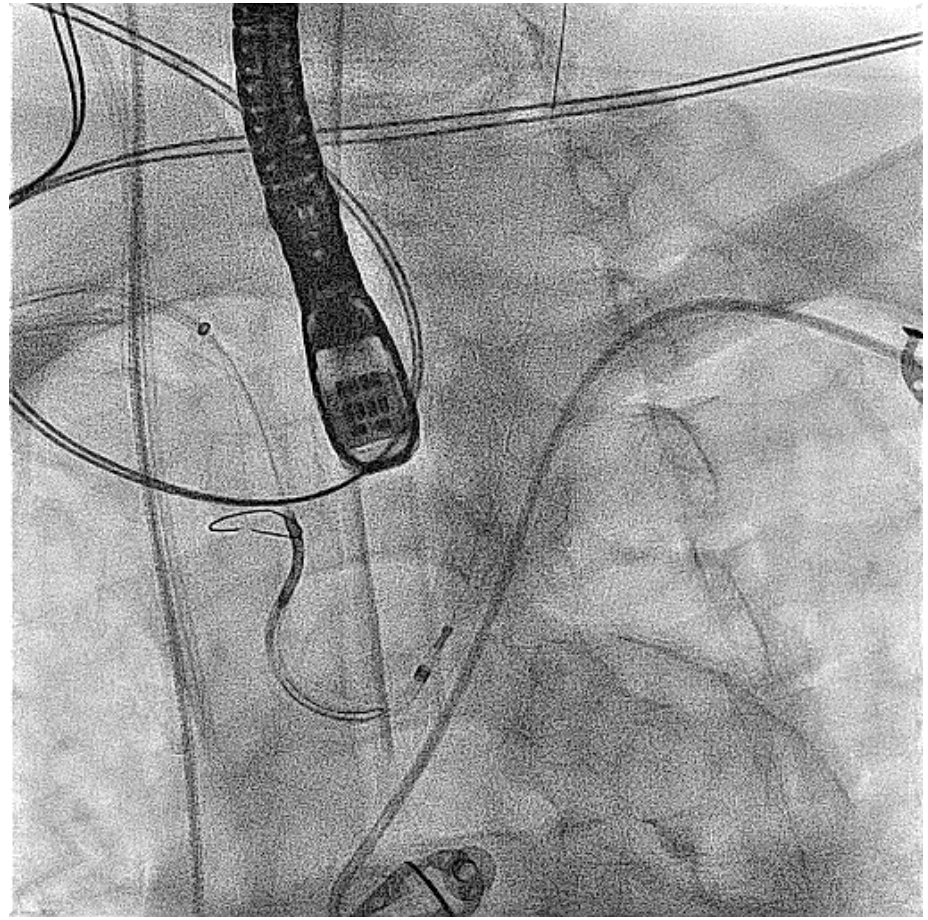


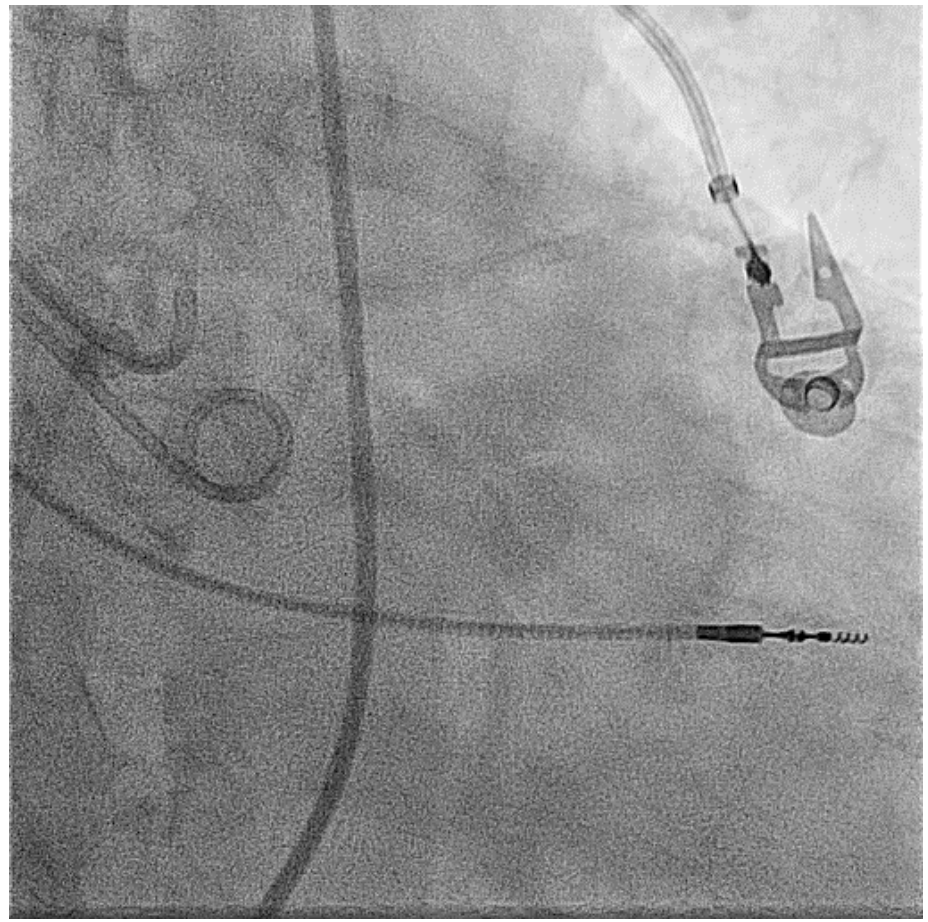
Discussion

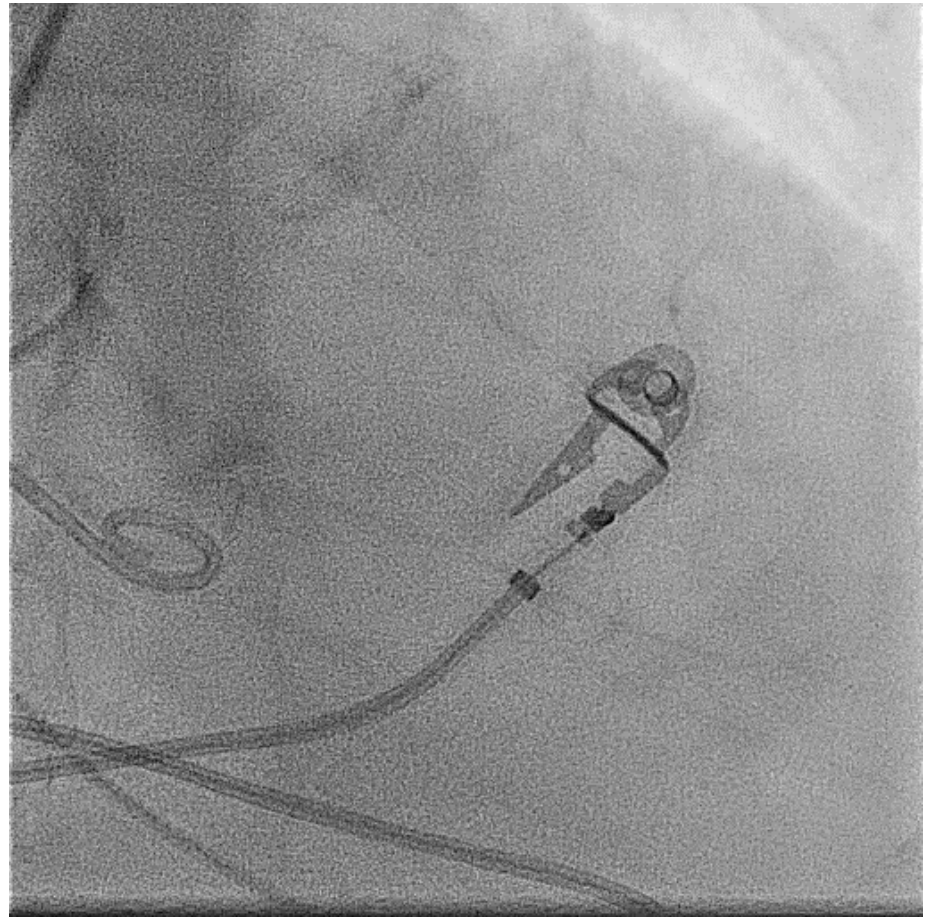
- PCI to LAD ?
    1. PCI to LAD then TAVI in same session
    2. PCI to LAD, stage TAVI procedure later
    3. TAVI first, then stage PCI to LAD
- Hemodynamic support?
    1. No support
    2. Impella support
        a. Impella support PCI first, remove the impella, then TAVI same session
        b. TAVI first, insert impella, then impella support PCI
    3. ECMO support

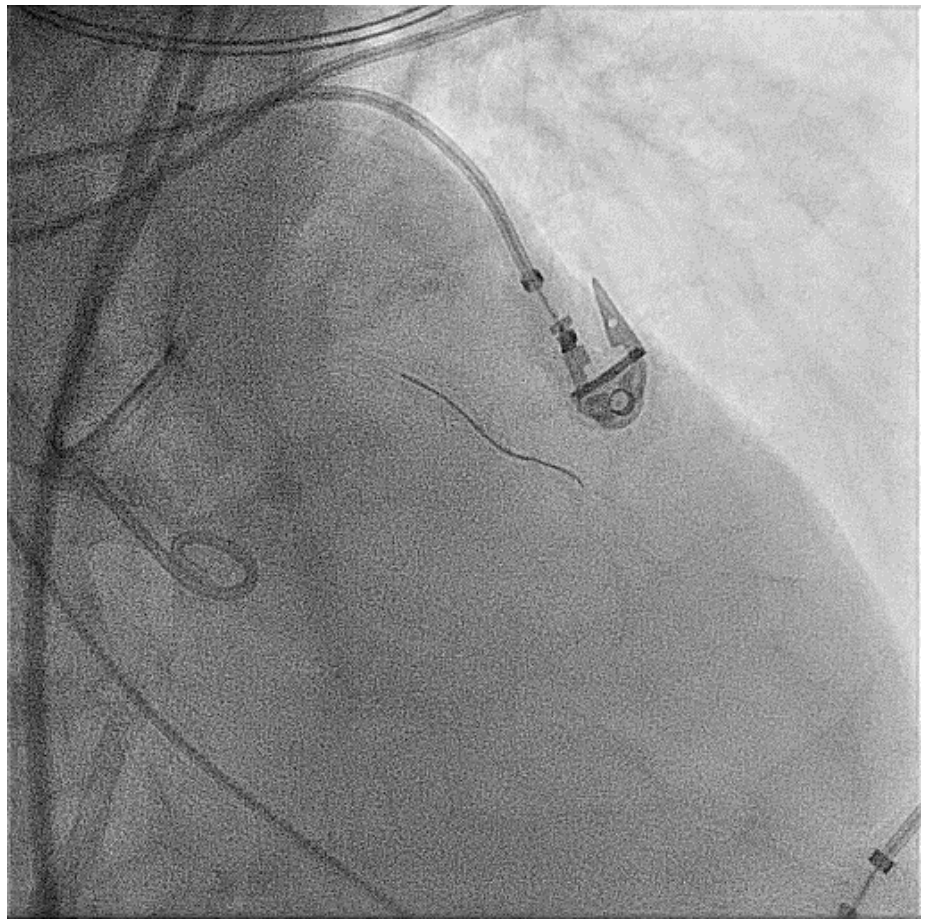
VA ECMO inserted

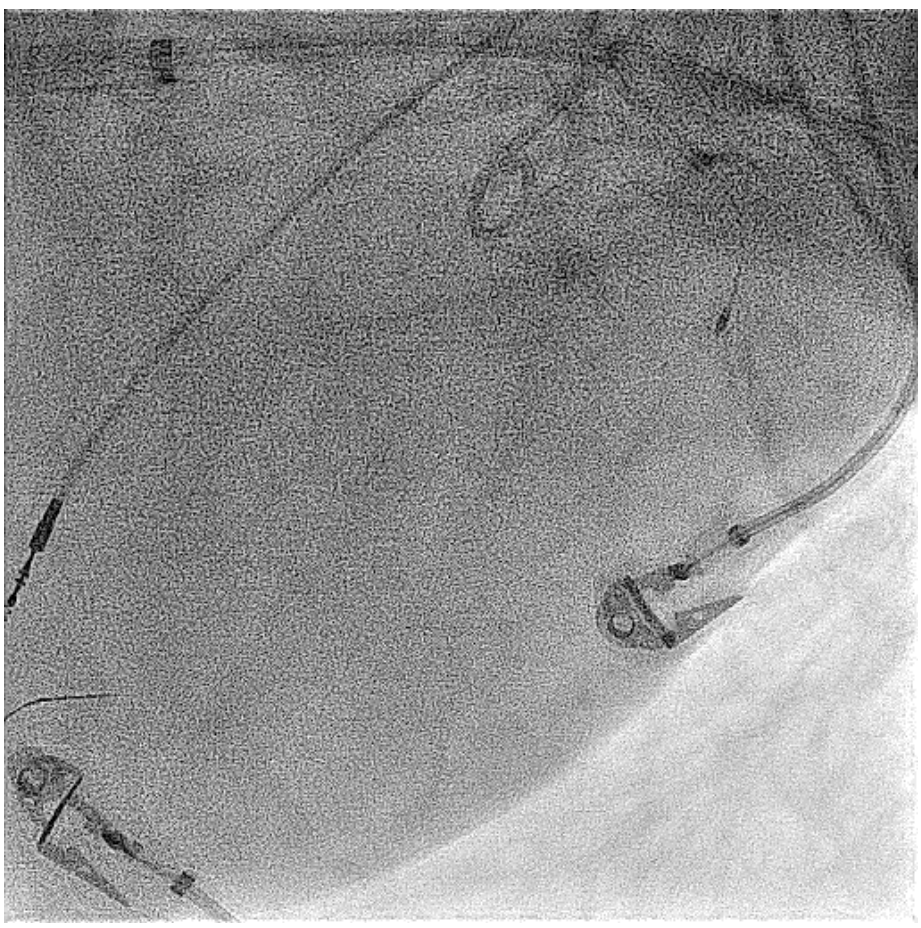












Halfway rotational atherectomy for calcified lesions: Comparison with conventional rotational atherectomy in a propensity-score matched analysis

Kenichi Sakakura*, Yousuke Taniguchi, Kei Yamamoto, Hiroshi Wada, Shin-ichi Momomura, Hideo Fujita

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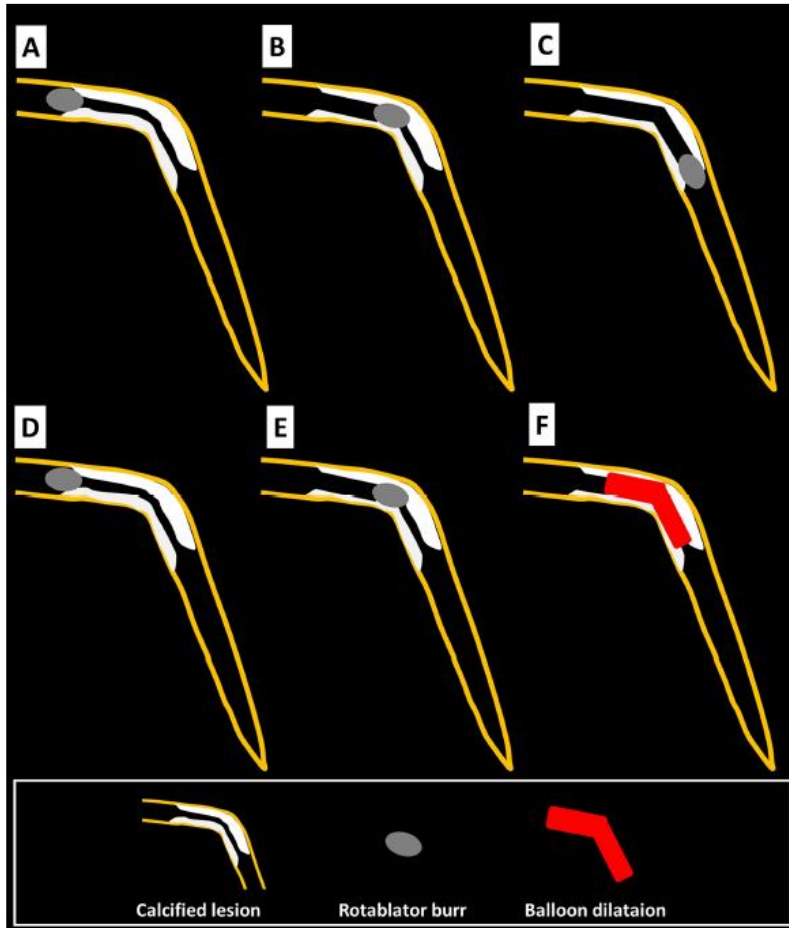
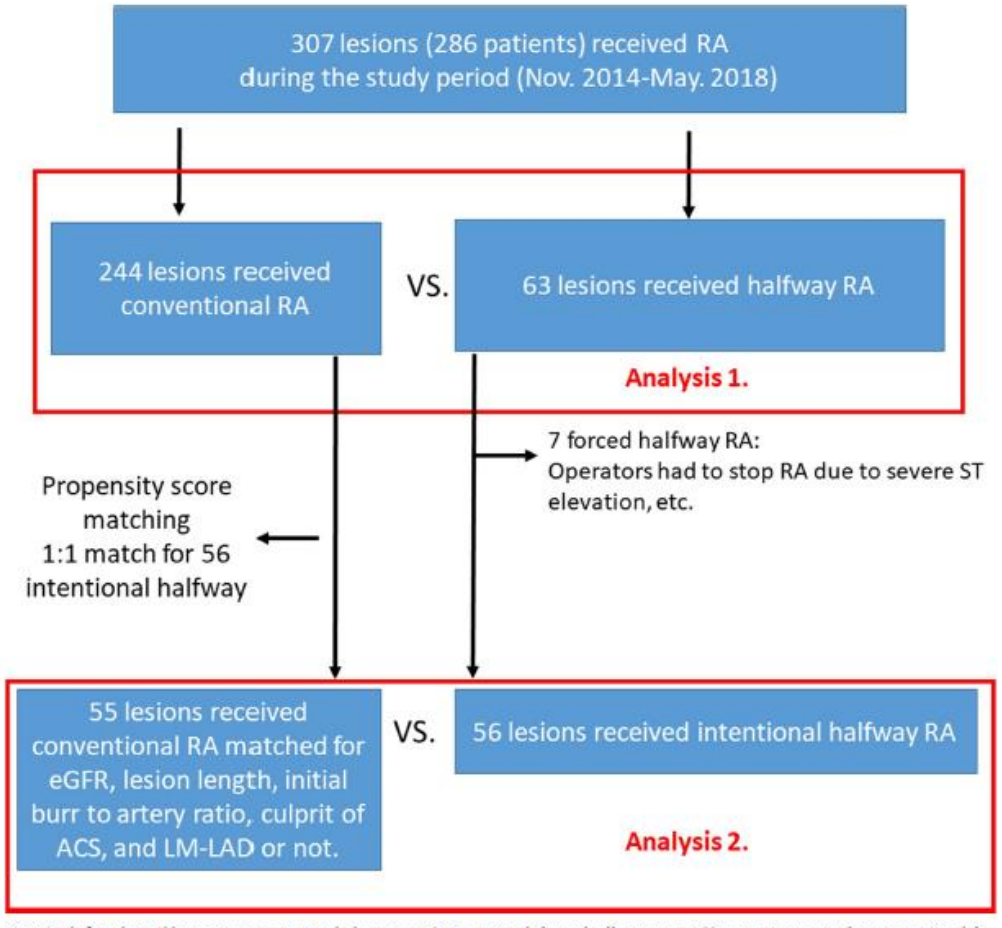




Halfway rotational atherectomy

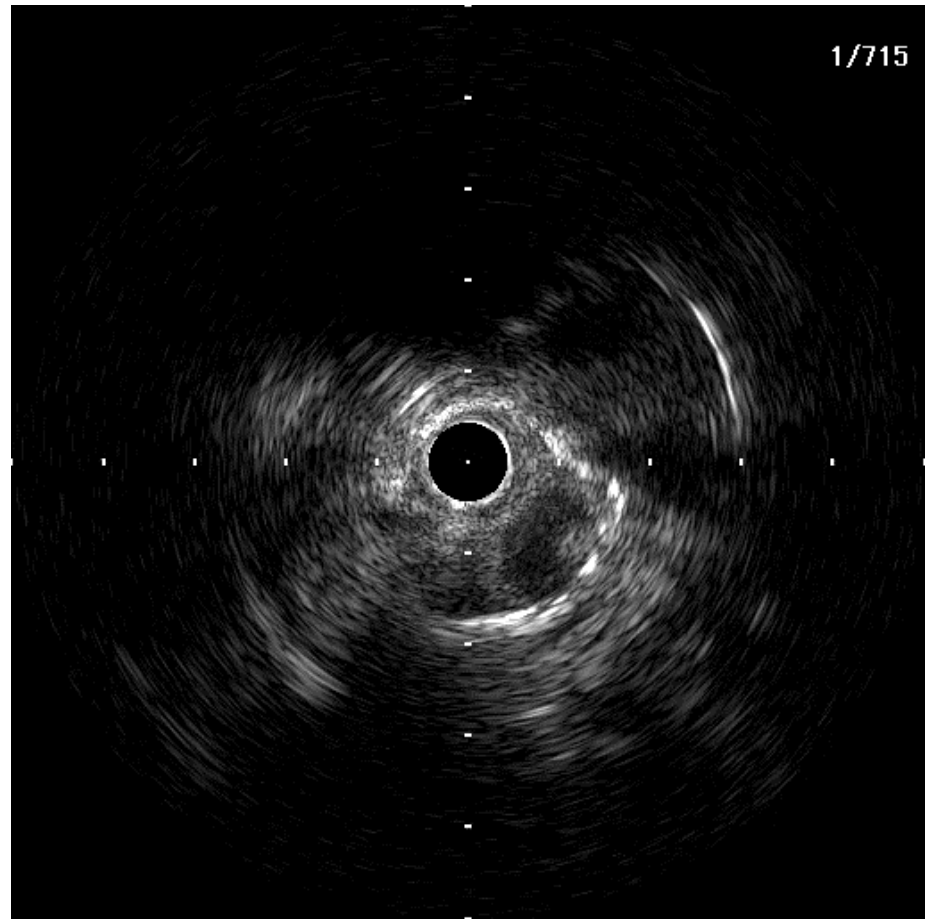
- Not the whole length of calcified lesion required rotablation, if the risk of rotablation in angulated calcified segment is too high, then half way rotablation may be considered
- In severely calcified and angulated lesion, it avoids burr entrapment or vessel perforation

Halfway rotational atherectomy

- Retrospective study, 307 lesions treated by RA, halfway RA in 63 lesions (20.5%)
- Success rate of halfway RA was 90.5%, unsuccessful cases required switching to conventional RA
- No burr entrapment or perforation in halfway RA, while in convention group, there is 5.5% of vessel perforation
- Goal of RA is to modify the calcification to facilitate stent dilatation, another goal of RA is to finish the procedure without complications such as perforation or burr entrapment

Table 5. Comparison of complications between the matched conventional RA (n = 55) and intentional halfway RA (n = 56) groups.

Complications	All (n = 111)	Matched conventional RA group (n = 55)	Intentional halfway RA group (n = 56)	P value
Slow flow just after RA	35 (31.5)	18 (32.7)	17 (30.4)	0.79
TIMI flow grade just after RA				0.85
TIMI 0 flow	2 (1.8)	1 (1.8)	1 (1.8)	
TIMI 1 flow	12 (10.8)	5 (9.1)	7 (12.5)	
TIMI 2 flow	21 (18.9)	12 (21.8)	9 (16.1)	
TIMI 3 flow	76 (68.5)	37 (67.3)	39 (69.6)	
Periprocedural myocardial infarction with slow flow	6 (5.4)	3 (5.5)	3 (5.4)	0.98
Burr entrapment	0 (0)	0 (0)	0 (0)	-
Vessel perforation (any)	3 (2.7)	3 (5.5)	0 (0)	0.08
Vessel perforation (Type III) due to Burr	2 (1.8)	2 (3.6)	0 (0)	0.15
Vessel perforation (Type II) due to guidewire	1 (0.9)	1 (1.8)	0 (0)	0.31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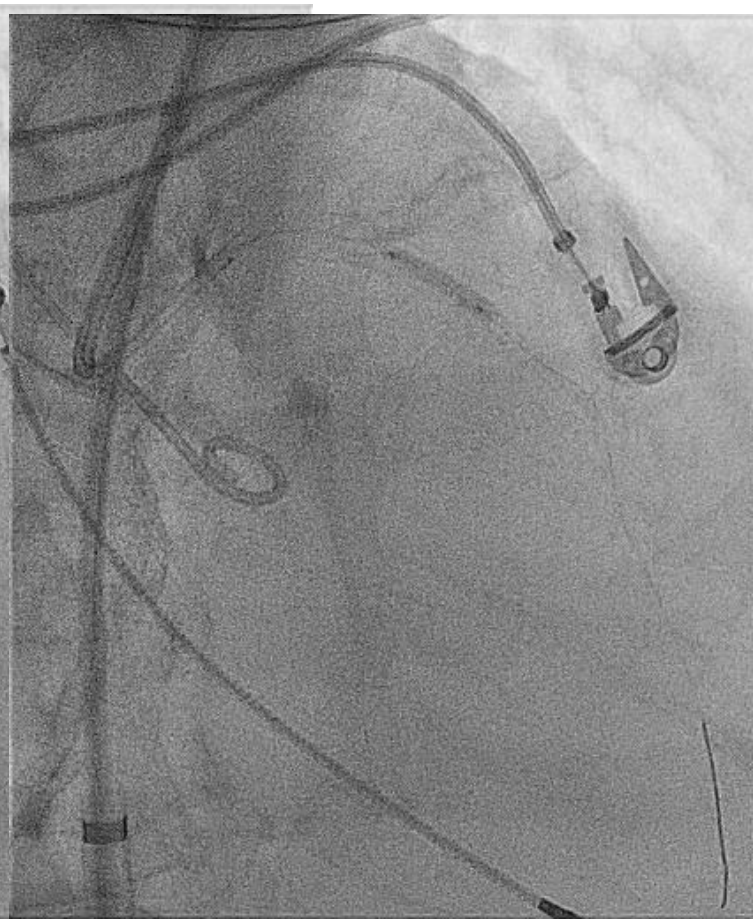
Balloon predilation

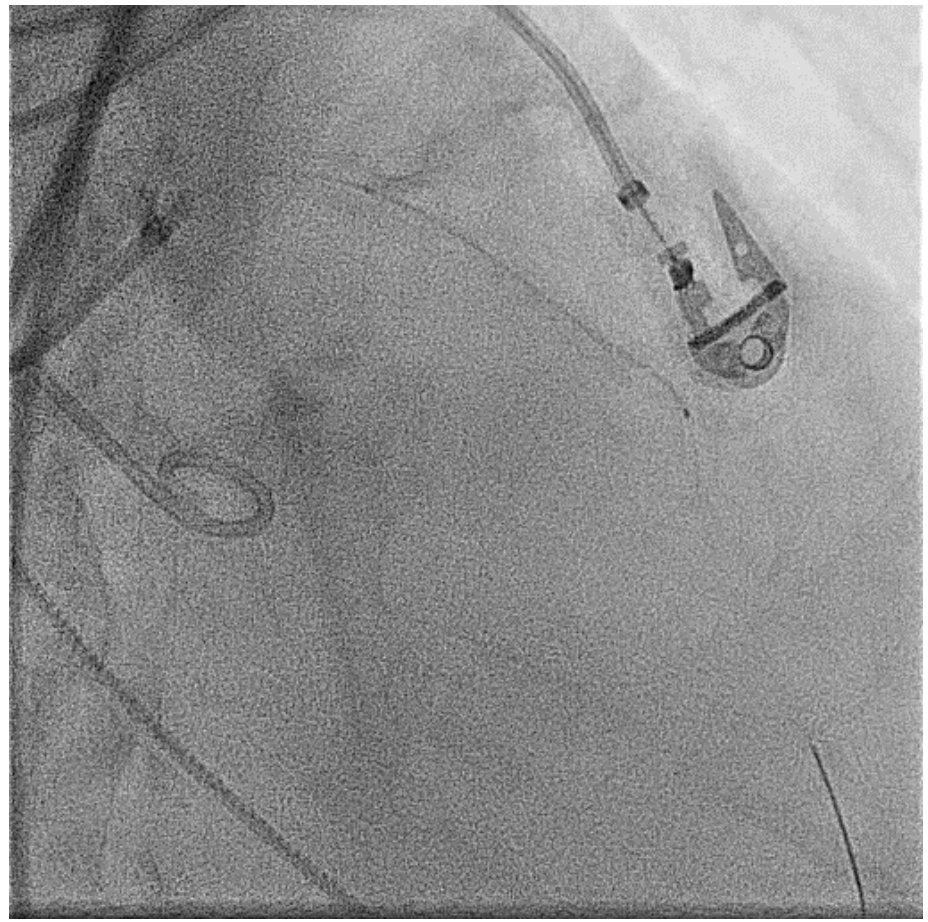
2.5NC

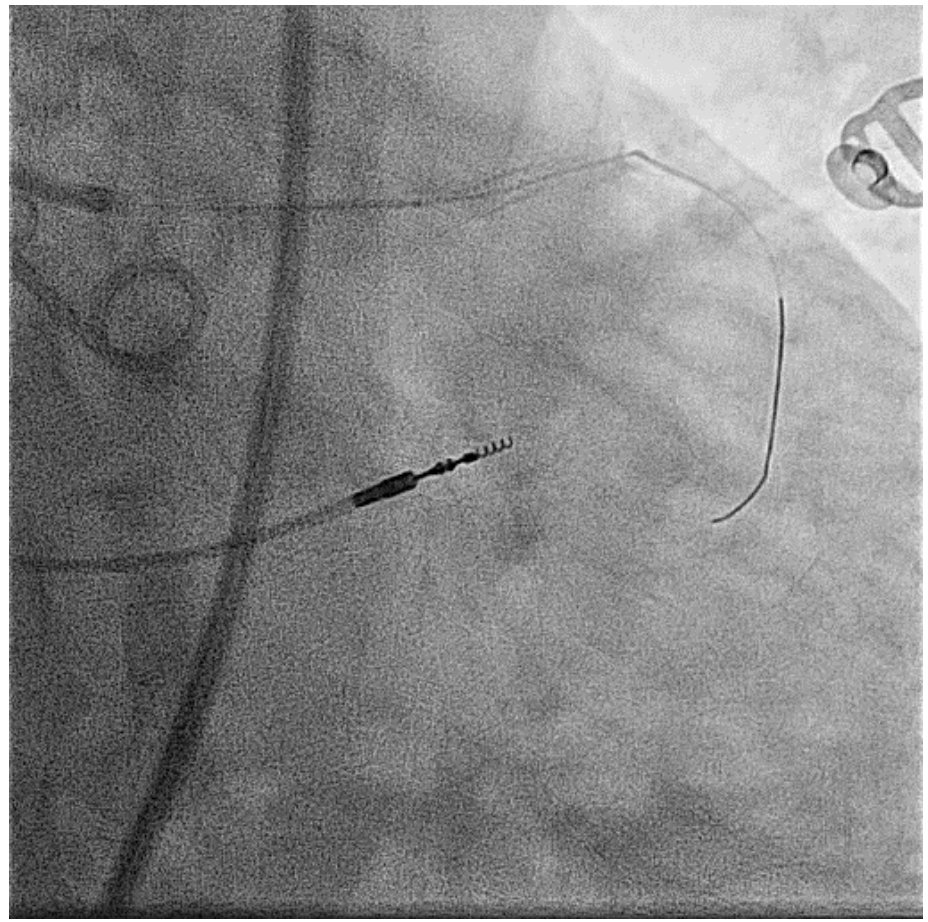
2.5NC

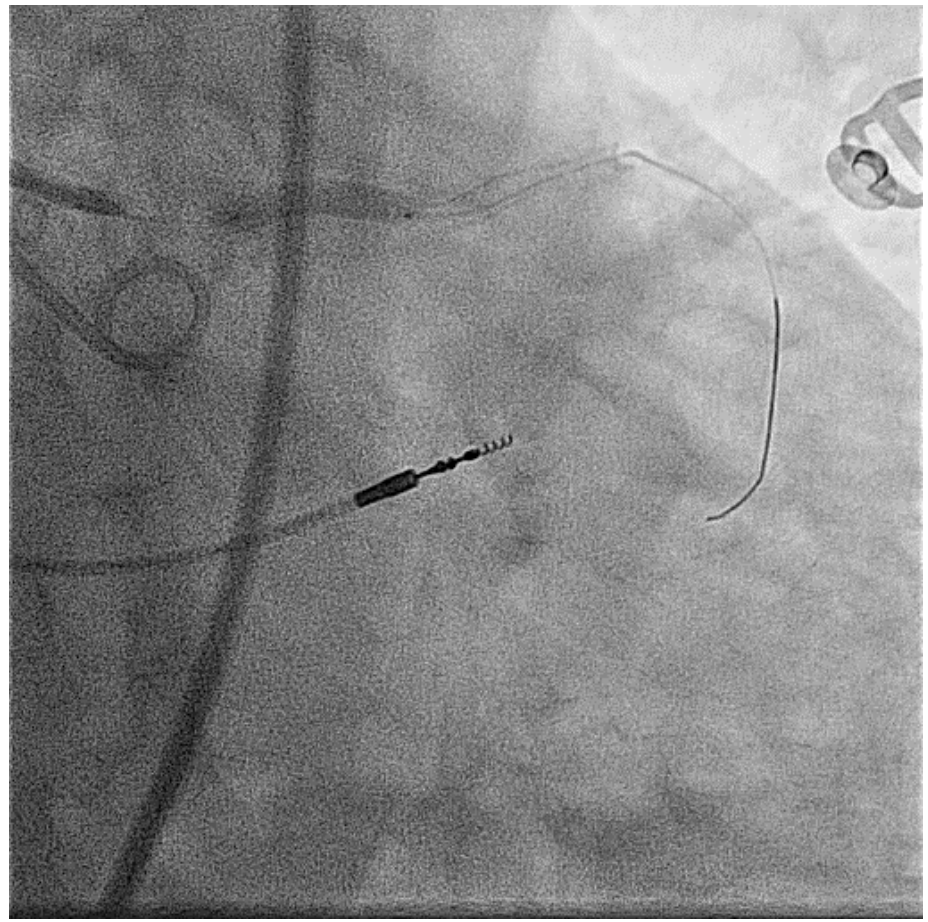
2.5 shock wave

3.0 Shock wave

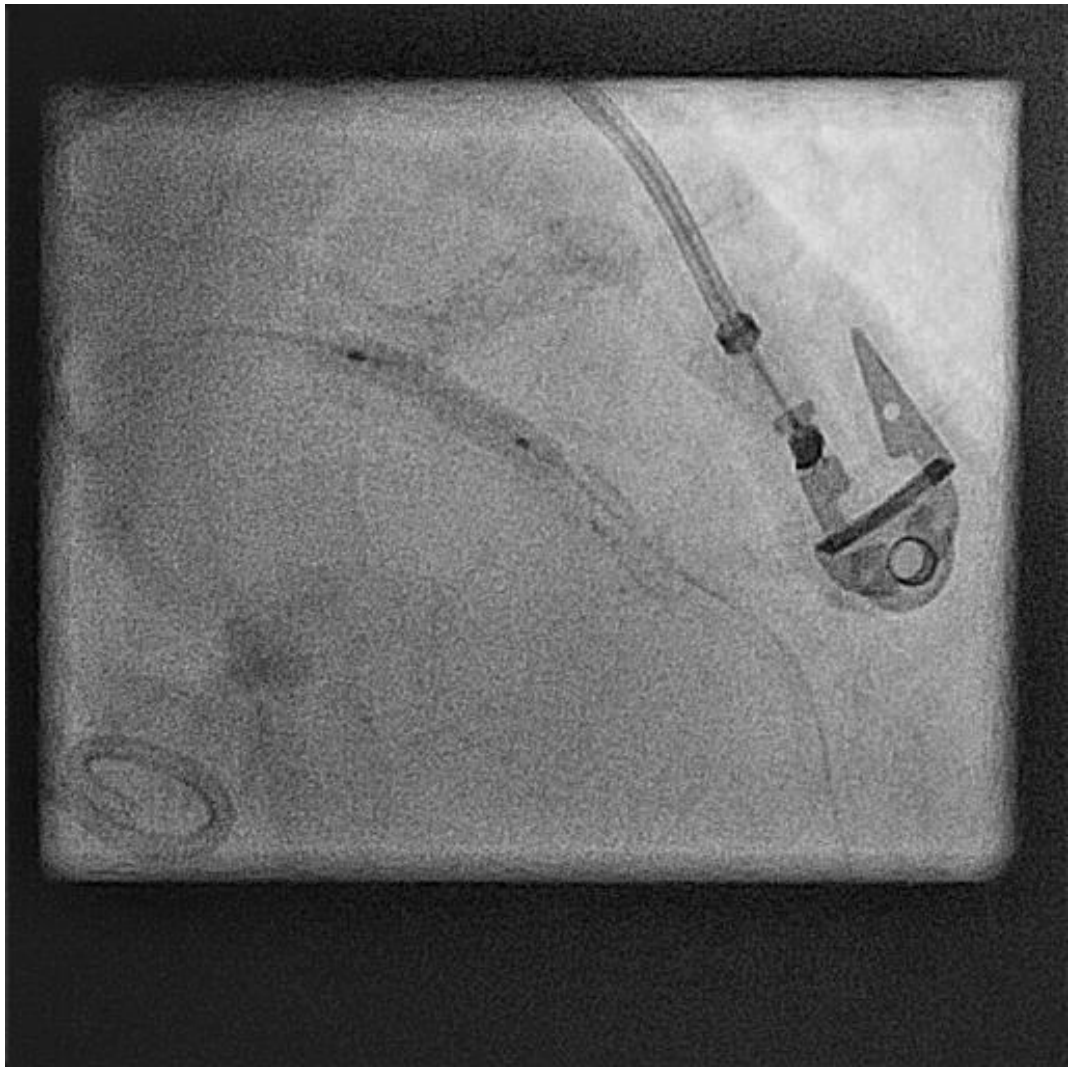


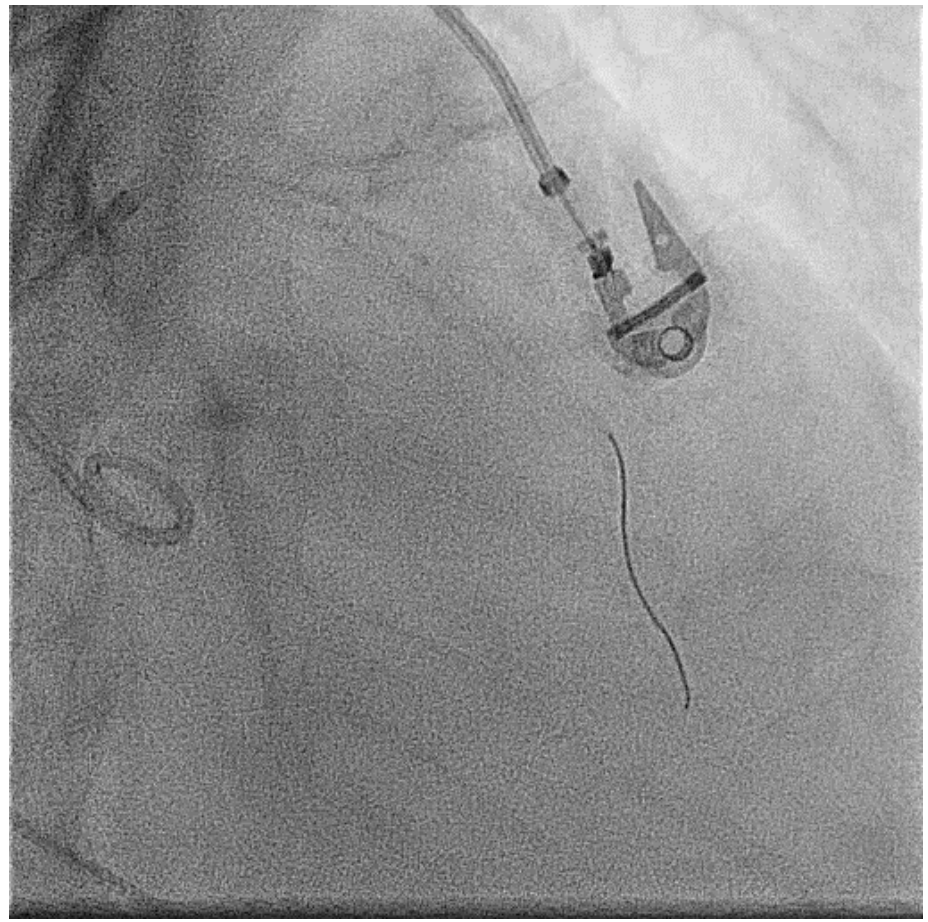


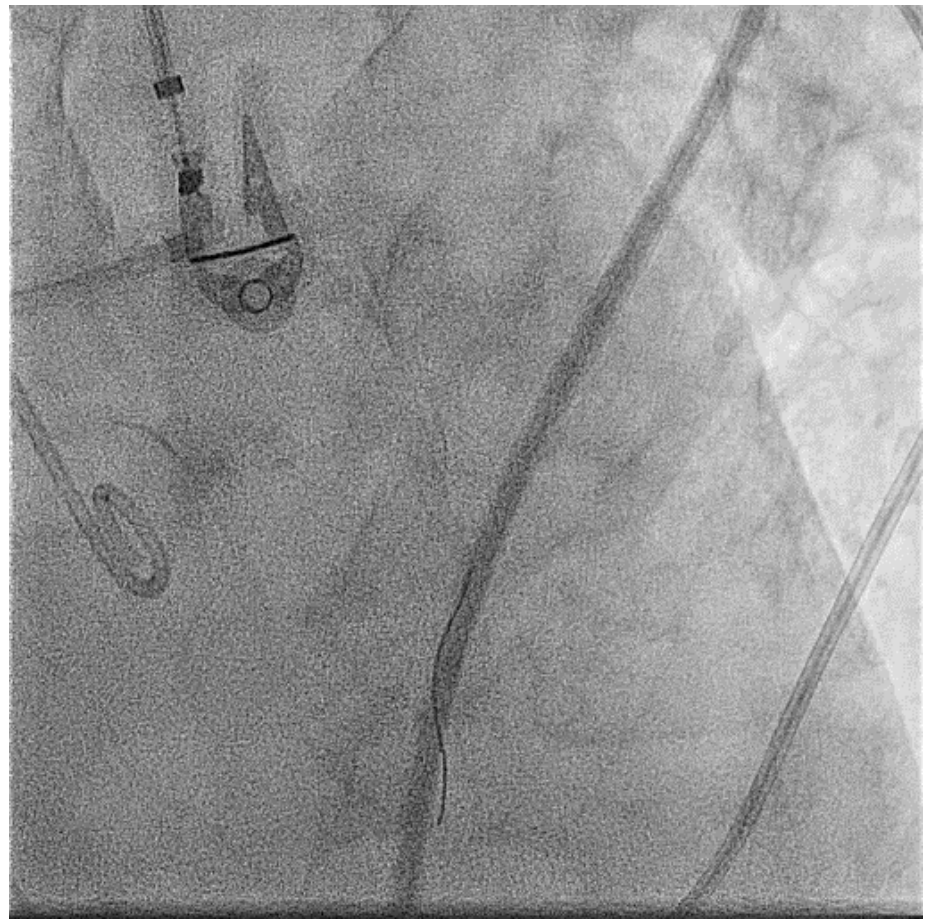


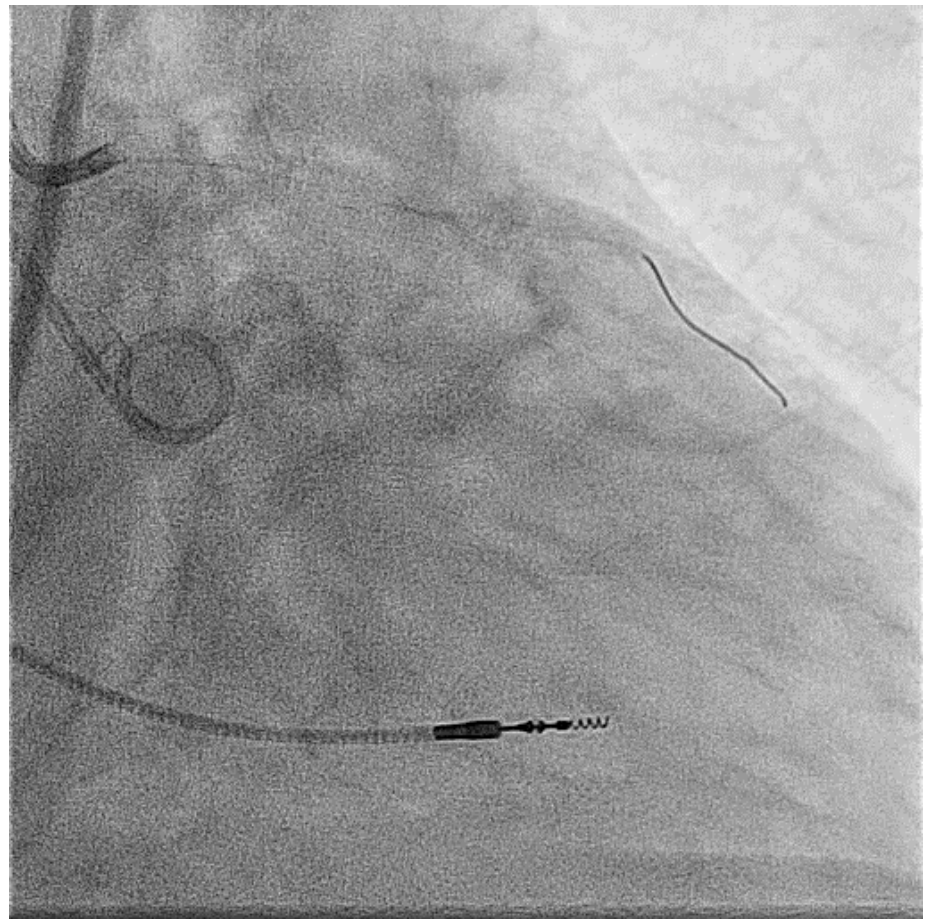


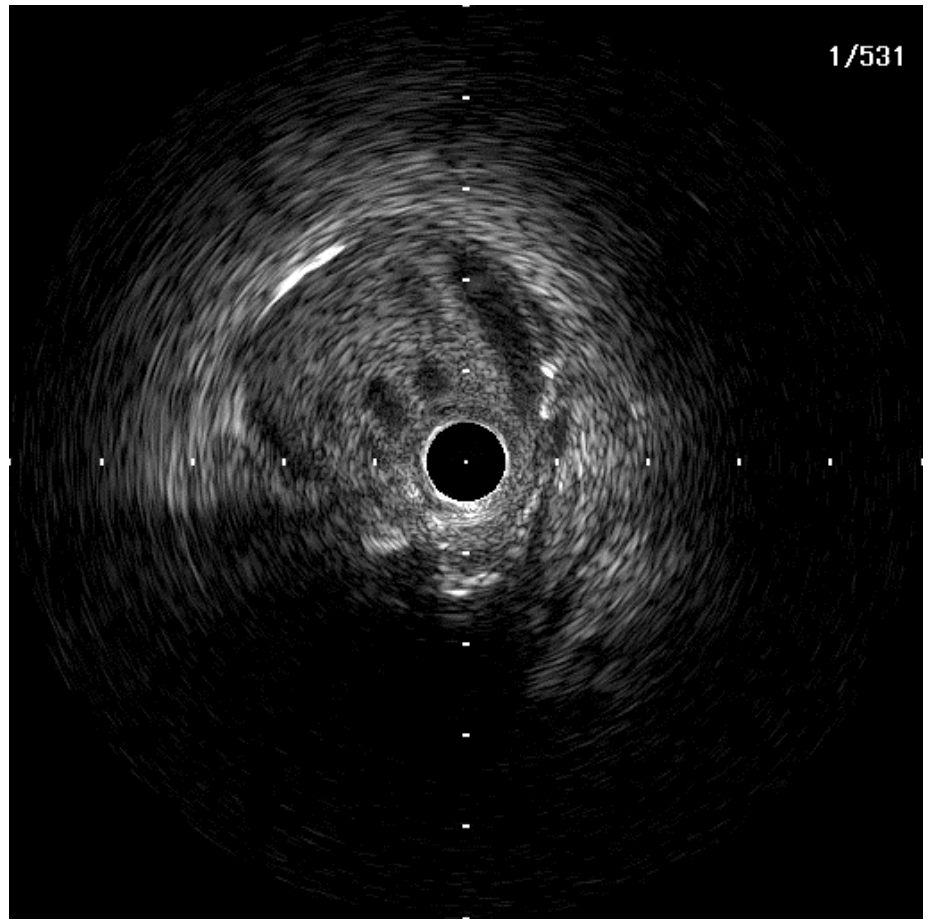
Post dilated 3.0 NC distal and 3.5 NC prox







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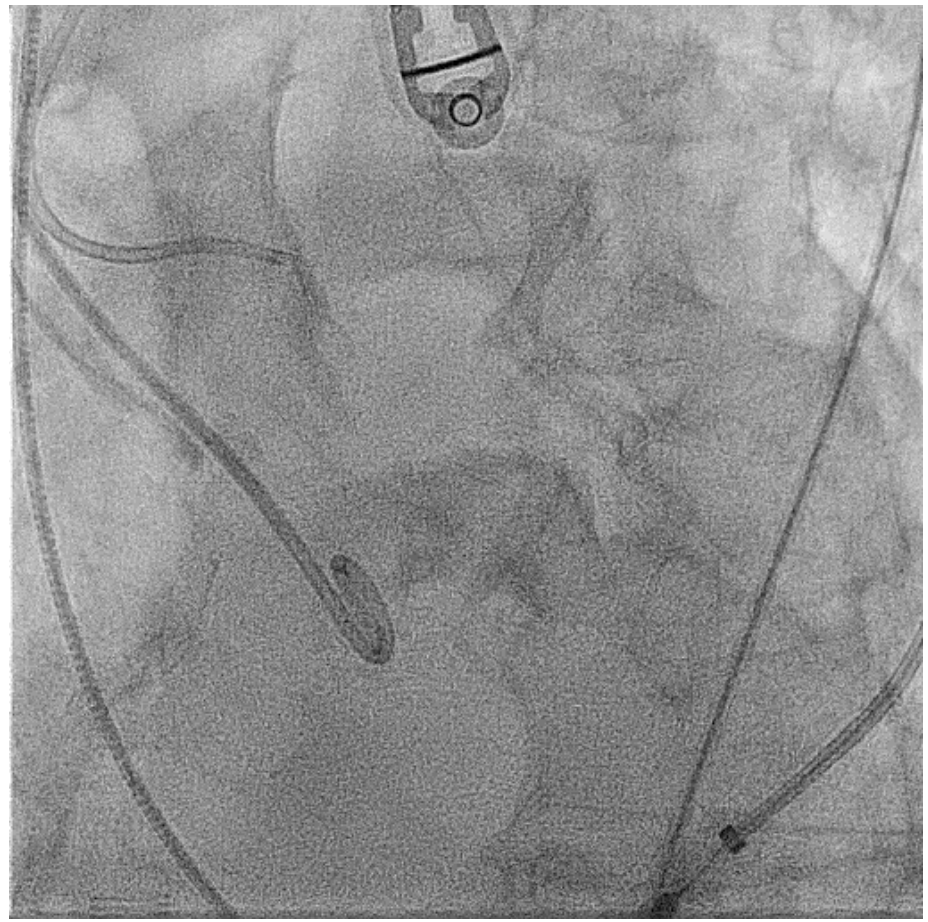
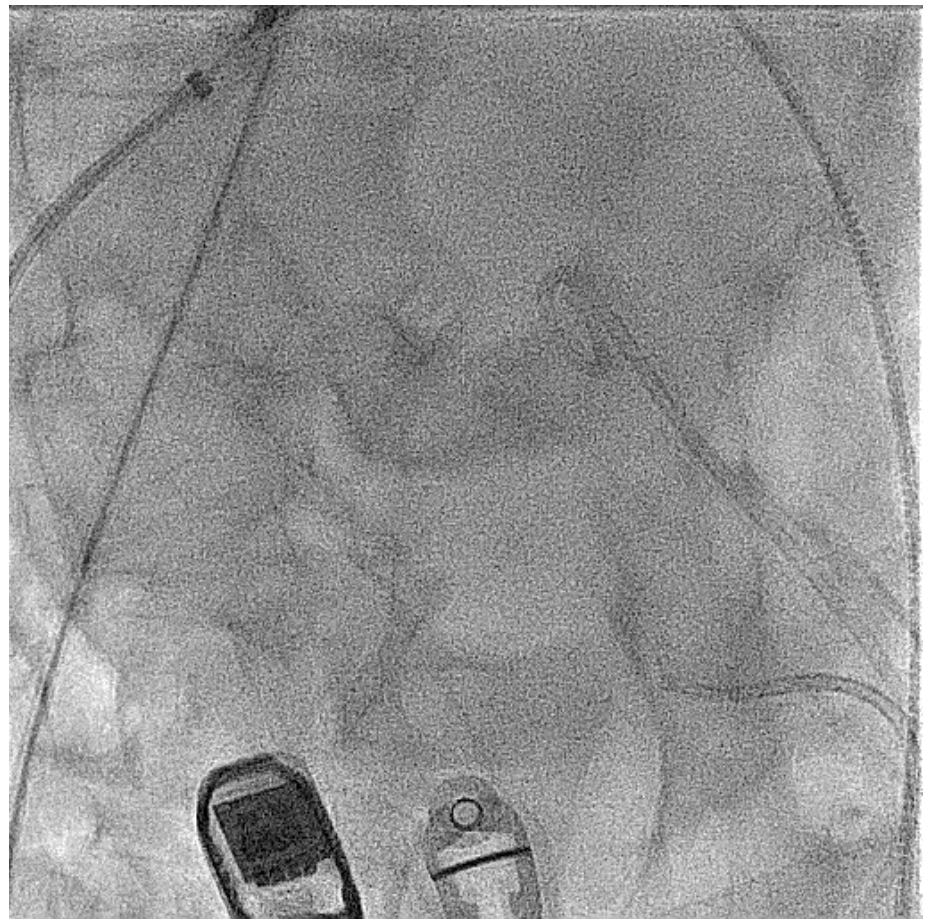
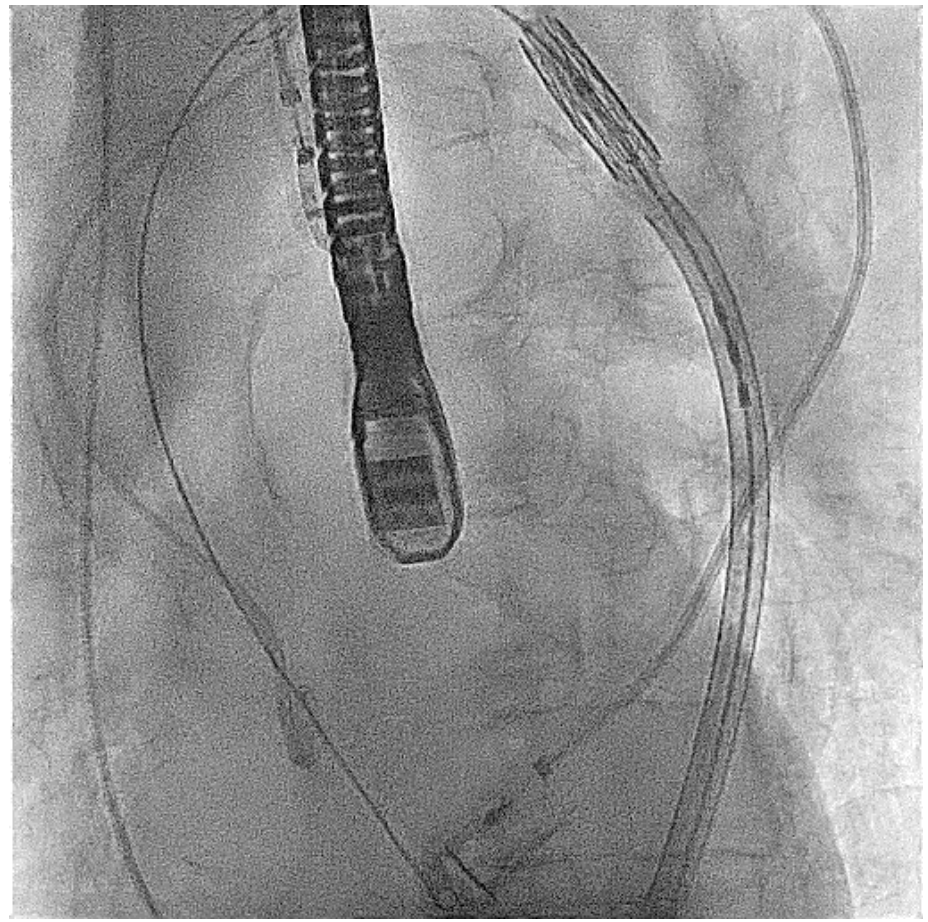
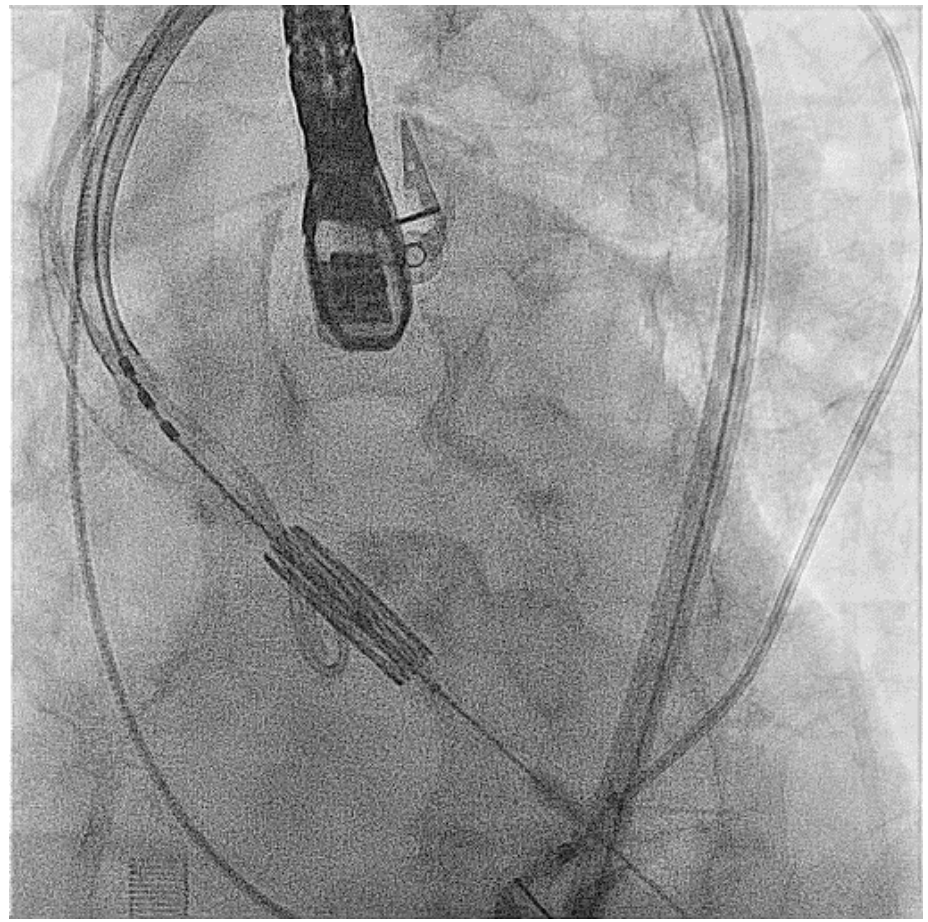
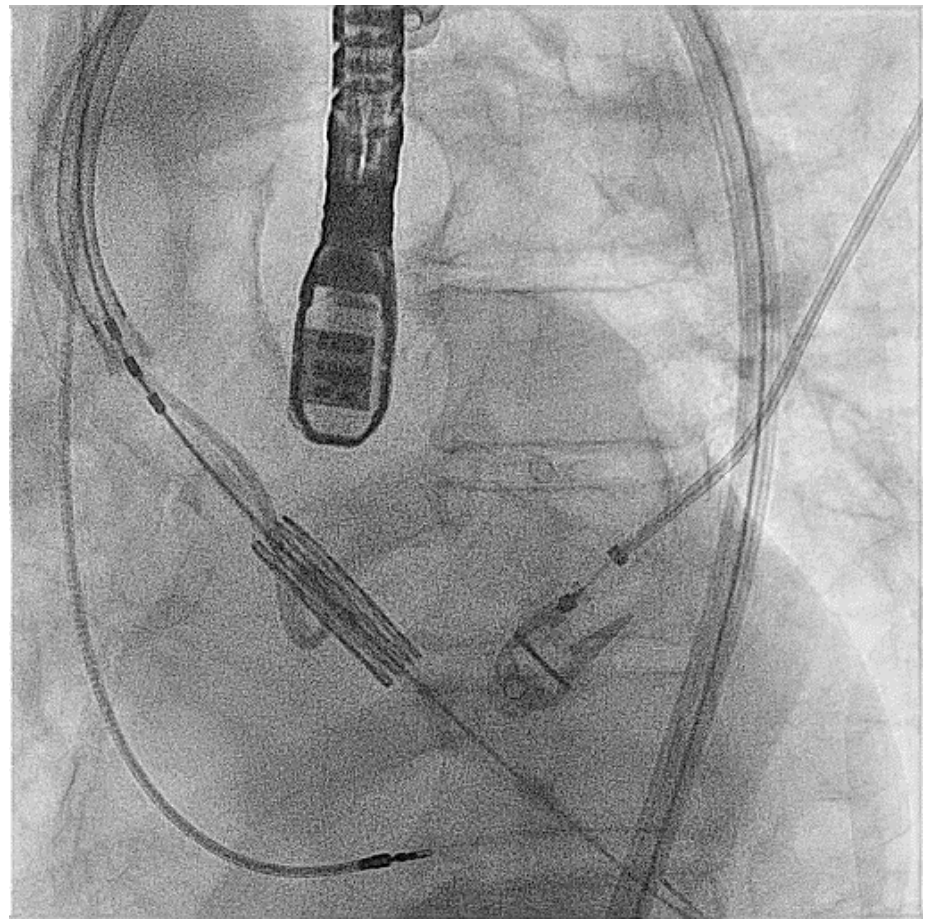
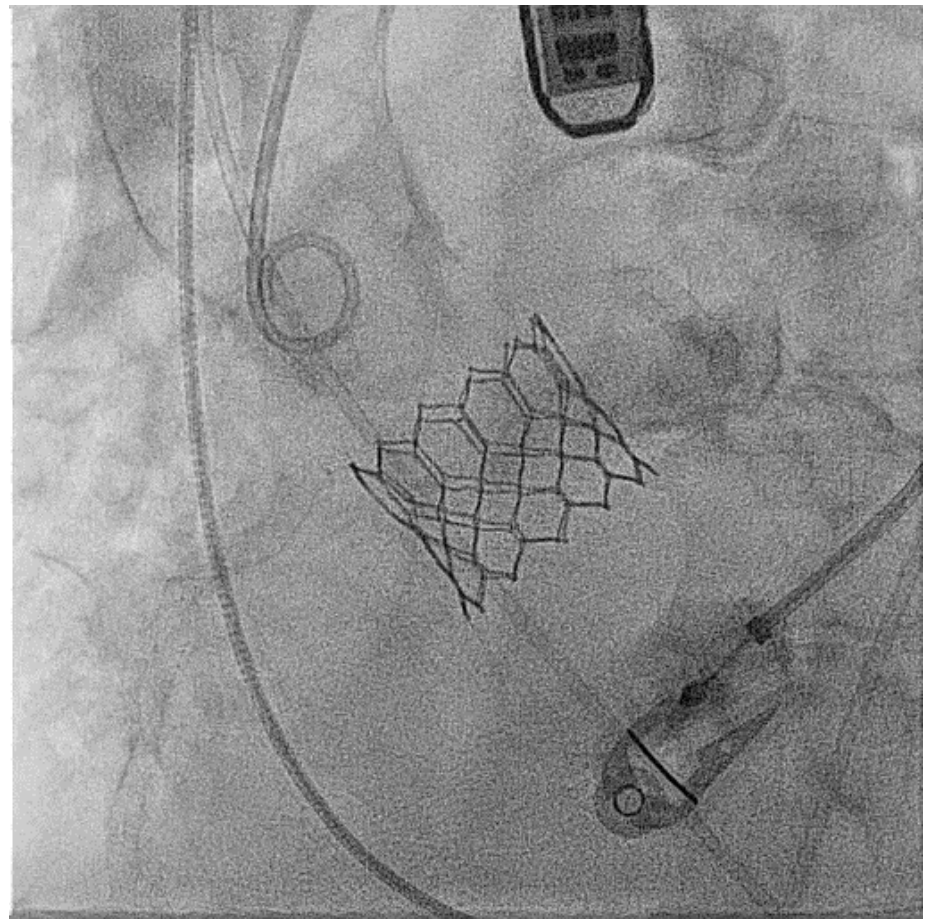


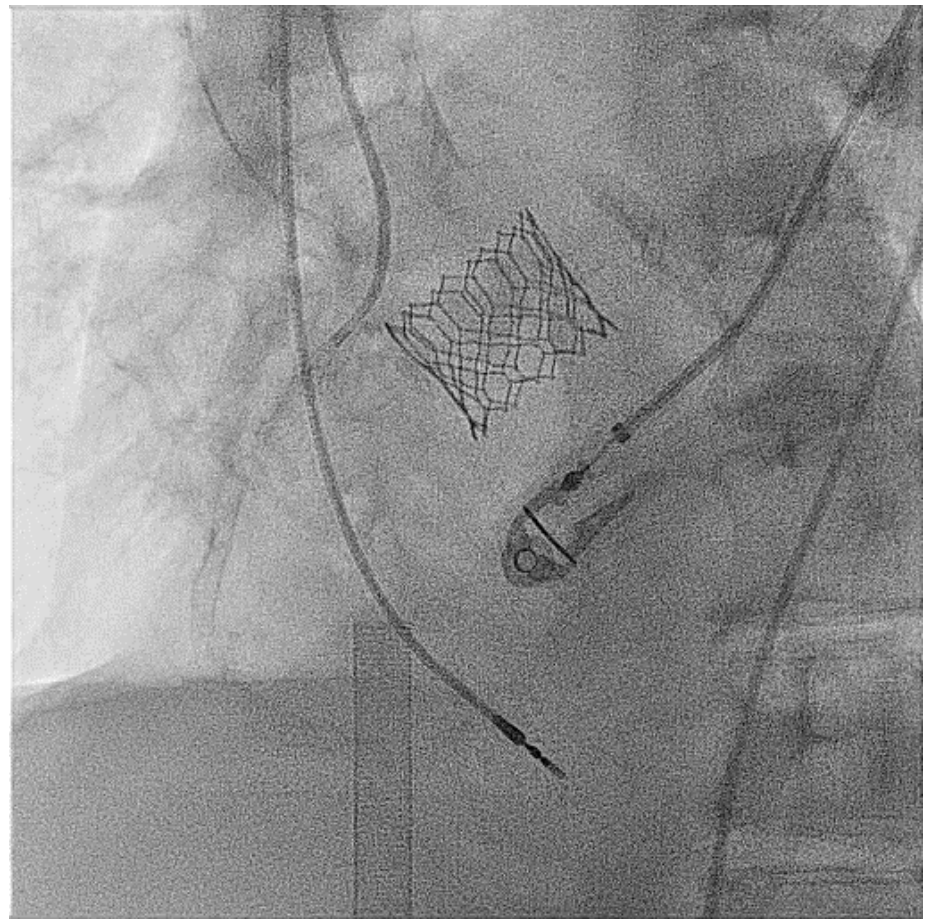


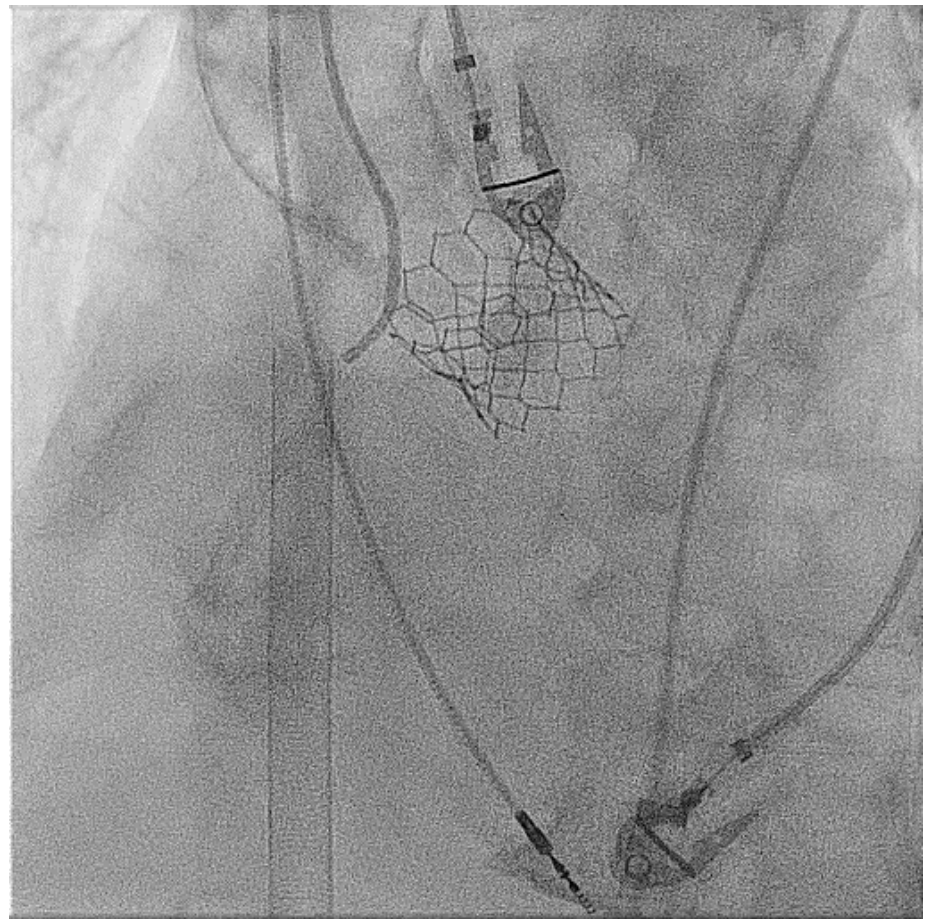


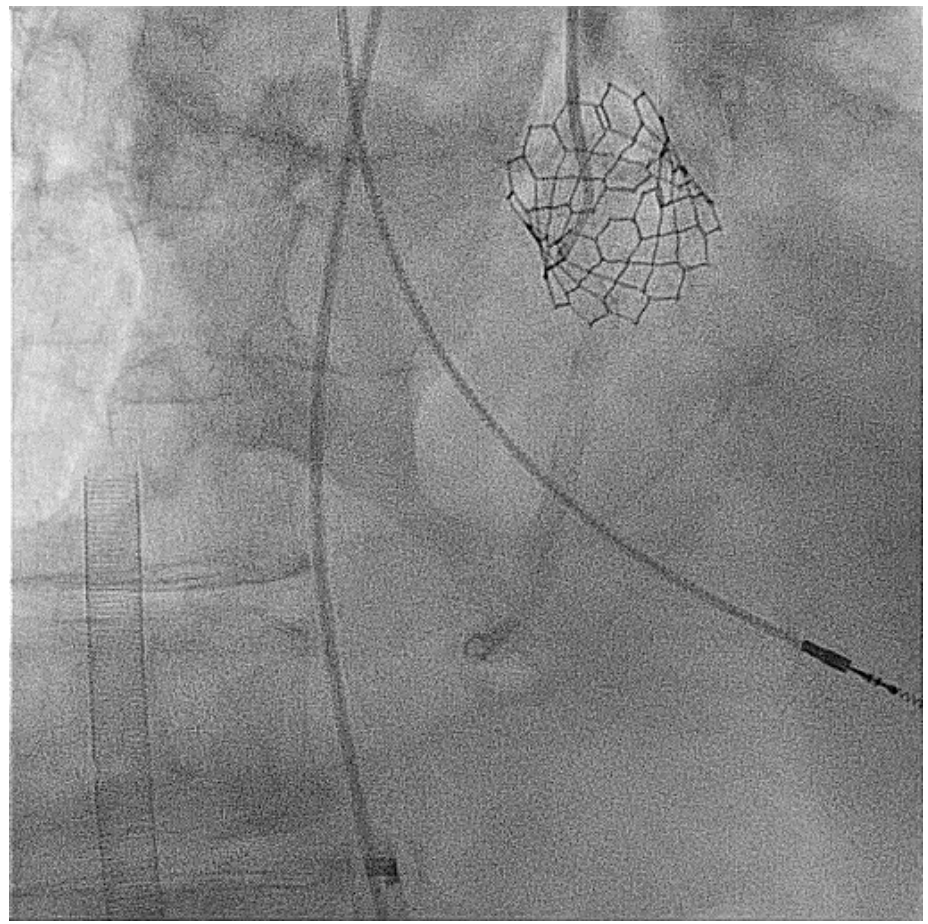


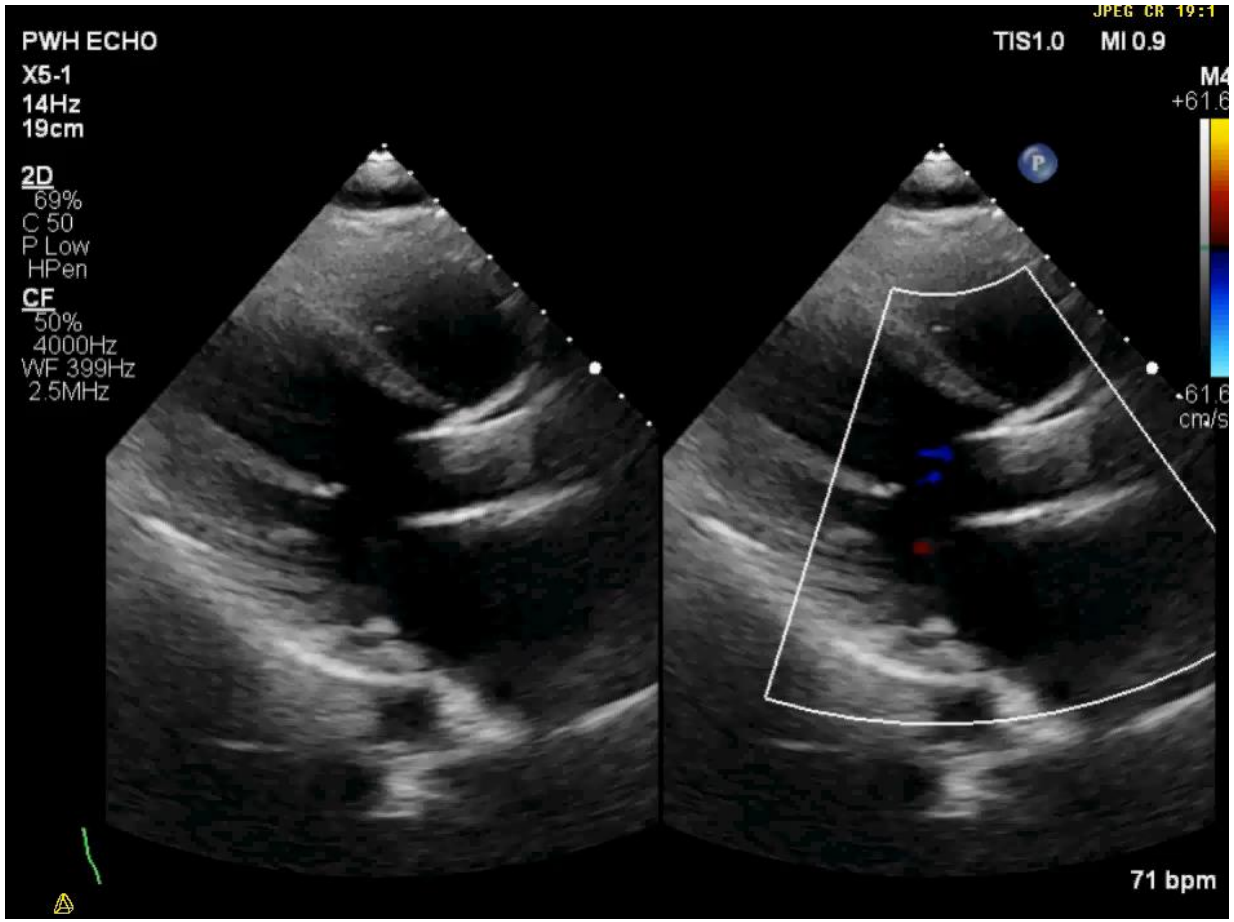


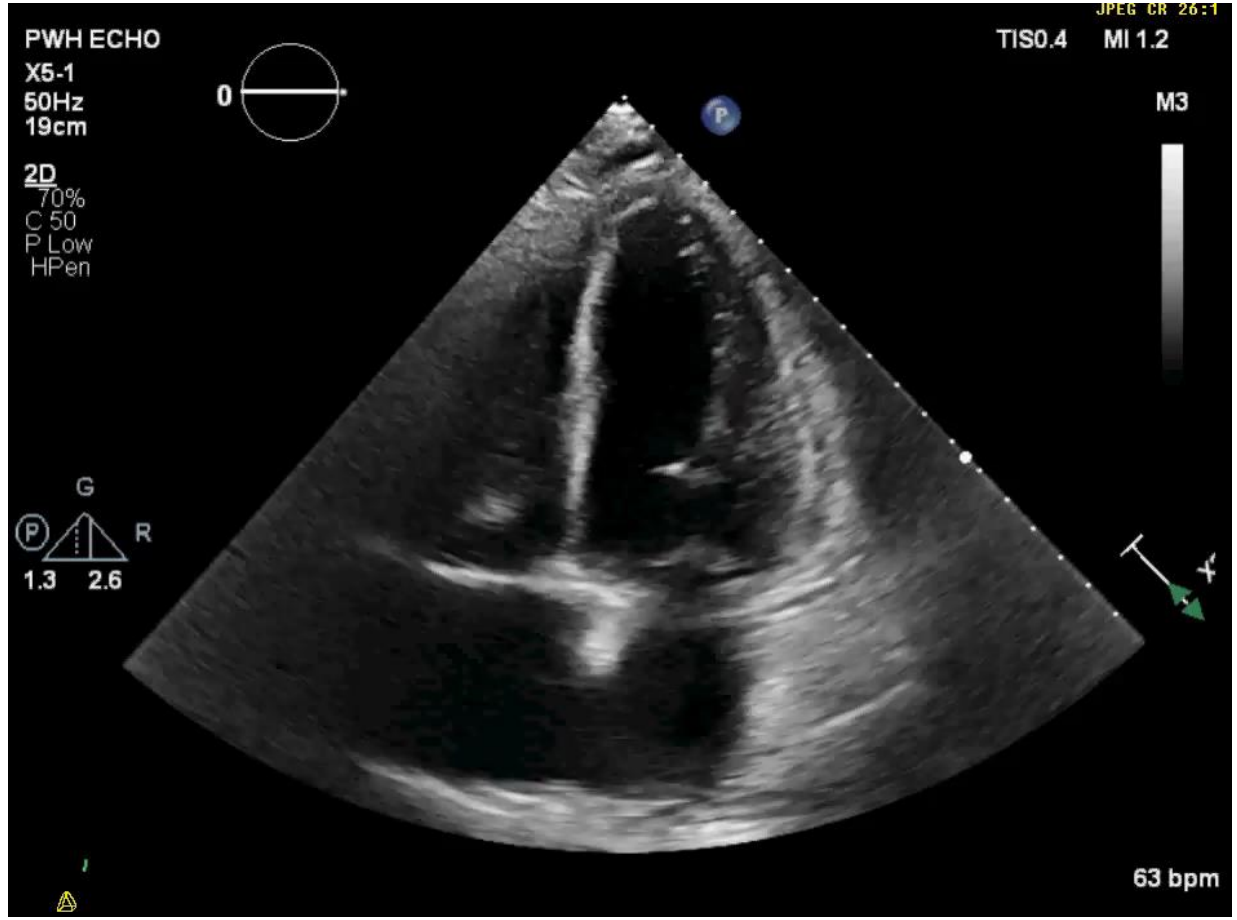


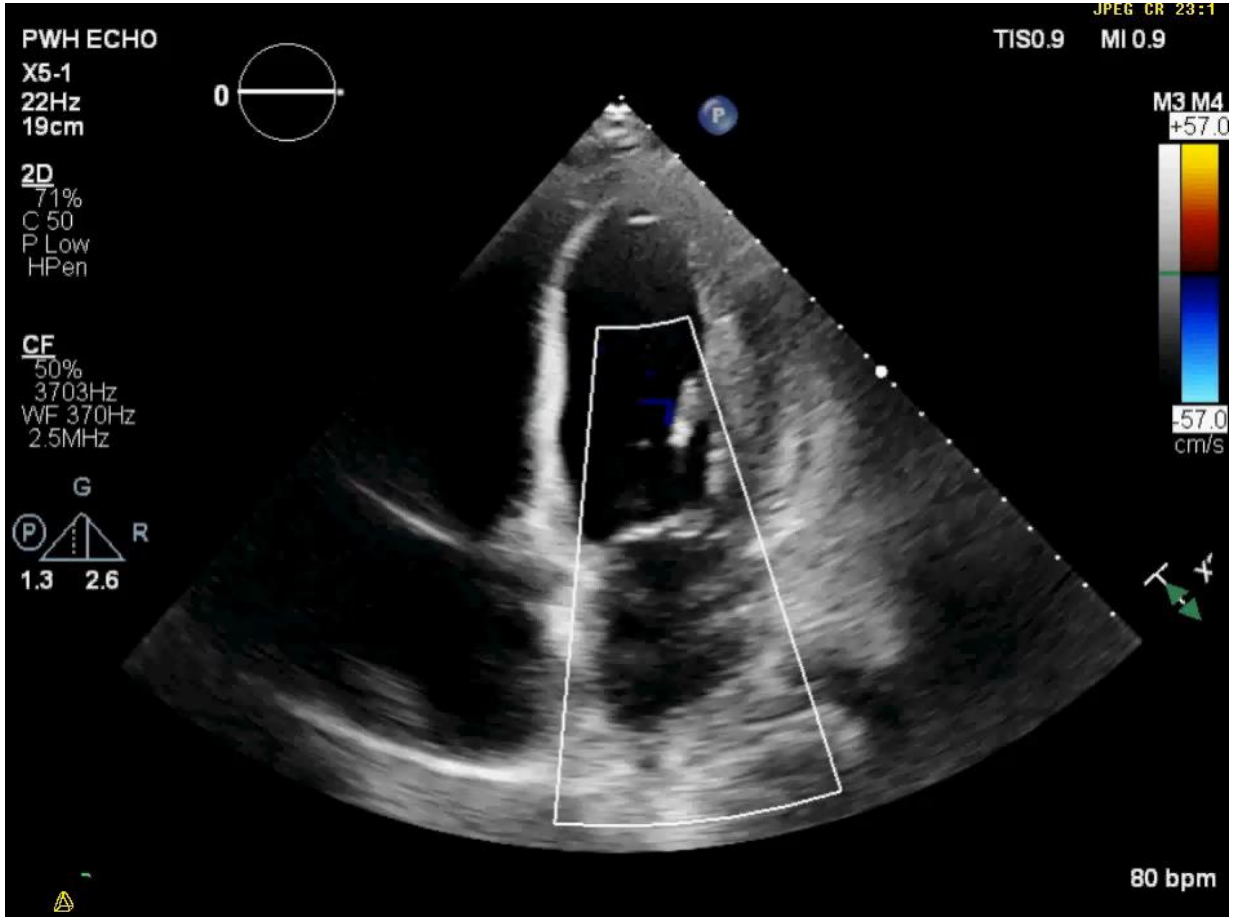







PWH ECHO
X5-1
14Hz
19cm
2D
69%
C 50
P Low
HPen
CF
50%
4000Hz
WF 399Hz
2.5MHz
TIS1.0
MI 0.9
71 bpm


PWH ECHO
X5-1
50Hz
19cm
2D
70%
C 50
P Low
HPen
0
TIS0.4
MI 1.2
M3
G
P
R
1.3
2.6
63 bpm


JPEG CR 23:1
PWH ECHO
X5-1
22Hz
19cm
2D
71%
C 50
P Low
HPen
CF
50%
3703Hz
WF 370Hz
2.5MHz
G
R
1.3
2.6
0
TIS0.9
MI 0.9
M3 M4
+57.0
-57.0
cm/s
80 bpm

Summary

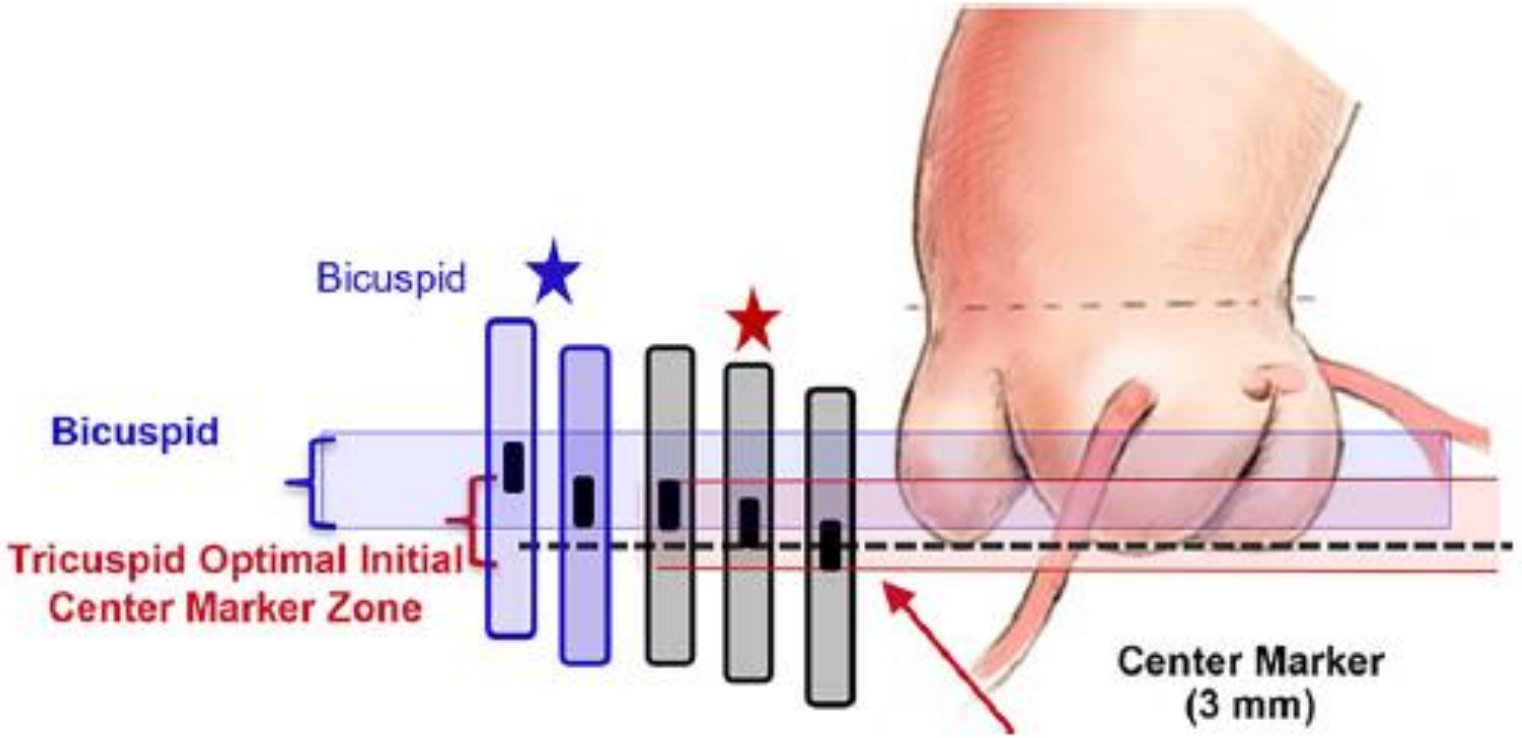
- ECMO provides full cardiopulmonary support during both PCI and TAVI procedure
- It increases the afterload to the heart, therefore we need to titrate the flow to minimally required in order to support the patient during the procedure
- In case of severe calcified and angulated segments, halfway rotablation may be considered to avoid serious complications

Thank you for your kind attention

Questions?

Backup slides

High implant in bicuspid AV



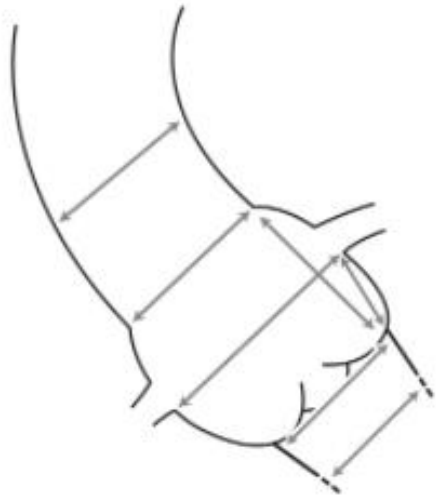
MEDTRONIC ANALYSIS

ANNULUS

Diameter (mm)	24.7 (Min)	x	31.7 (Max)	,	28.2 (Mean)
Perimeter (mm)	91.1	, Derived Ø (mm)			29.0
Area (mm²)	//	, Derived Ø (mm)			//

LVOT

Diameter (mm)	27.1 (Min)	x	34.1 (Max)	,	30.6 (Mean)
Perimeter (mm)	98.5	, Derived Ø (mm)			31.3
Area (mm²)	//	, Derived Ø (mm)			//



Max Ascending Aorta Diameter (mm)	24.7		
Sinotubular Junction Diameter (mm)	14.7 (Min) x	22.8 (Max)	
Sinus of Valsalva Diameter (mm)	40.0 (LCC)	24.1 (RCC)	(NCC)
Sinus of Valsalva Height (mm)	30.2 (LCC)	30.9 (RCC)	(NCC)
Coronary Ostia Height (mm)	22.7 (Left)	21.8 (Right)	

RIGHT

CIA Min Diameter (mm): 8.0 x 8.3

EIA Min Diameter (mm): 6.2 x 6.5

Femoral Min Diameter (mm): 7.0 x 7.9

LEFT

CIA Min Diameter (mm): 7.1 x 7.7

EIA Min Diameter (mm): 7.3 x 7.4

Femoral Min Diameter (mm): 5.9 x 8.2

RIGHT

Subclavian Min Diameter (mm): x

Annular Angulation: 38°

LEFT

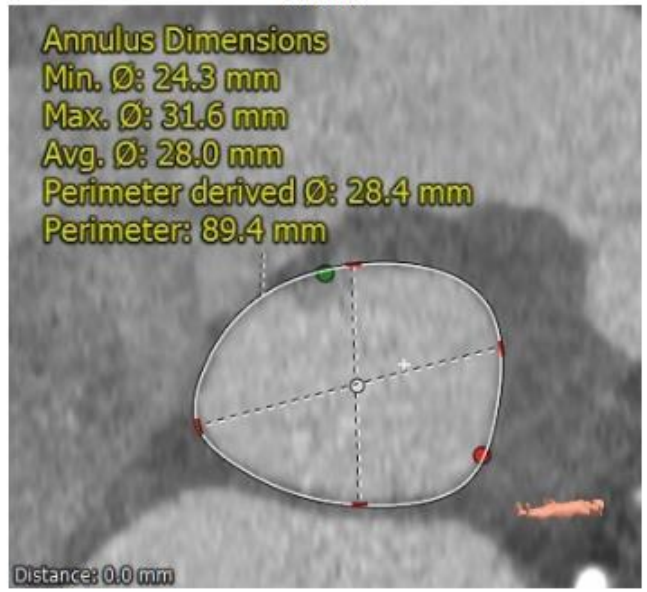
Subclavian Min Diameter (mm): x

Please review images for direct aortic evaluation.

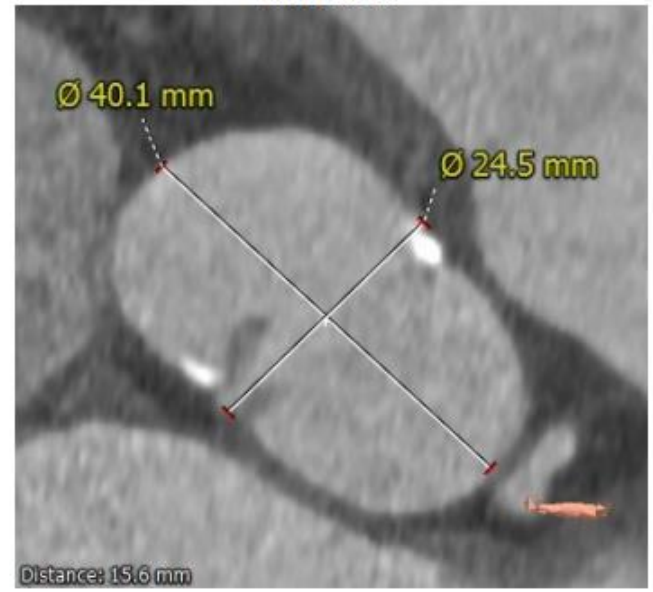
Calcium: Mild ☐ Moderate ☐ Severe ☐

Aorta

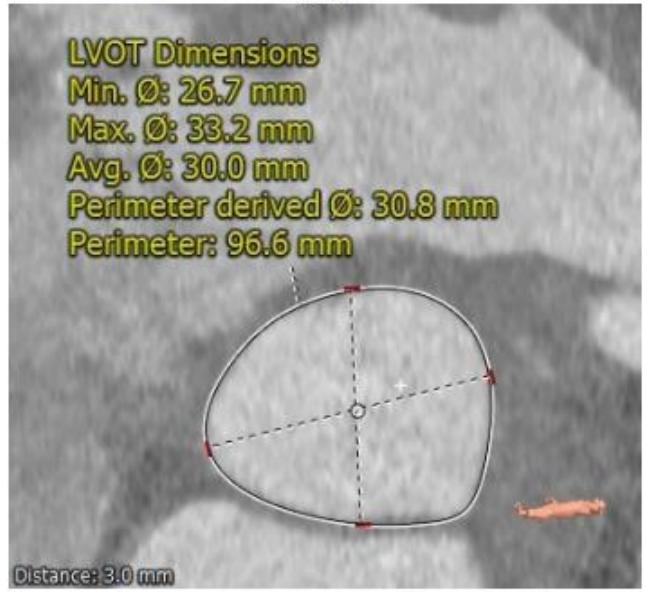
ANNULUS



SOV DIAMETER



LVOT

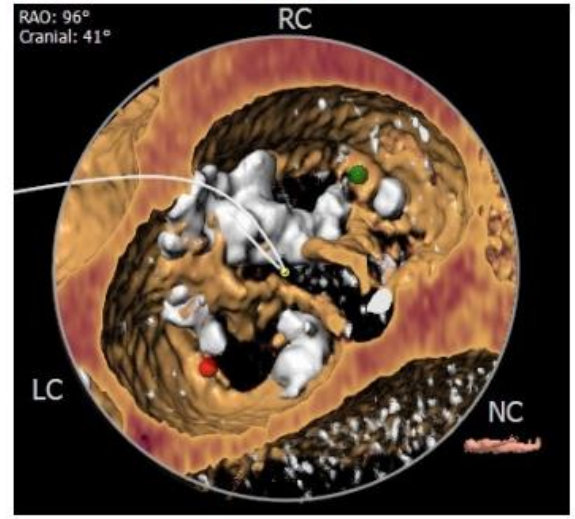


STJ

Aorta

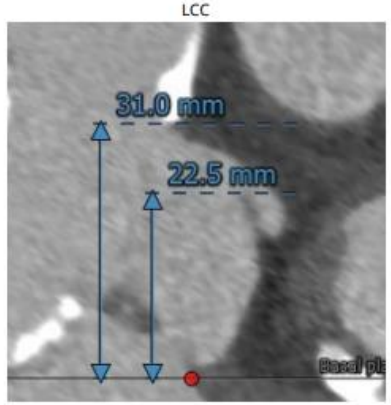
ASCENDING AORTA

AORTIC VALVE CALCIFICATION

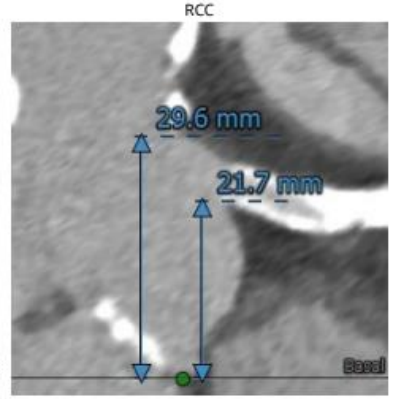


SINUS HEIGHT

LCC



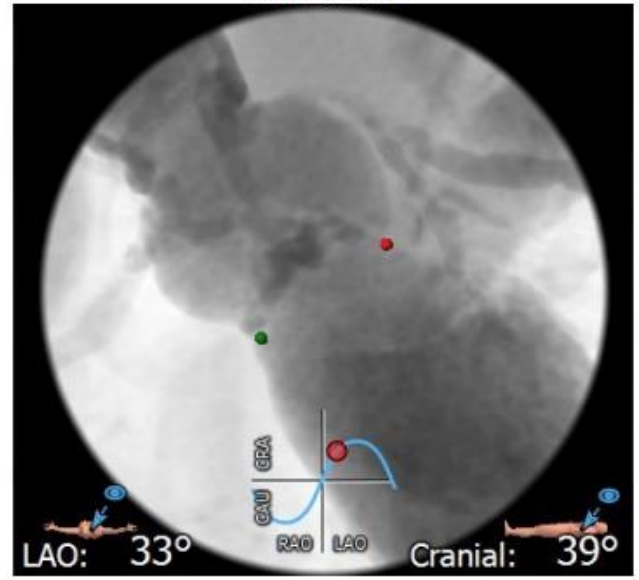
RCC



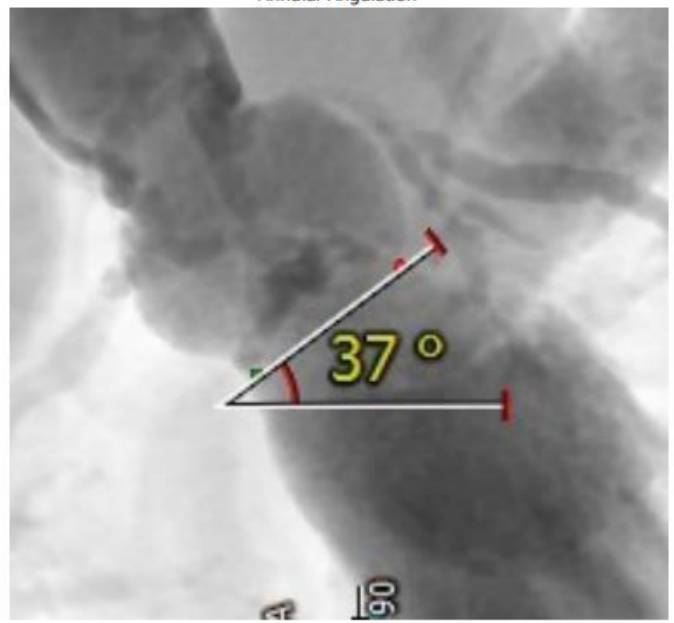
NCC

AORTIC ROOT

IMPLANTER'S VIEW



Annular Angulation



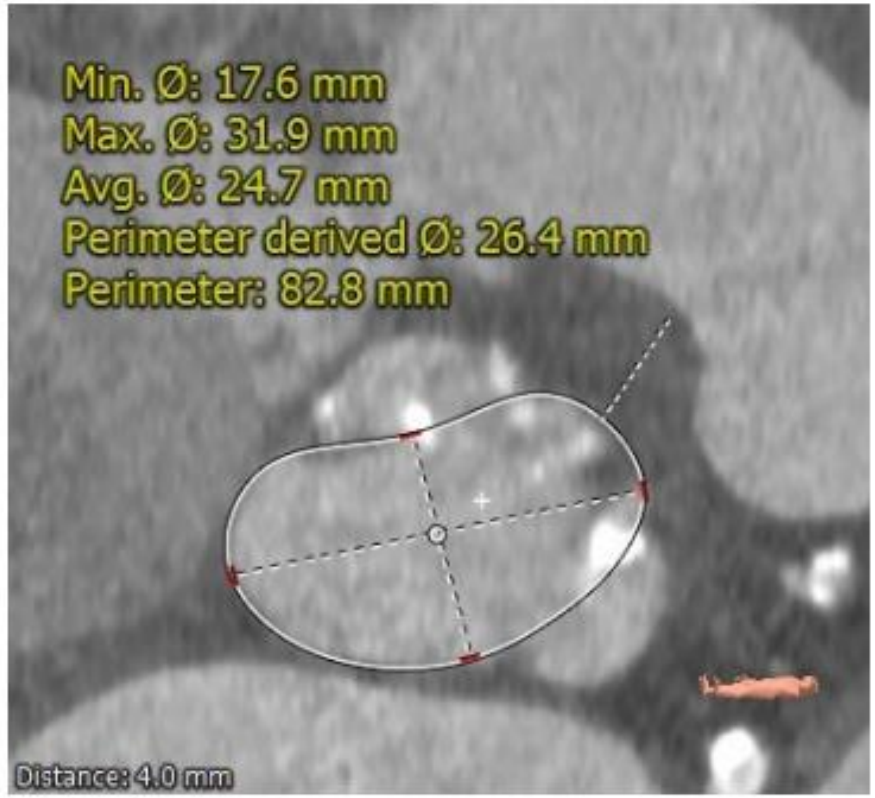
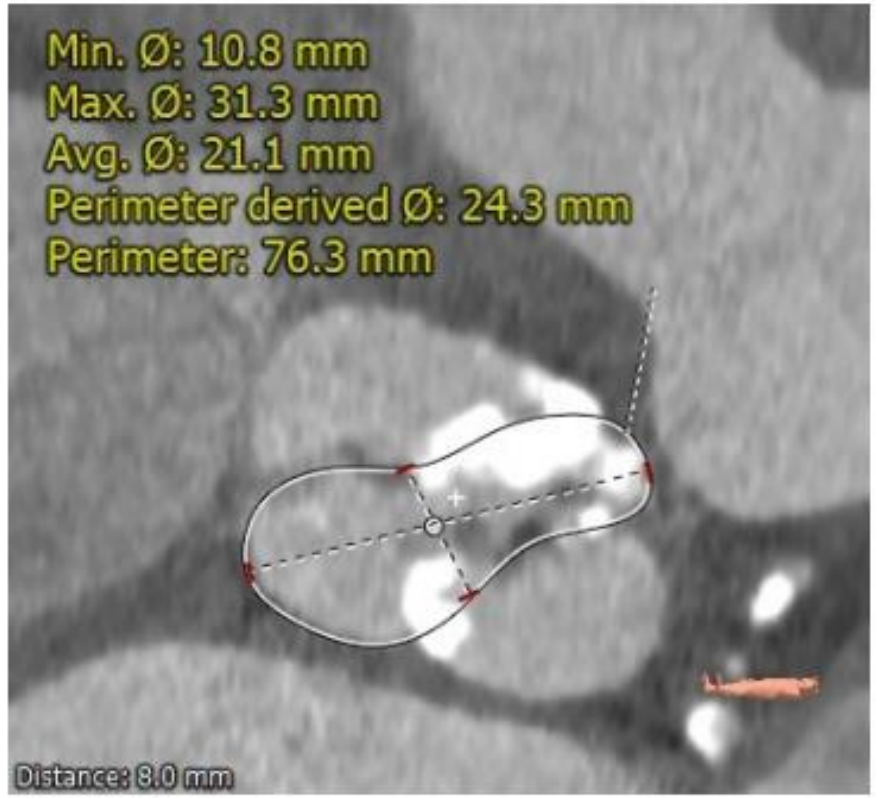
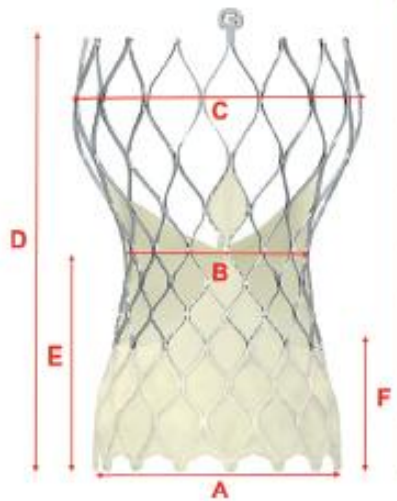
Perpendicular Plane	Perpendicular Plane
	
EOA 4mm above annulus	EOA 8mm above annulus

FIGURE 1 **Repositionable Self-Expanding Valves With and Without an External Pericardial Wrap: Features and Dimensions**



	23mm Evolut R / PRO	26 mm Evolut R / PRO	29mm Evolut R / PRO	34mm Evolut R
A. Inflow Diameter	23 mm	26 mm	29 mm	34 mm
B. Waist Diameter	20 mm	22 mm	23 mm	24 mm
C. Outflow Diameter	34 mm	32 mm	34 mm	38 mm
D. Frame height	45 mm	45 mm	45 mm	46 mm
E. Commissure Height	26 mm	26 mm	26 mm	26 mm
F. Skirt Height	13 mm	13 mm	13 mm	14 mm

Various dimensions of the Evolut-R and Evolut-PRO CoreValve (Medtronic, Galway, Ireland) are listed for comparison.