



2023.08.10

12<sup>th</sup> AP VALVES & STRUCTURAL HEART



**Nightmare Case Series, How DO We Rescue?**

**Case of Transcatheter Heart Valve**

**Embolization in the Patient with Kyphosis**

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**Cardiovascular Center**

**Chonnam National University Hospital**

**Gwangju, Korea**

# Case

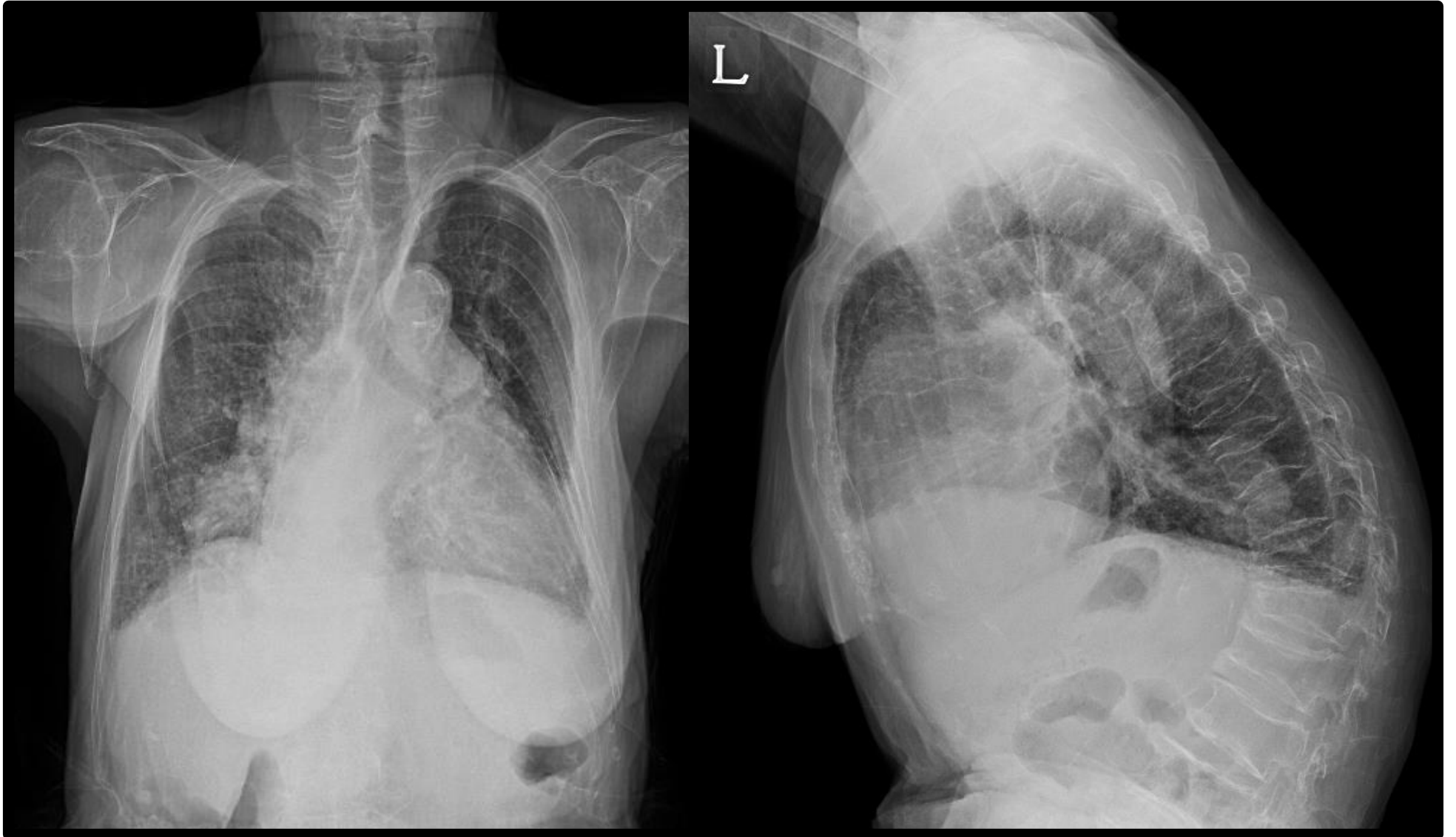
**86/F**

**P/H** Kyphosis

**STS Score** 4.693%

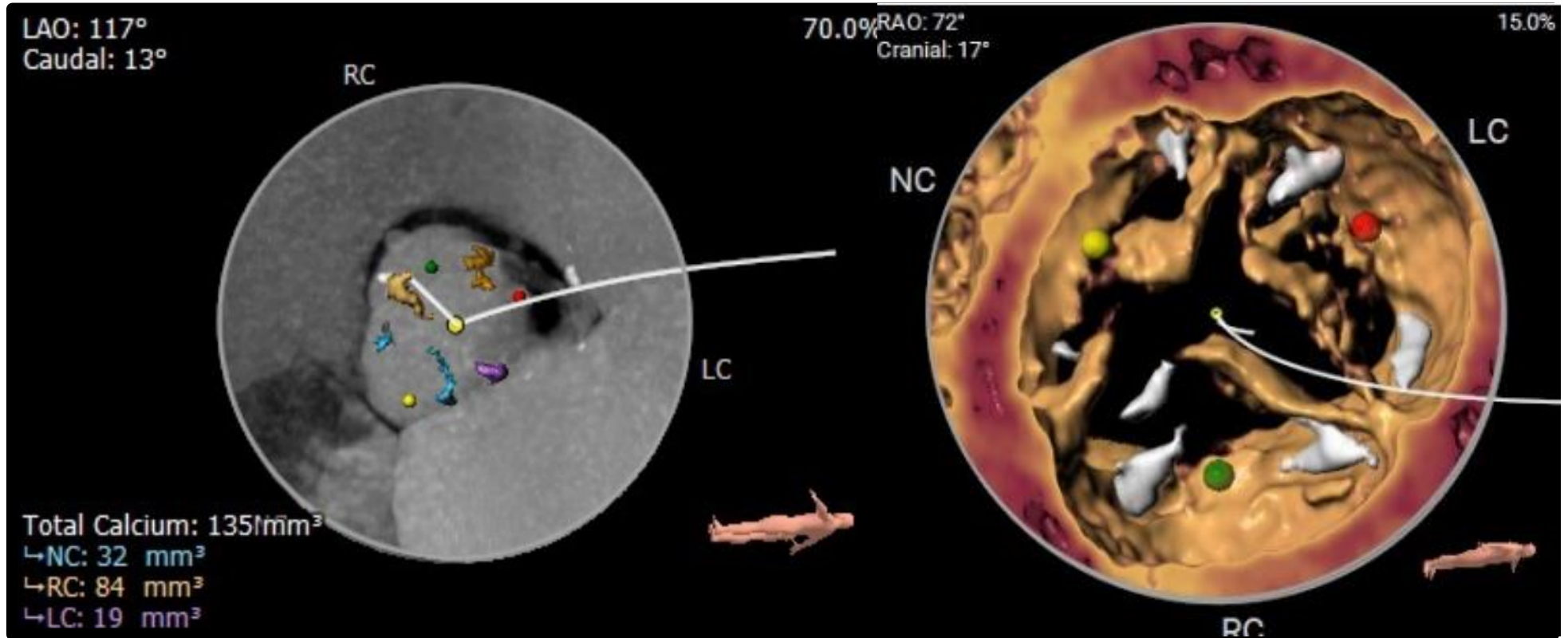
**2DE** Severe AS, mild AR  
(AVA 0.71cm<sup>2</sup>, Vmax 4.27m/s, meanPG 41.1mmHg)  
Moderate MR

# Chest X-ray



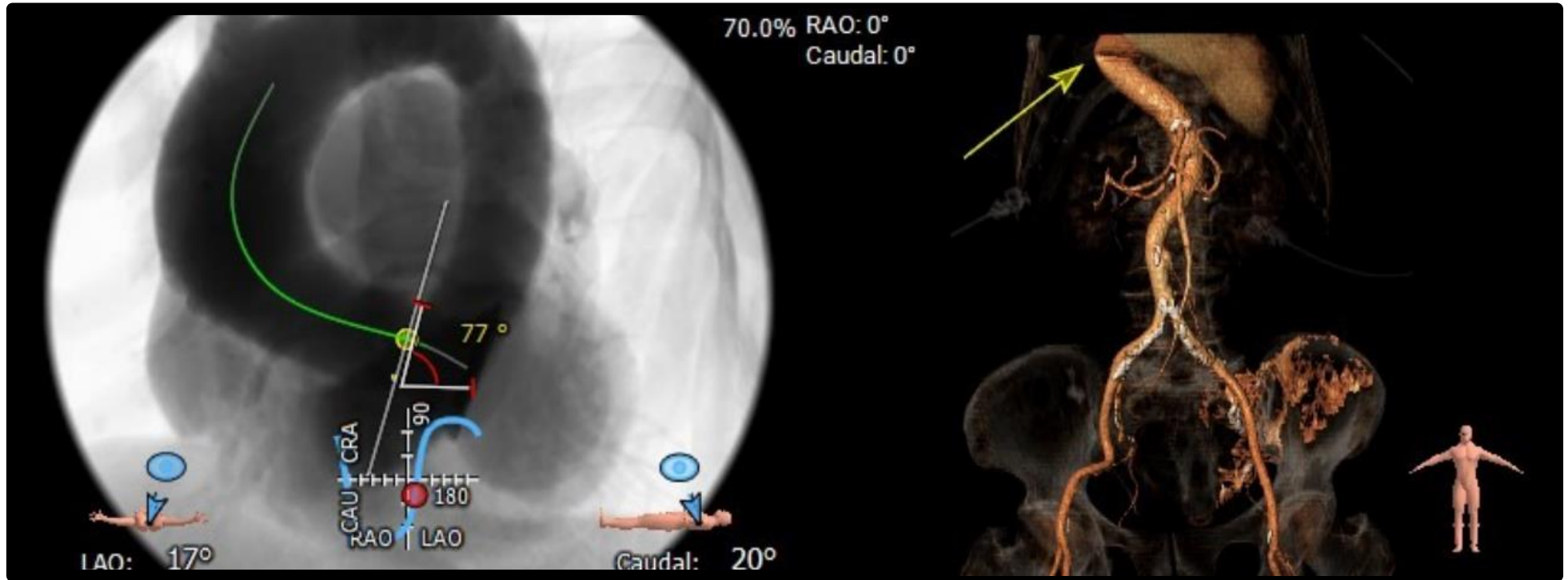
Kyphosis

# Pre-TAVR Assessment



**Mild calcification on the native leaflets (Total calcium 135mm<sup>3</sup>)**

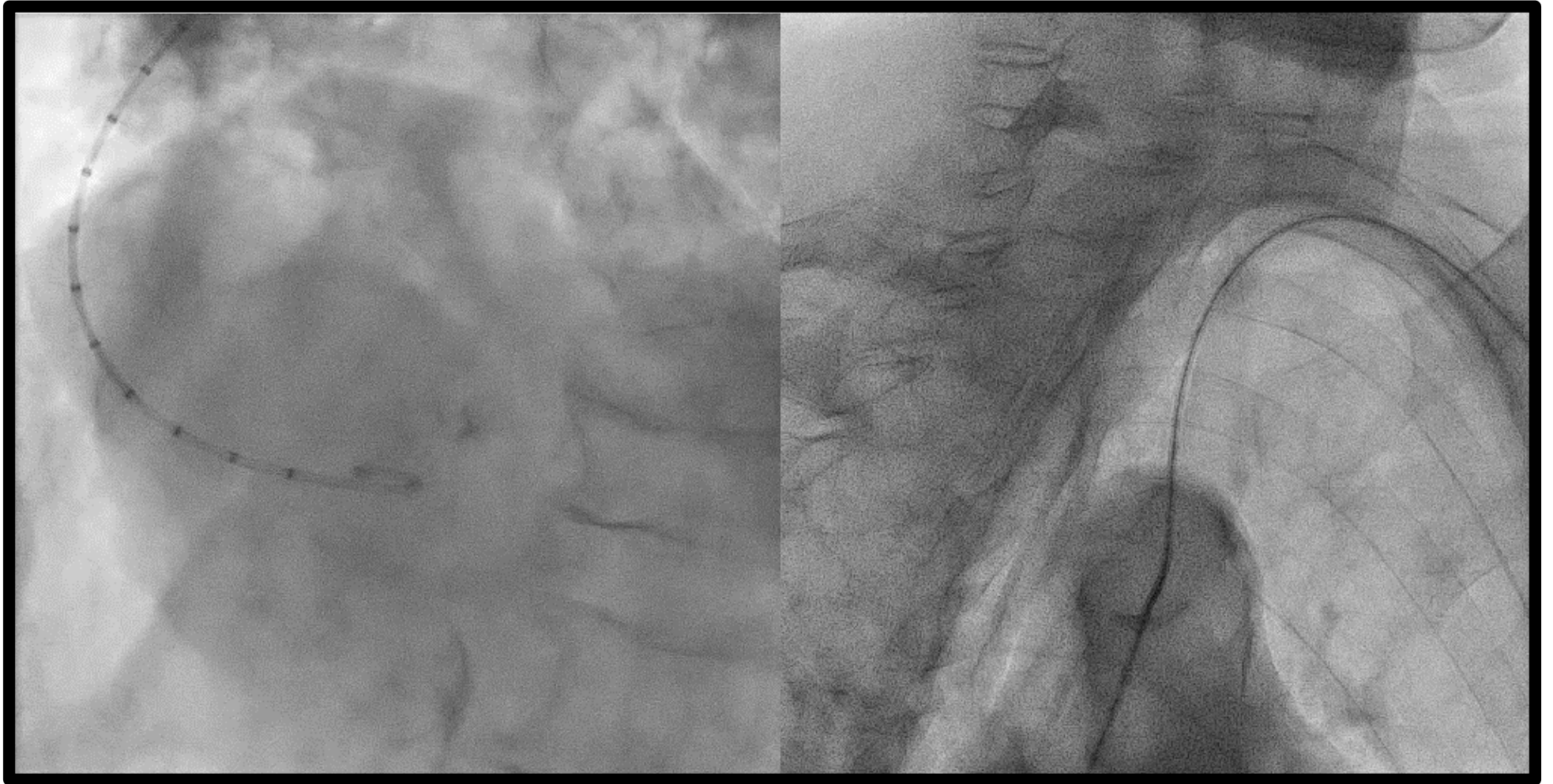
# Pre-TAVR Assessment



**Horizontal Aorta  
(Aortic angle 77)**

**Descending Aorta  
Bending**

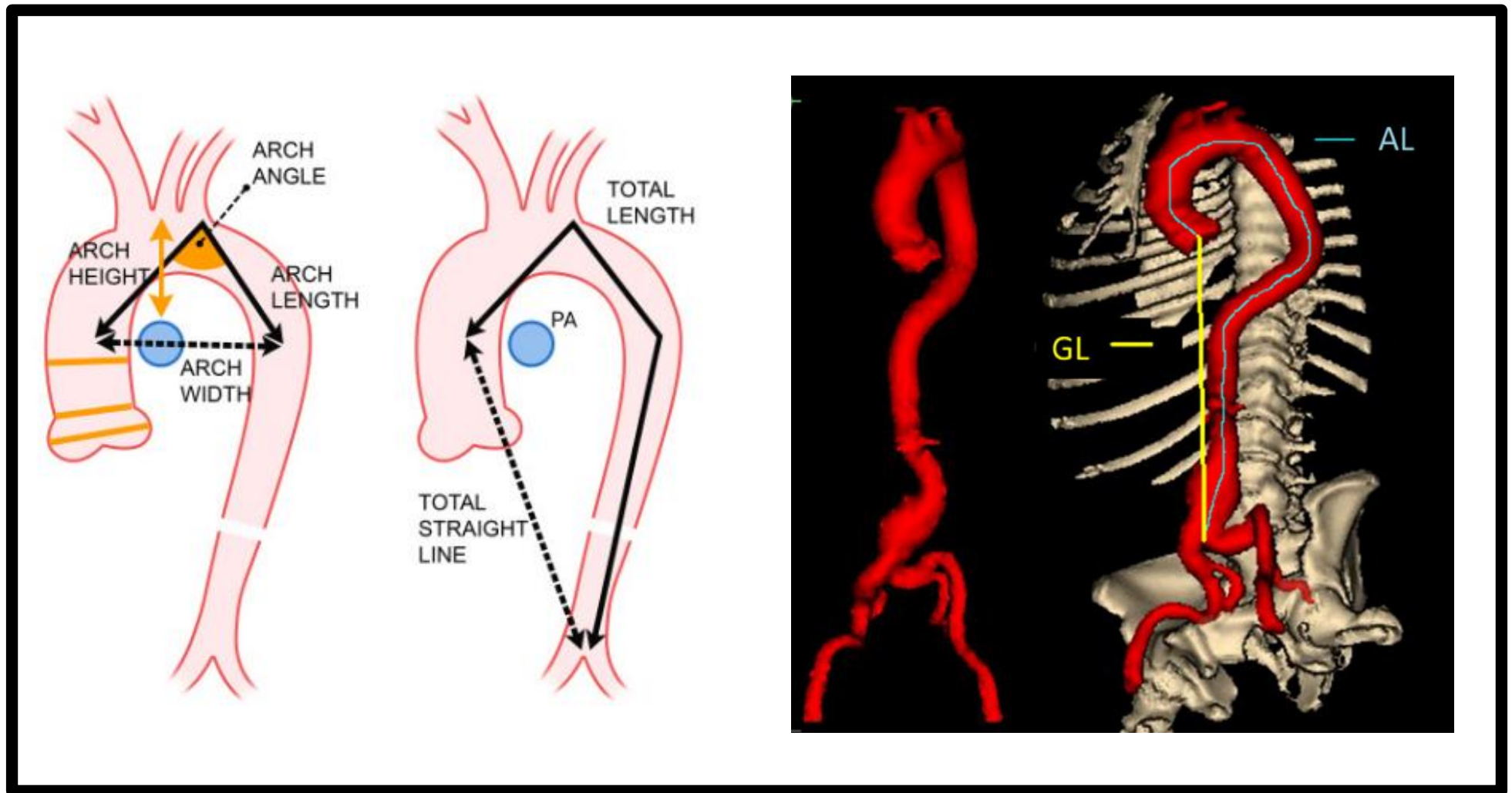
# Pre-TAVR Assessment



**Horizontal Aorta**

**Tortuous Aorta**

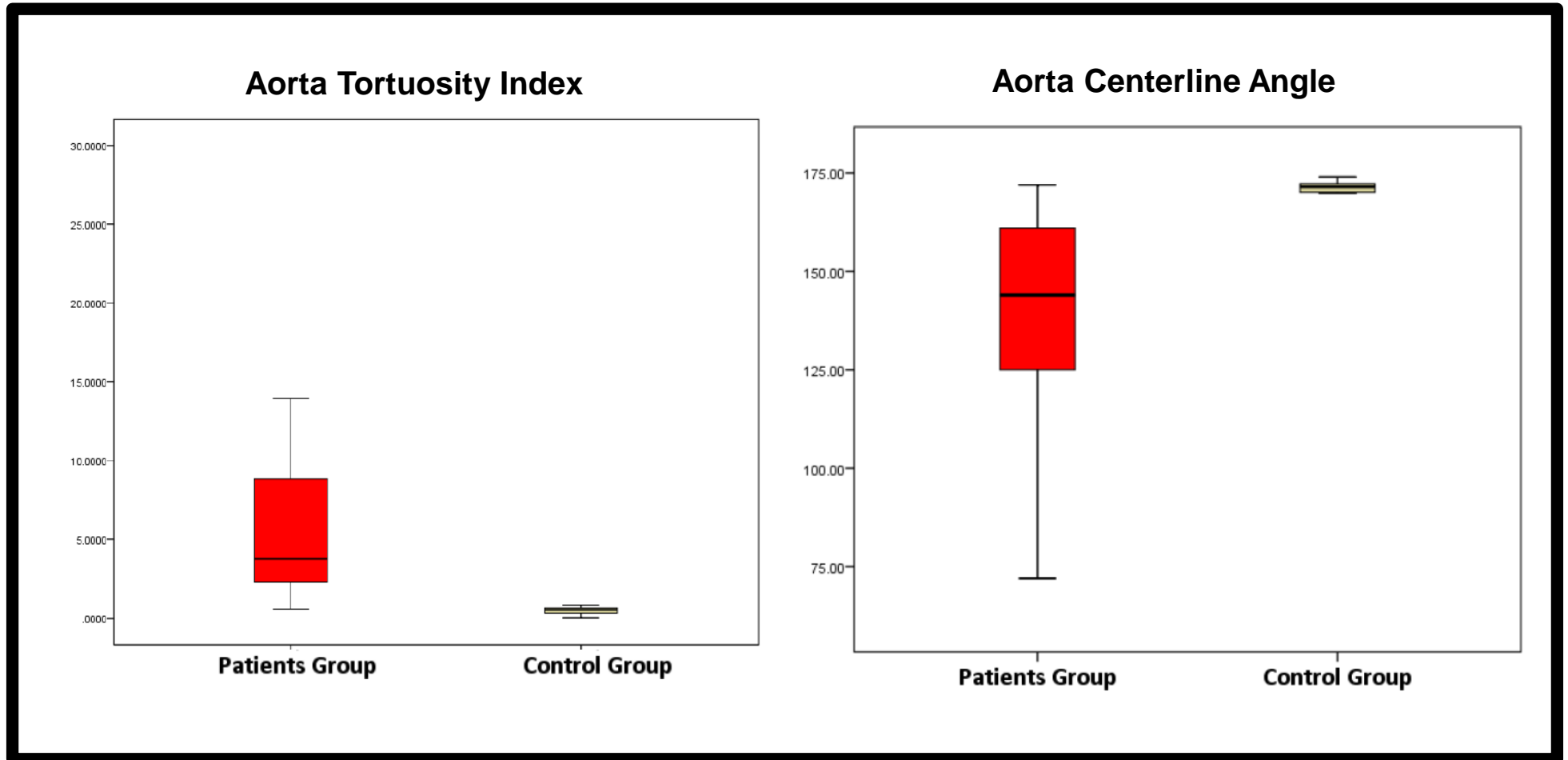
# Aorta Tortuosity



*Int J Cardiol. 2019;284:84-89*

*Int J Cardiol. 2015;194:7-12*

# Aorta Tortuosity

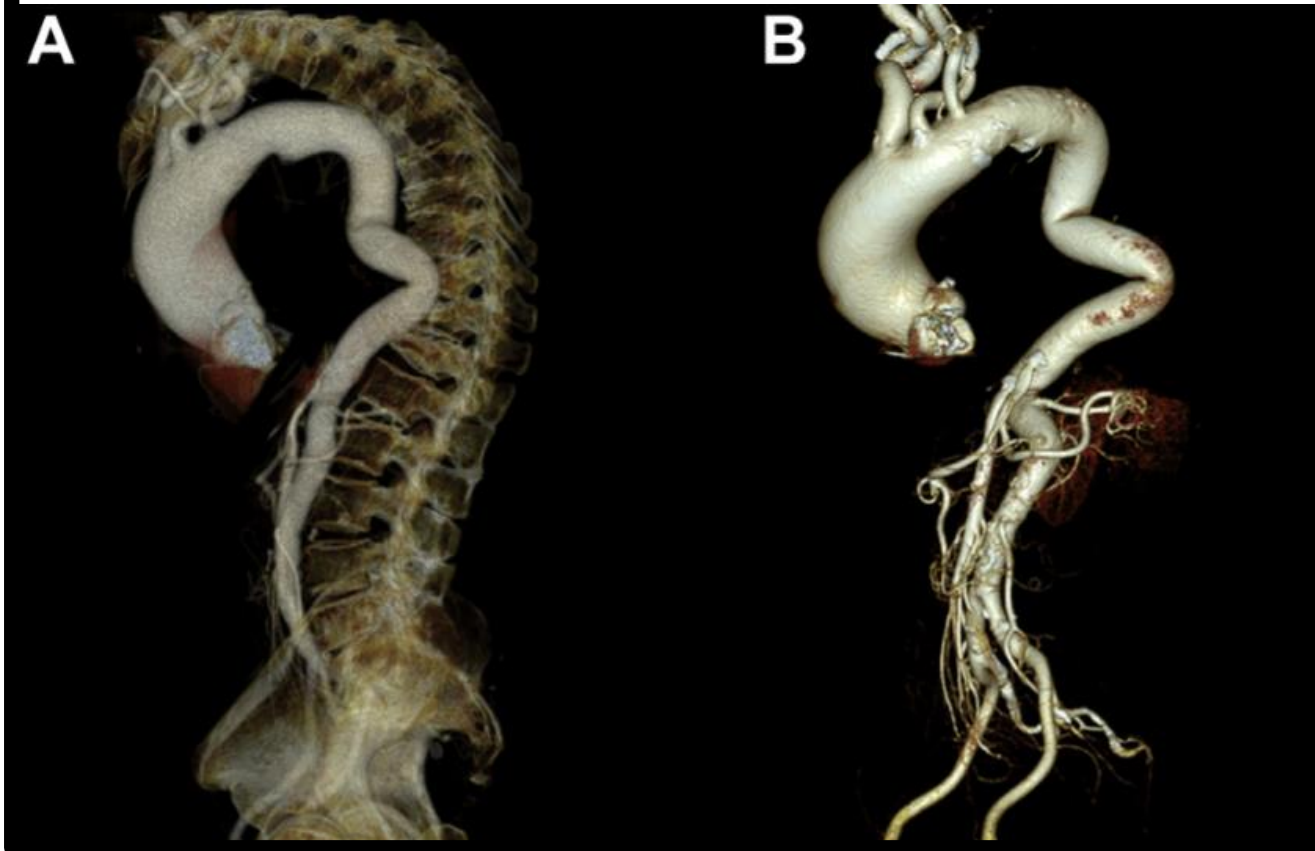


Aortic curvature increase in proportion to the degree of scoliosis



# Aorta Tortuosity

Extensive arterial tortuosity, scoliosis and kyphosis



Compared with a tortuous artery without spinal deformity, the aortic access of scoliosis and kyphosis patients is more complex

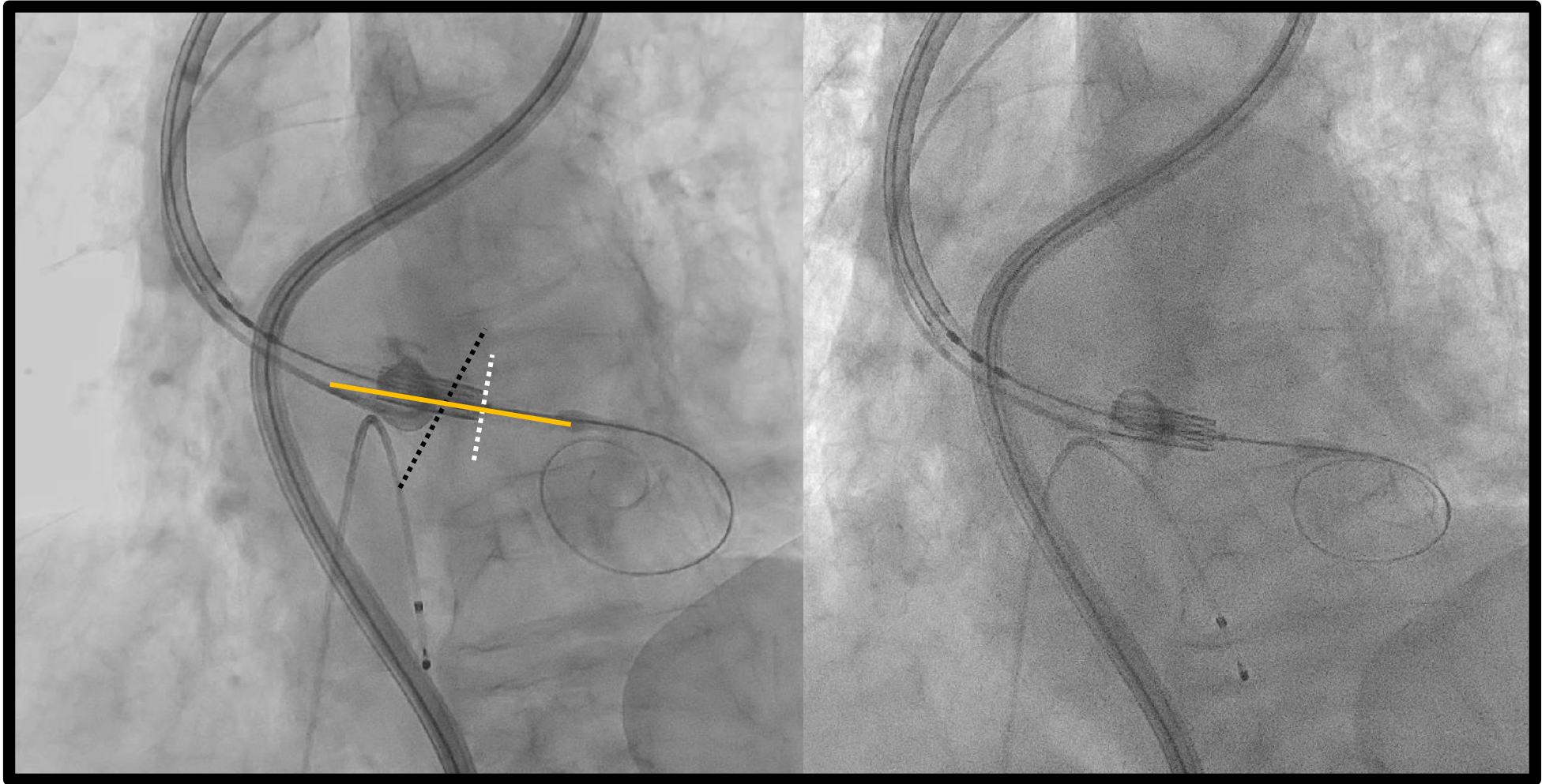
*J Am Coll Cardiol Interv. 2022;15:791-792*

# TAVR



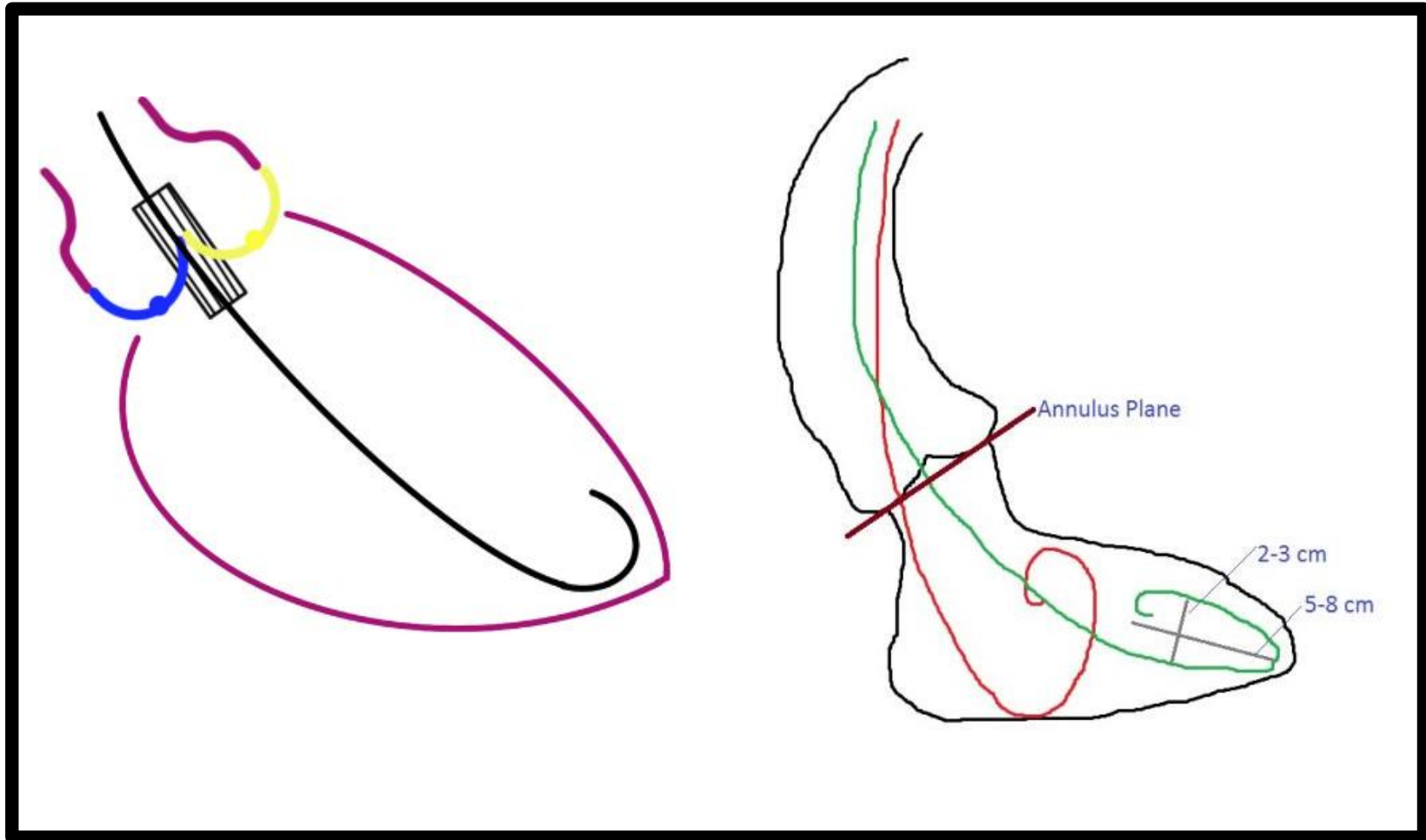
**Predilation: 18mm sized balloon**

# TAVR



**SAPIEN 3 Ultra 20mm (Oversizing 7.3%, +1cc)**

# Coaxial Positioning of THV



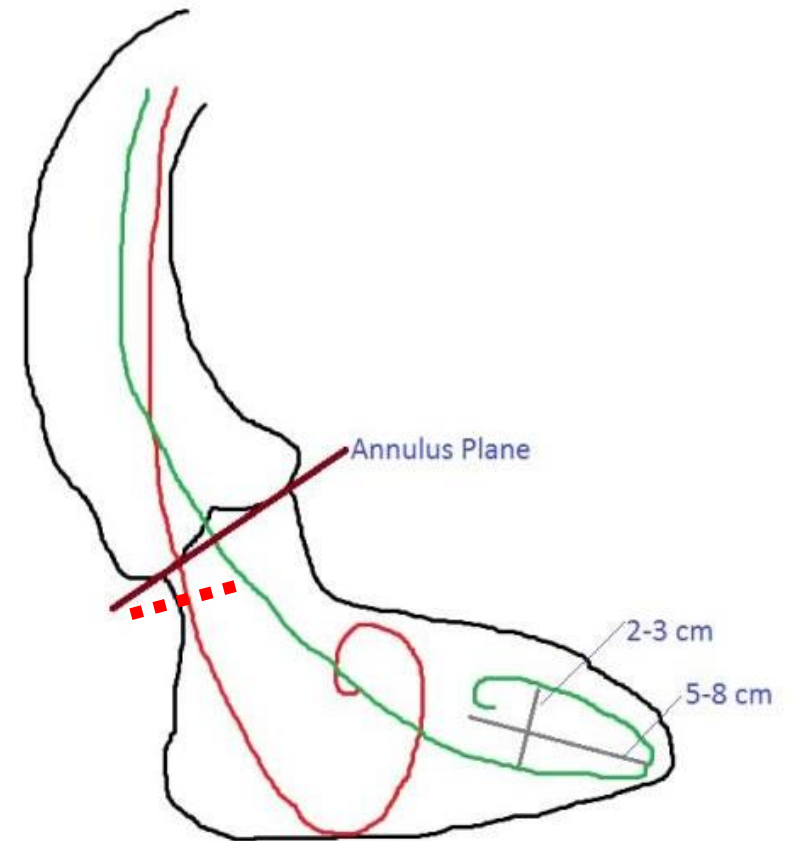
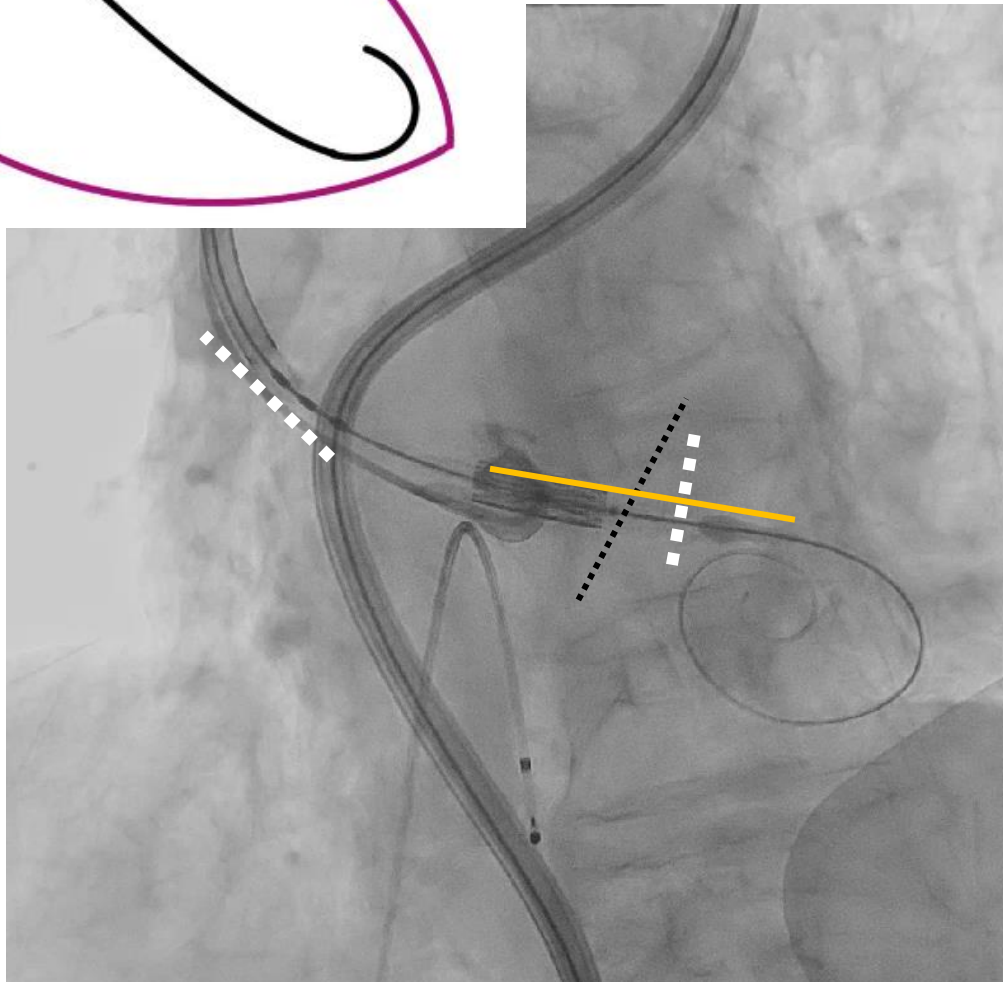
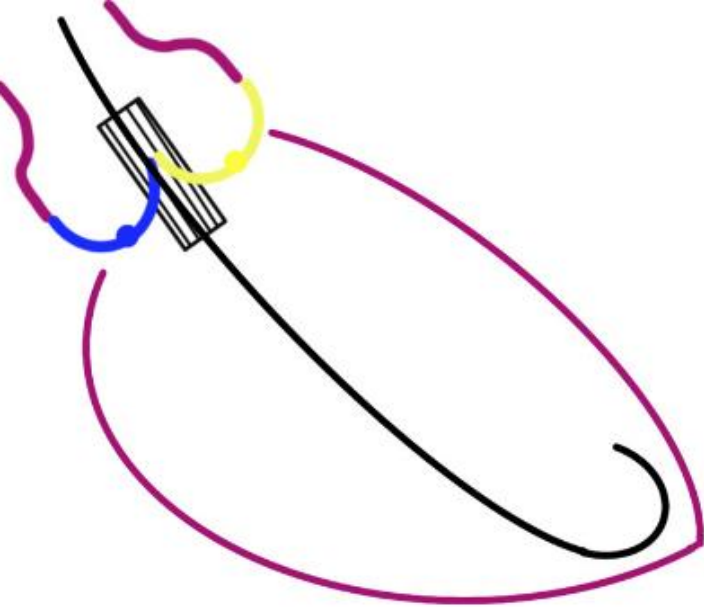
Coaxiality of THV, native valve with the left ventricular outflow tract, annulus and aortic root should be obtained for optimal prosthesis deployment

*JACC Asia. 2021;1(2):147-161*

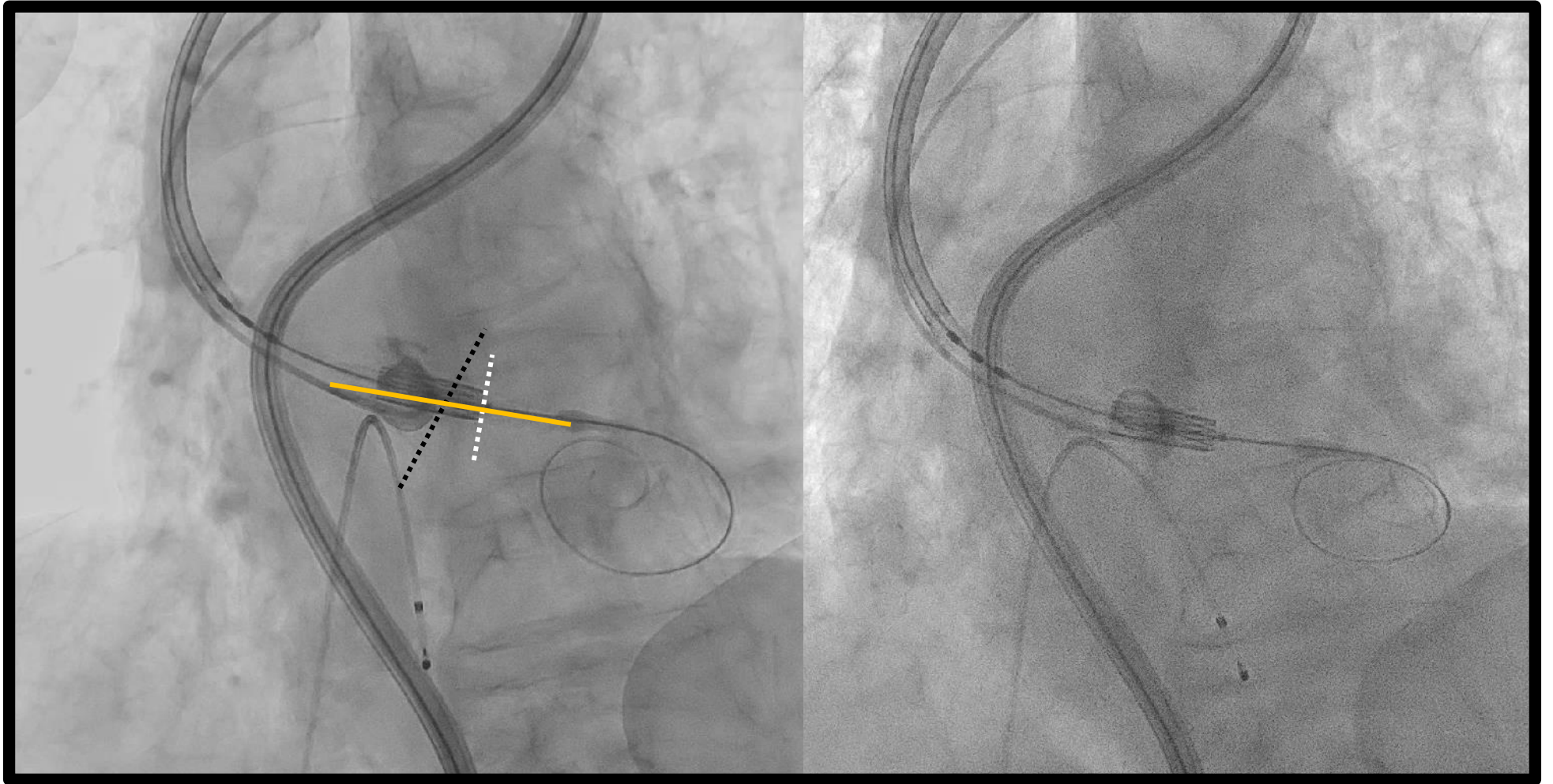
*Mark Russo, Paolo Tartara, 2014. CTSNet*

# TAVR

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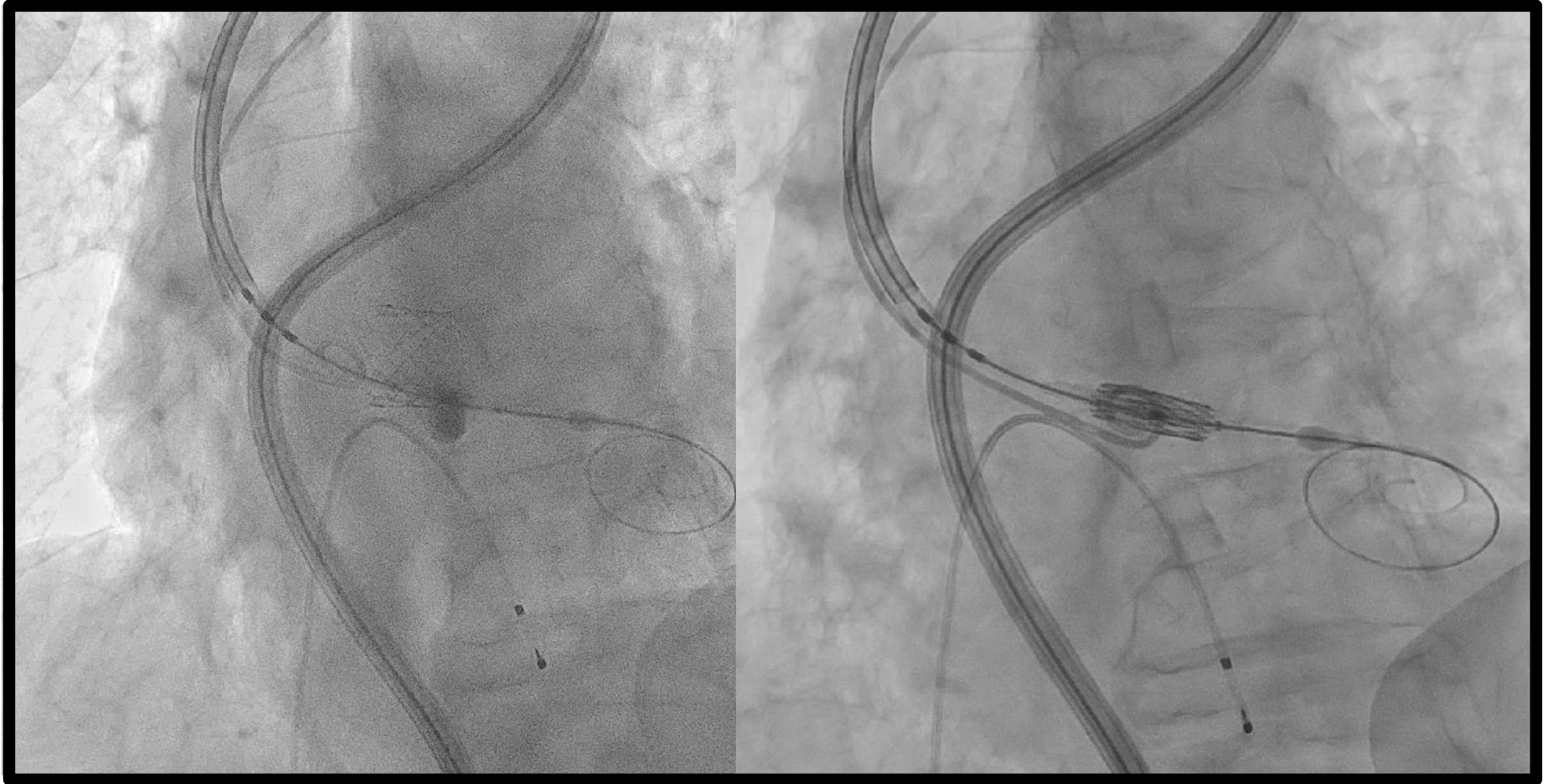


# TAVR



**SAPIEN 3 Ultra 20mm (Oversizing 7.3%, +1cc)**

# TAVR



**Valve embolization**

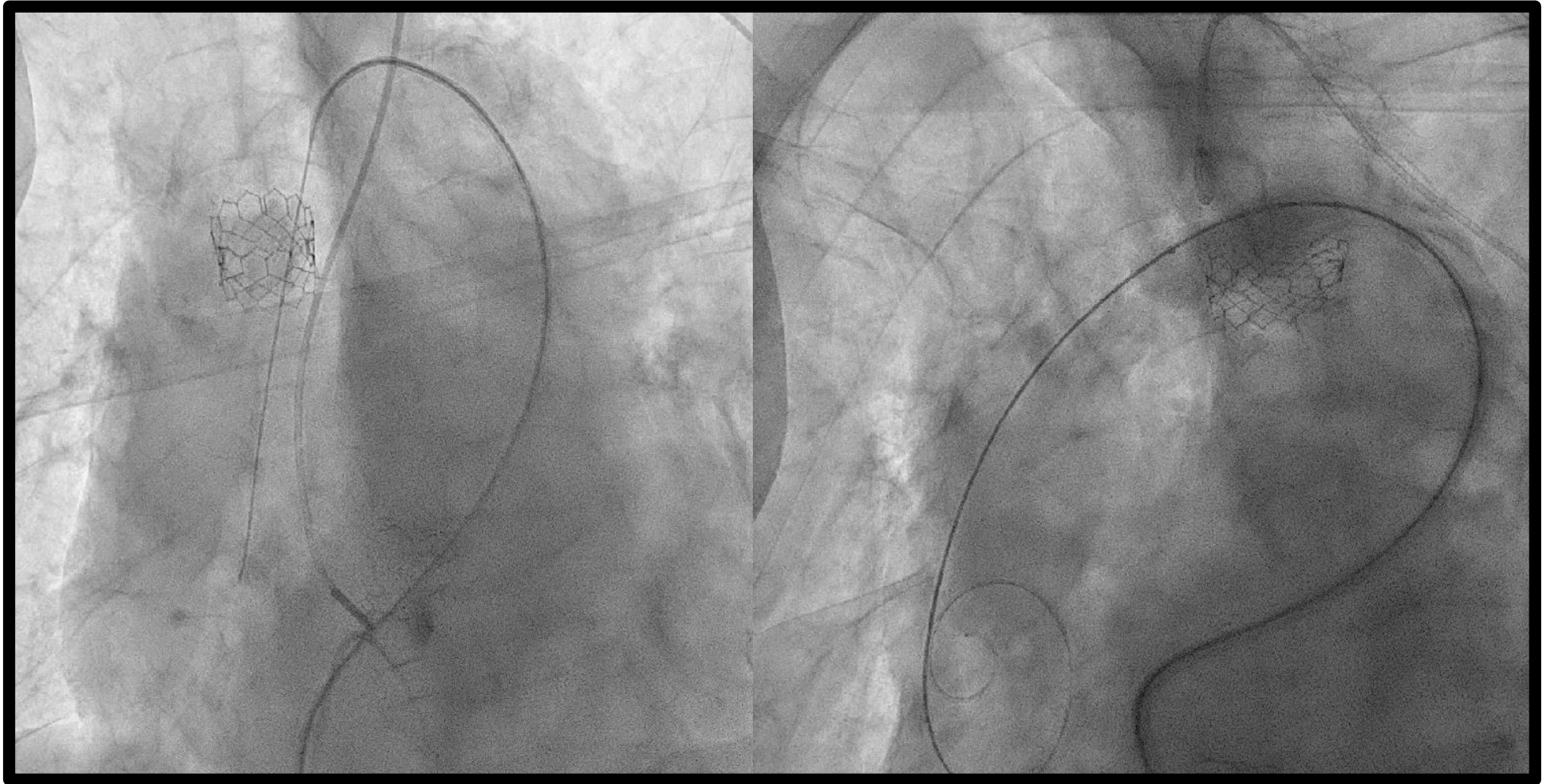
**2<sup>nd</sup> SAPIEN 3 Ultra 20mm  
(Oversizing 11.8%, +1.5cc)**

# TAVR



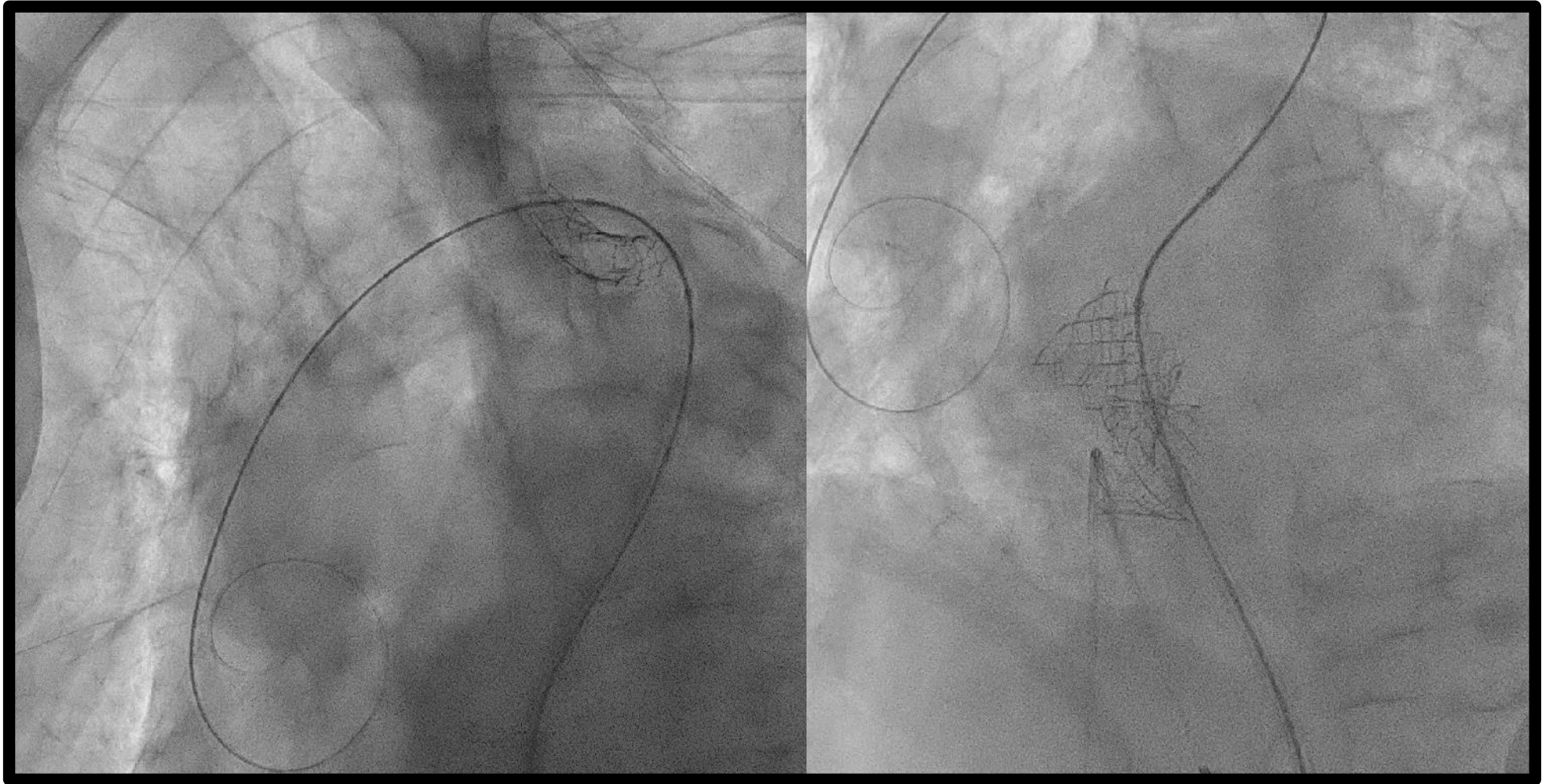


# TAVR



**Ballooning for embolized valve at aorta**

# TAVR



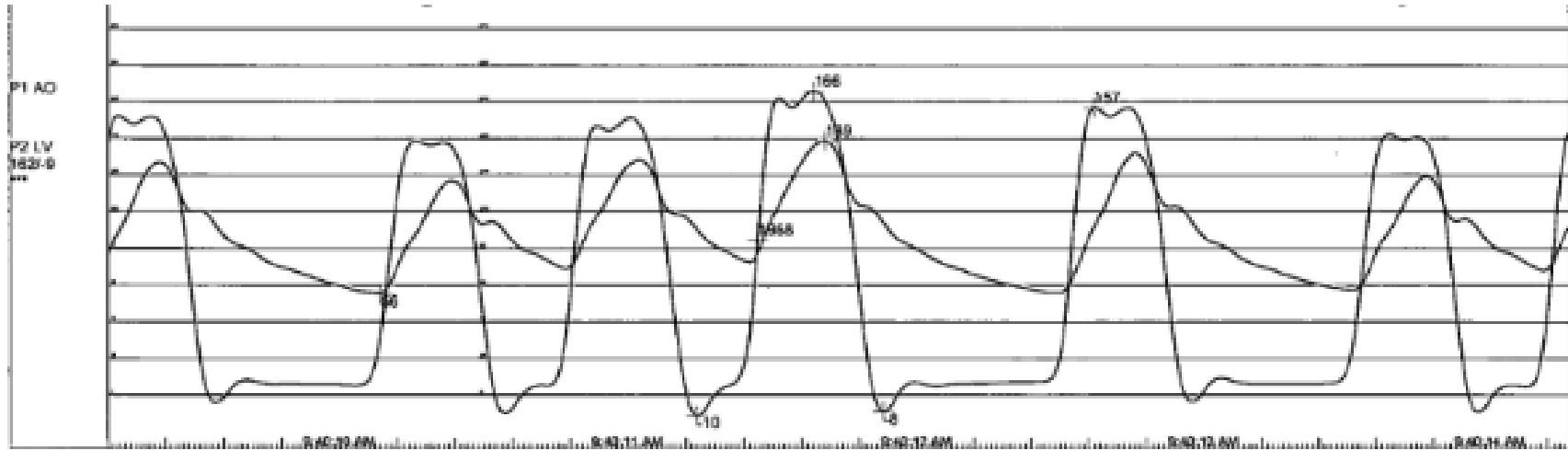
**Drag embolized valve to the lower abdominal aorta**

# TAVR

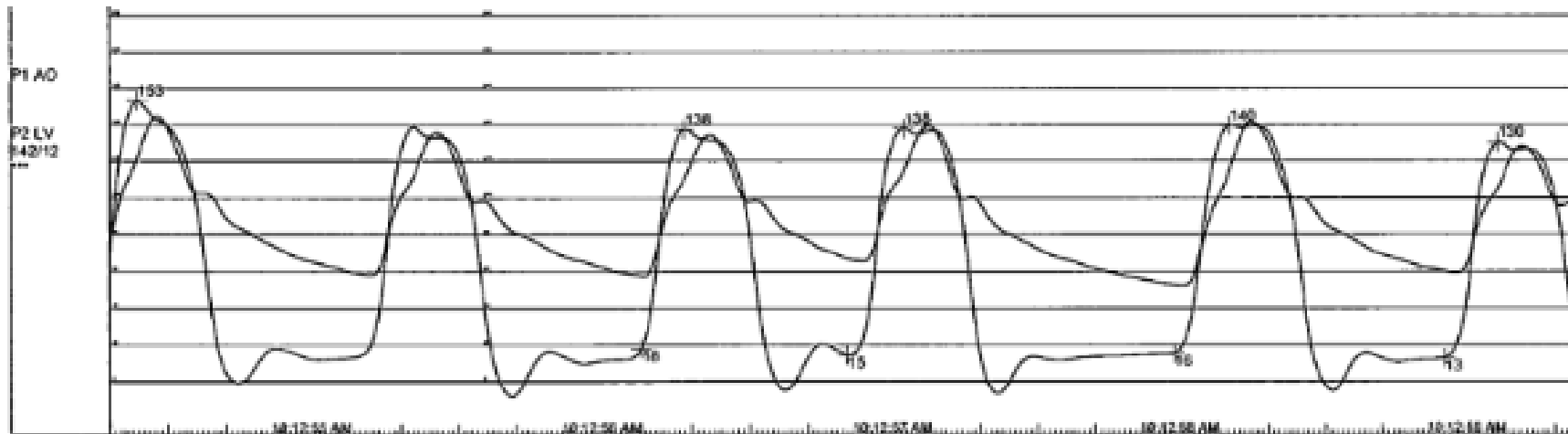


**Crushing embolized valve with snare**

# Peak to Peak Pressure Gradient

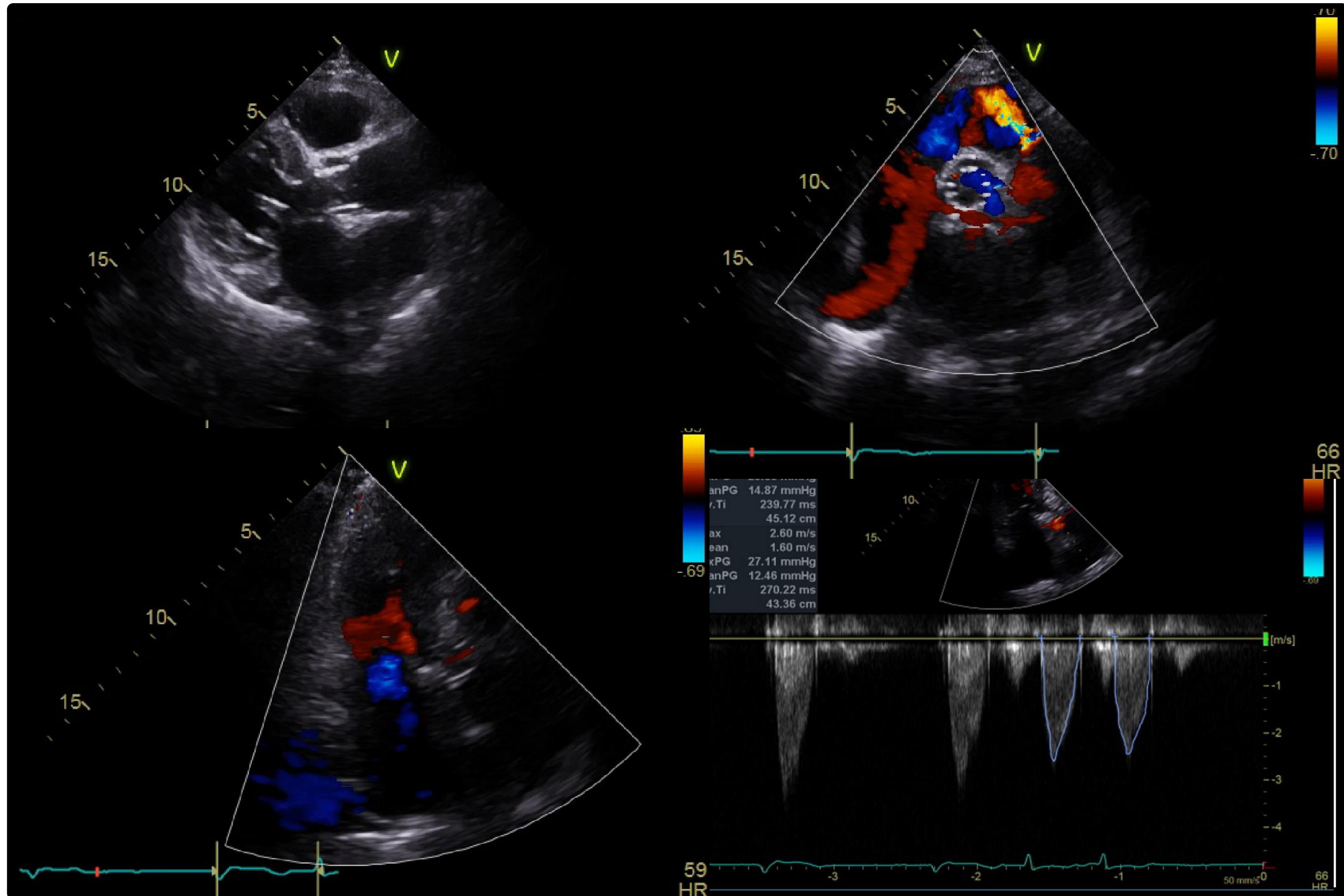


**Pre-TAVR**



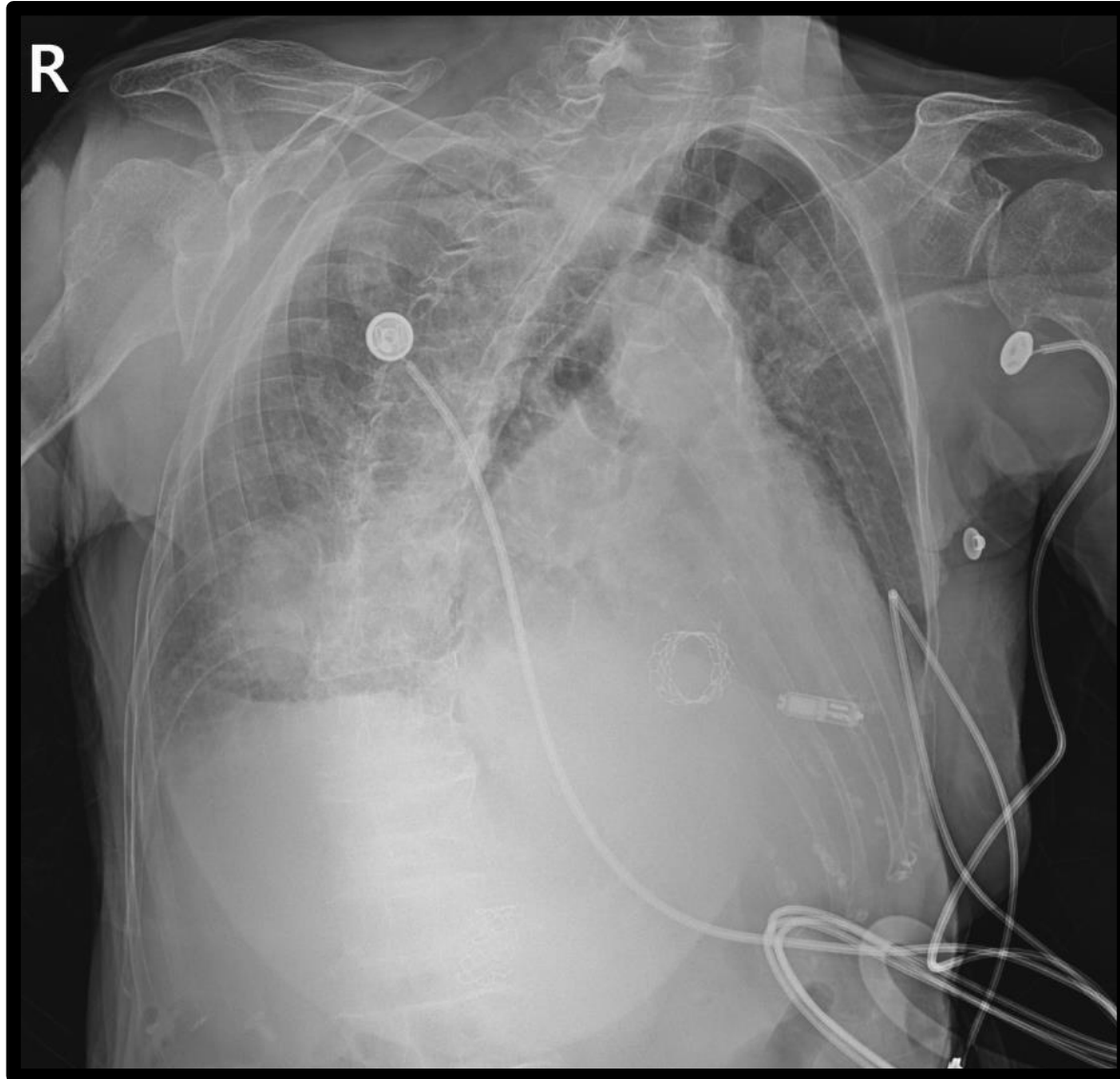
**Post-TAVR**

# Transthoracic echocardiography



s/p TAVI with mild paravalvular leakage  
(EOA = 1.01cm<sup>2</sup>, Peak Velocity = 2.52m/s, Mean PG = 13.7mmHg)

# Chest X-ray



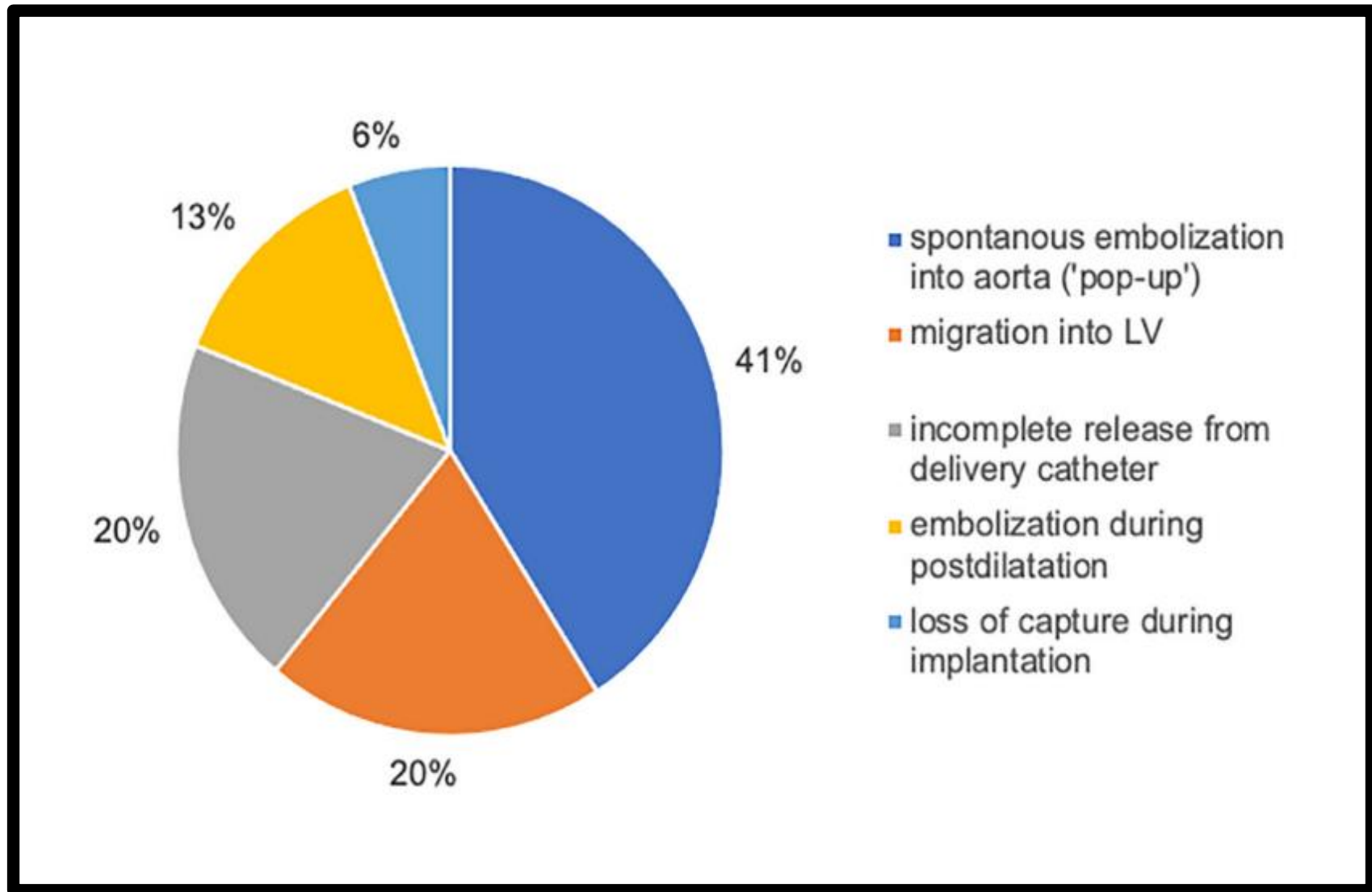
**Leadless Pacemaker Implantation**

# Incidence of THV Embolization

Study	Year(s)	Rate	References
Hamm et al	2011	0.5%	42
Gaede et al	2014–2016	0.2%	43
Ludman et al	2008–2015	0.2%–1.7%	44
Ludman et al	2016–2017	0.3%	45
Auffret et al	2010–2015	1.2%	46
Holmes et al	2012–2014	0.9%	47

**\*THV: transcatheter heart valve**

# Cause of THV Embolization





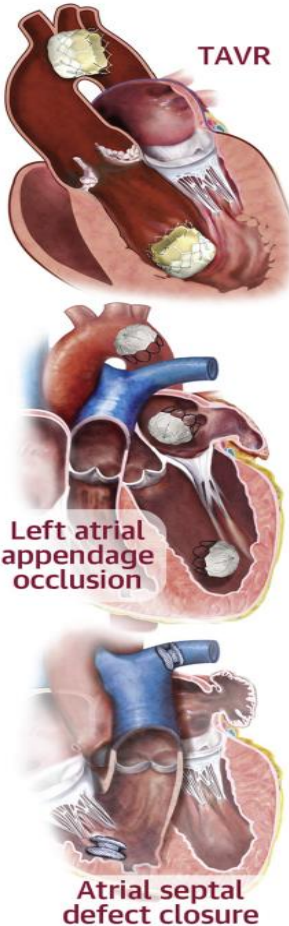

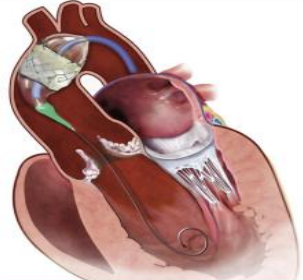

# Mechanisms of THV Embolization

	<b>TAVR</b>
<b>Anatomical Factors</b>	<ul style="list-style-type: none"><li>• Undersized prosthesis</li><li>• Bulky calcified leaflet</li><li>• Paucity of annular calcifications</li><li>• Horizontal annuli</li><li>• Mitral prosthesis struts displacing the THV balloon</li></ul>
<b>Procedural Factors</b>	<ul style="list-style-type: none"><li>• Poor coplanar angle</li><li>• Malpositioning</li><li>• Incomplete balloon inflation</li><li>• Pacing failure (no or intermittent capture)</li><li>• Premature pacing termination</li><li>• Post-dilatation</li><li>• 2<sup>nd</sup> valve implantation attempt</li><li>• Stored wire tension</li><li>• Failure to retract the THV pusher</li><li>• Resuscitation</li></ul>
<b>Device-Related Factors</b>	<ul style="list-style-type: none"><li>• Failure of tabs' detachment (self-expandable THV)</li><li>• THV loader defect</li></ul>
<b>Best Practice for Prevention</b>	<ul style="list-style-type: none"><li>• CTA for THV sizing</li><li>• Pacemaker testing before THV deployment</li><li>• Optimal balloon/THV alignment</li><li>• Aortic root angiogram during deployment</li><li>• Adequate balloon inflation</li><li>• Adequate pacing duration</li></ul>

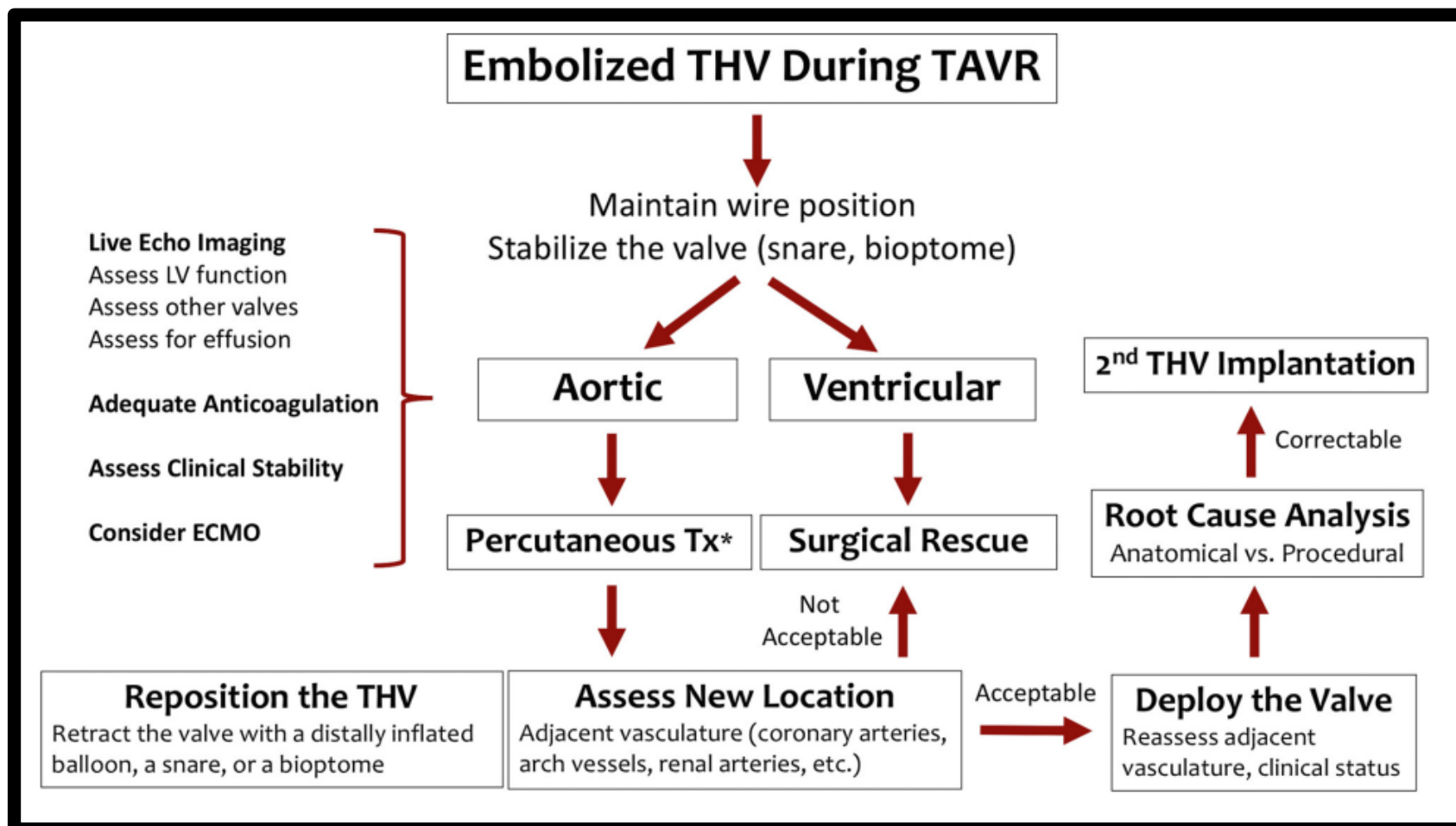
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	TAVR
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# Mechanisms of THV Embolization

Underlying Mechanism	Embolization Patterns	Management
<ul style="list-style-type: none"> <li>• Inaccurate Sizing</li> <li>• Challenging Anatomy</li> <li>• Malpositioning</li> <li>• Suboptimal Anchor</li> <li>• Stored Wire/ Cable Tension</li> <li>• Pacing Failure</li> <li>• Post-Release Manipulation</li> <li>• Device Malfunction</li> </ul>	 <p>TAVR</p> <p>Left atrial appendage occlusion</p> <p>Atrial septal defect closure</p>	<ul style="list-style-type: none"> <li>• Maintain wire position</li> <li>• Stabilize (consider intubation, ECMO, etc.)</li> <li>• Device and location specific strategy</li> </ul>  <p>Percutaneous Retrieval</p>  <p>Heterotopic Implantation</p>  <p>Surgical Retrieval</p>

# Management of Embolized THV

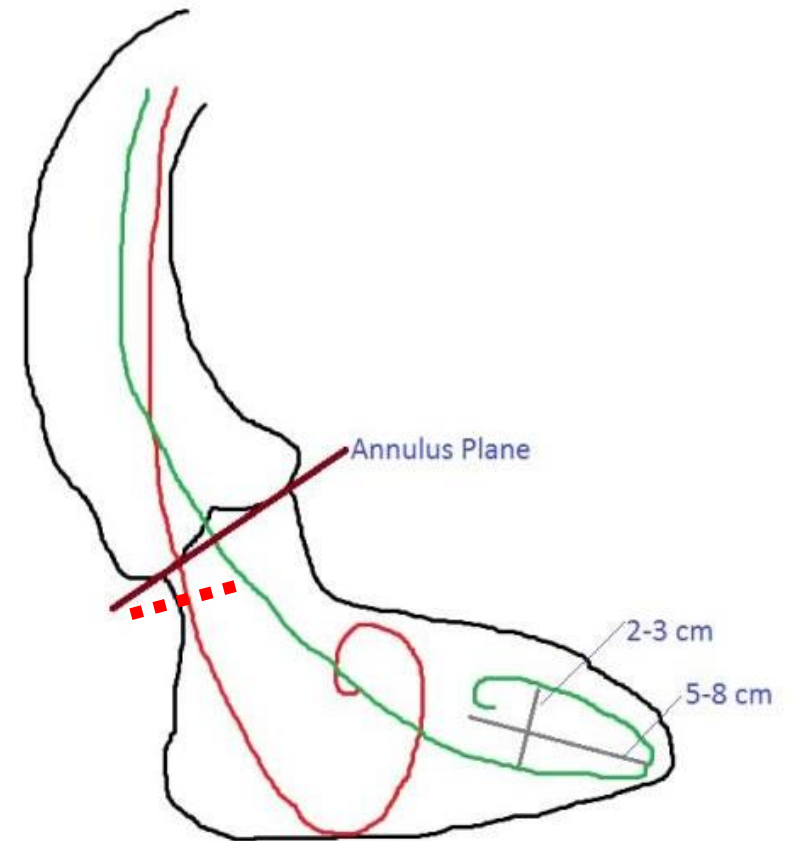
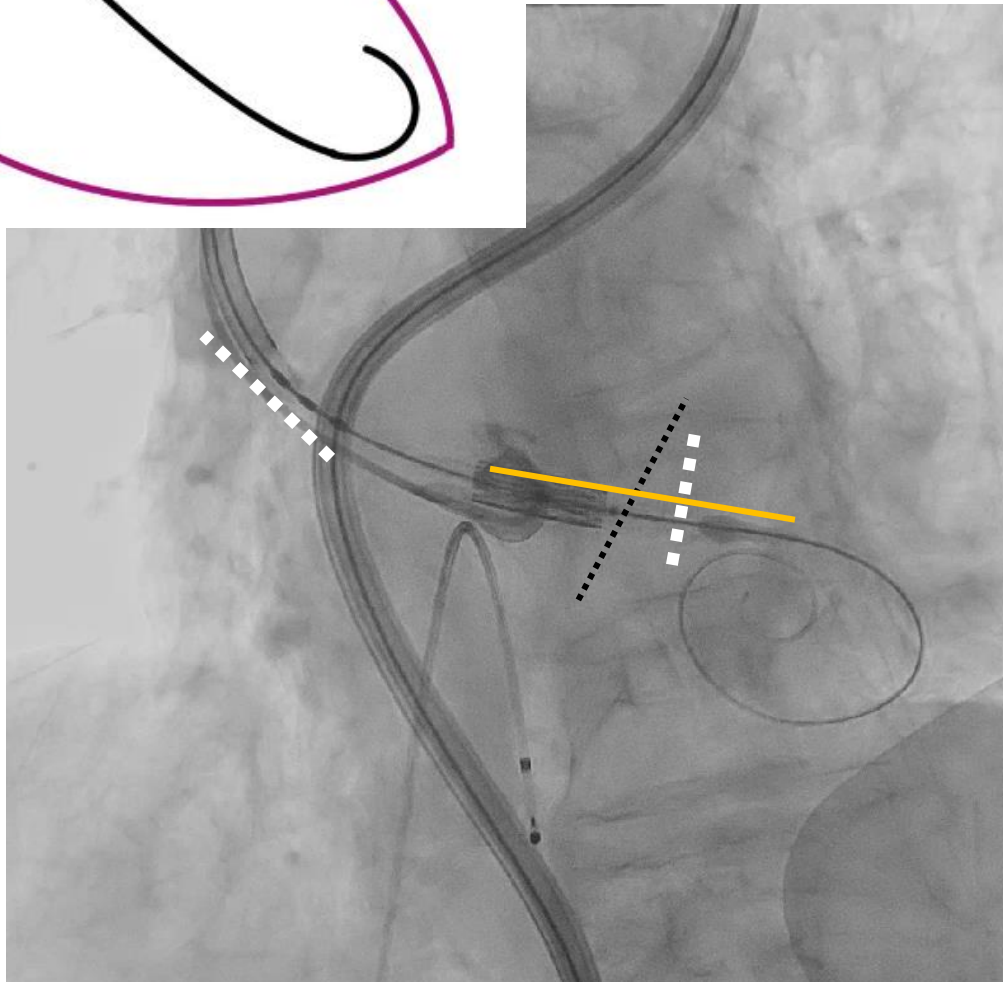
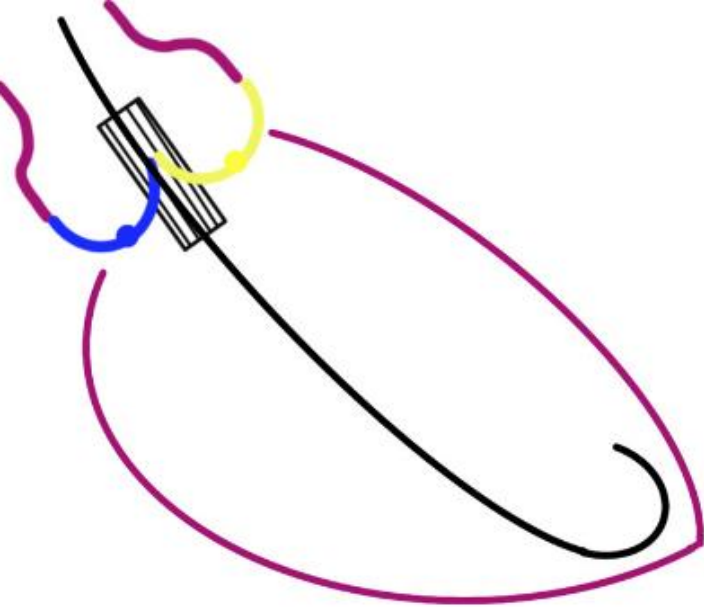


Algorithmic approach for the management of embolized balloon-expandable THV

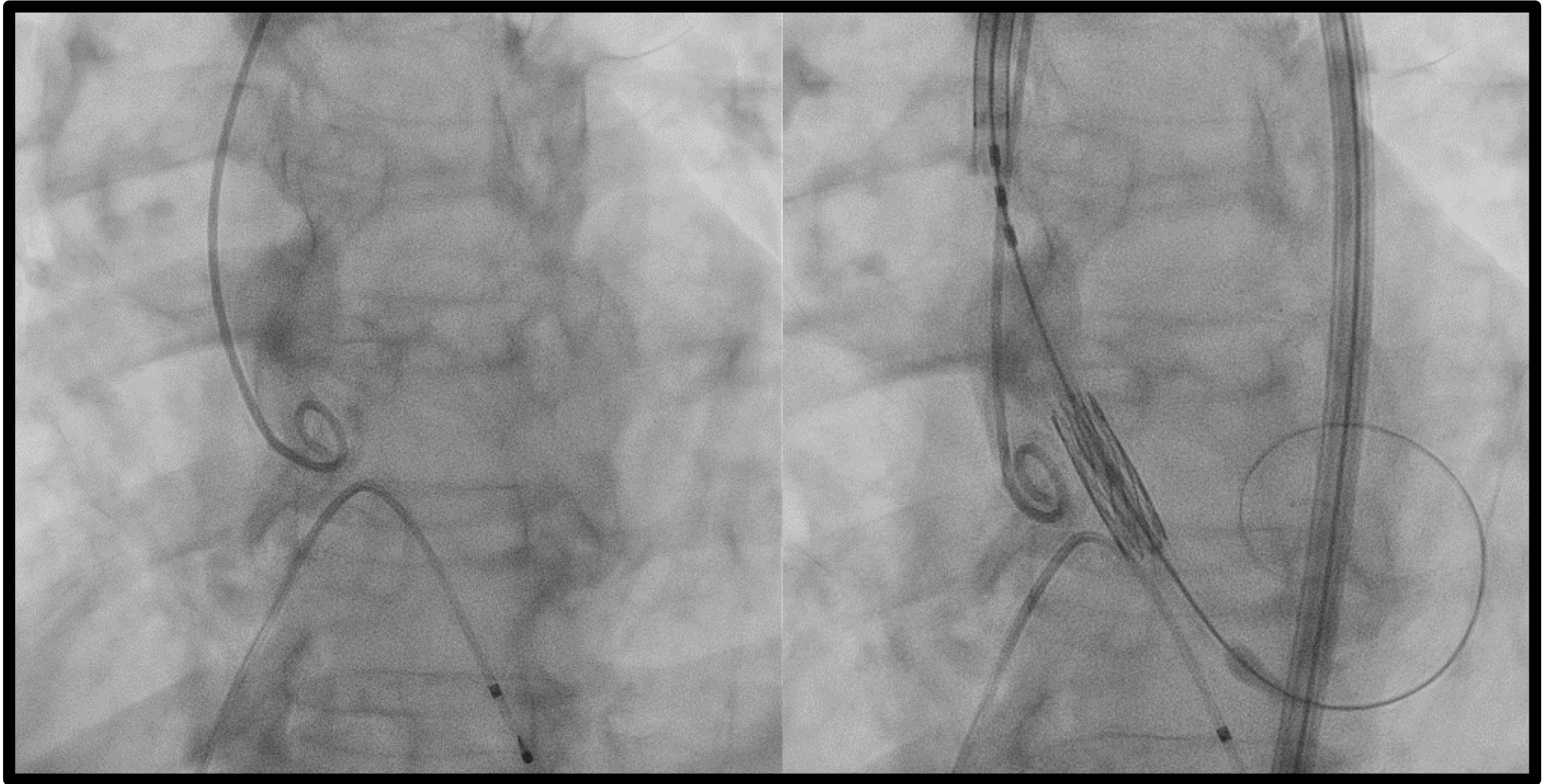
*J Am Coll Cardiol Interv* 2019;12:113-26

# TAVR

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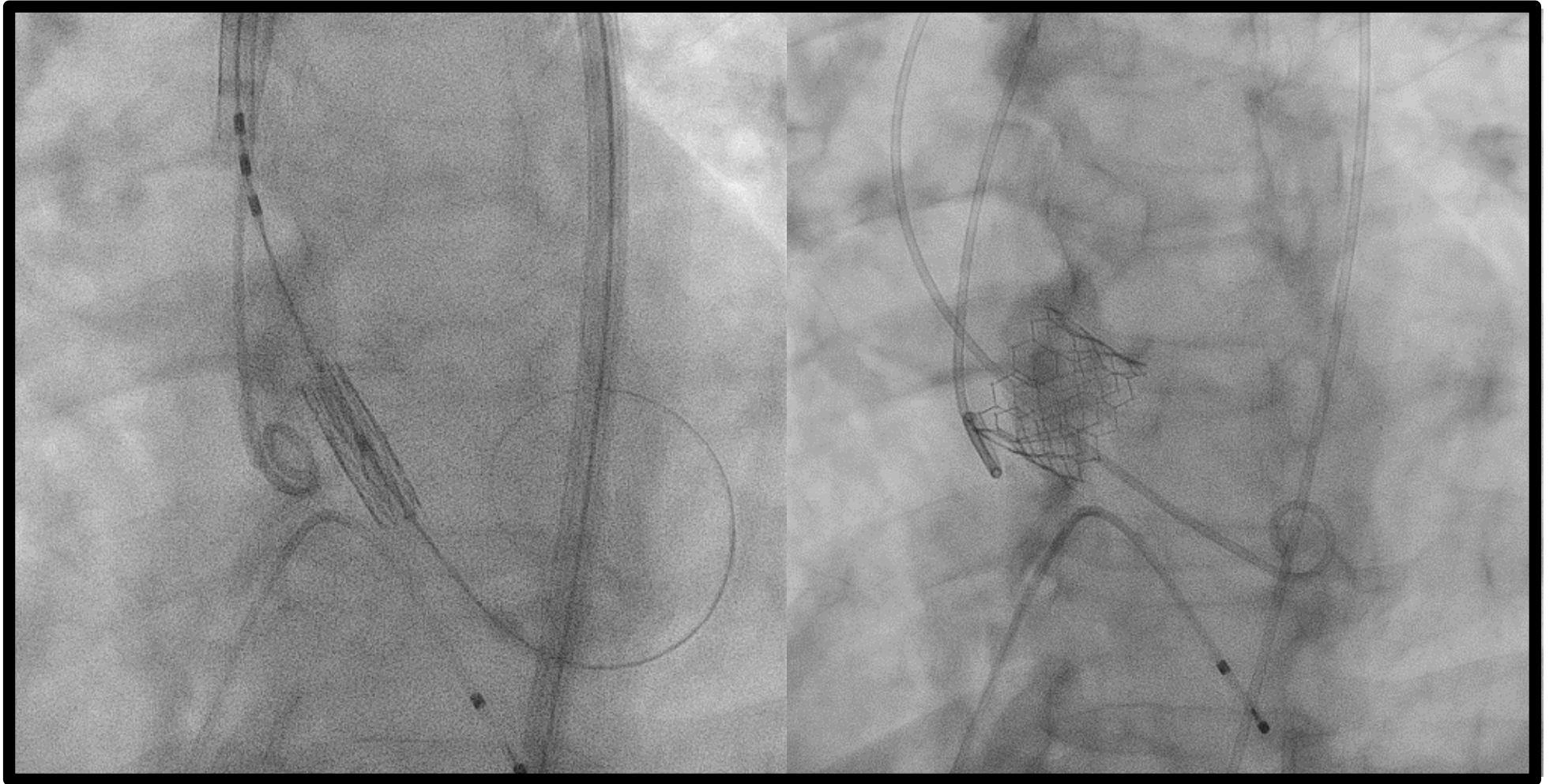


# TAVR



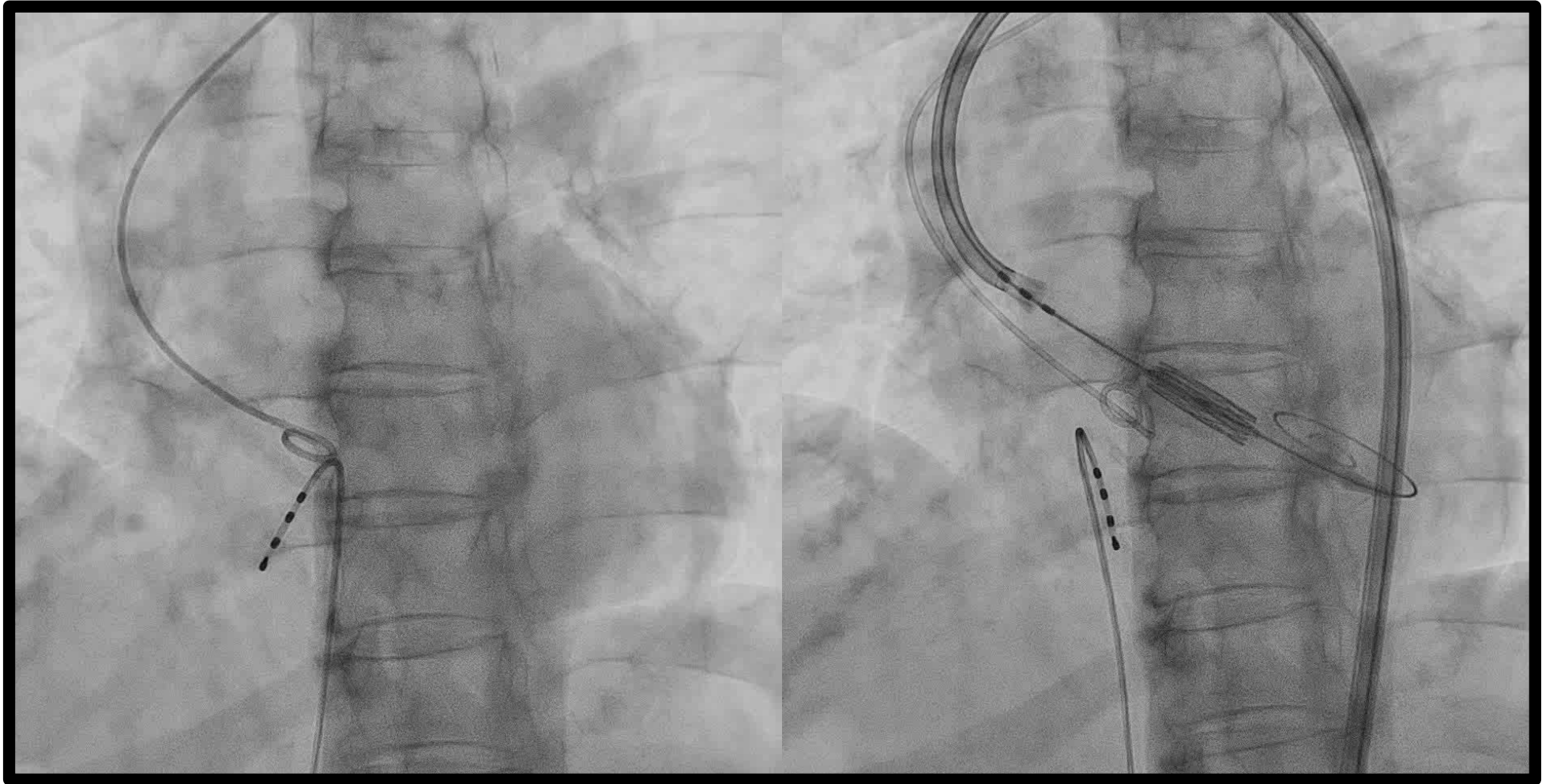
**SAPIEN 3 Ultra 23mm (Oversizing 5.5%)**

# TAVR



**THV pop-up into ascending aorta during implantation**

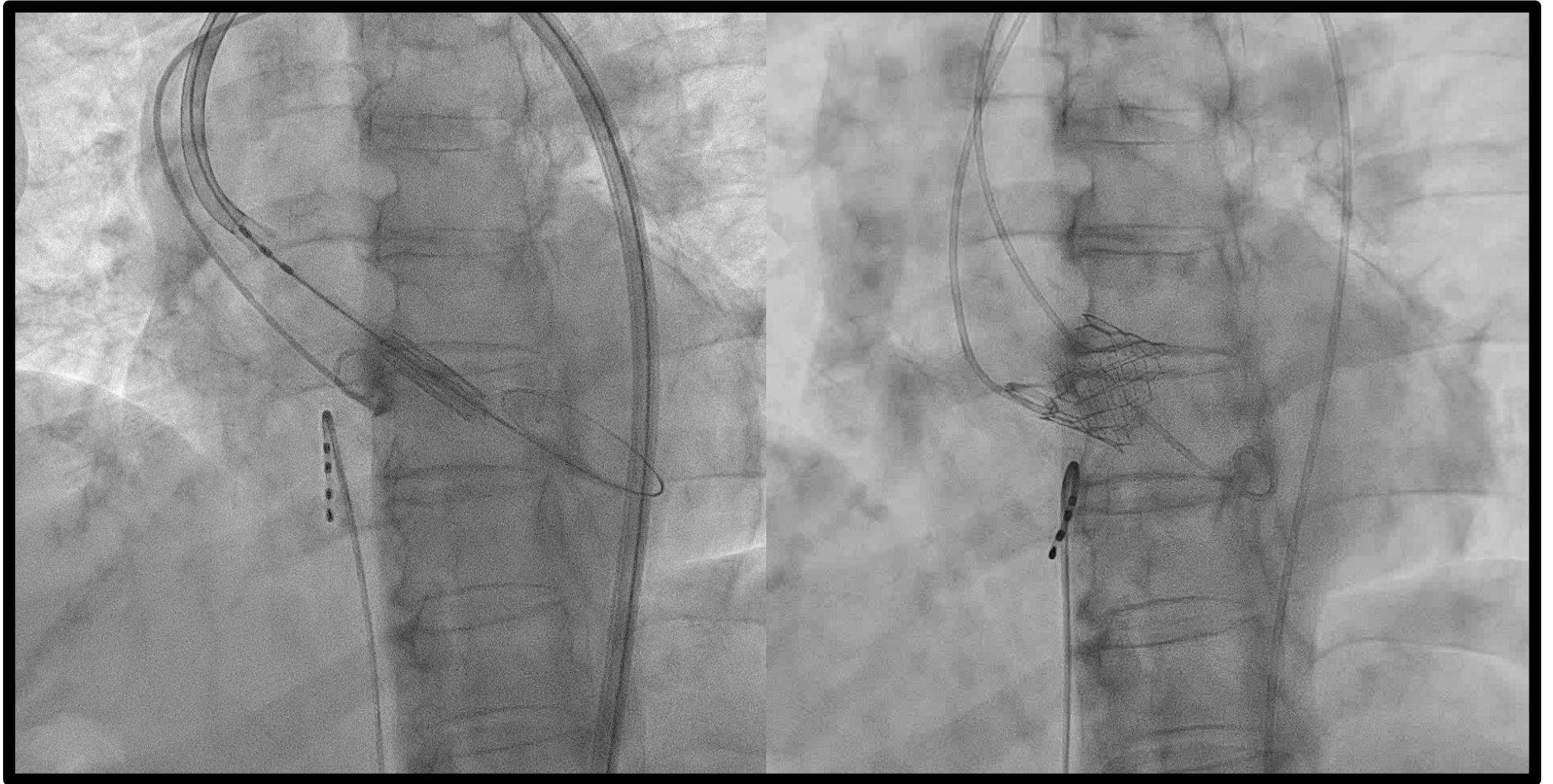
# TAVR



**SAPIEN 3 Ultra 23mm (Oversizing 9.0%)**

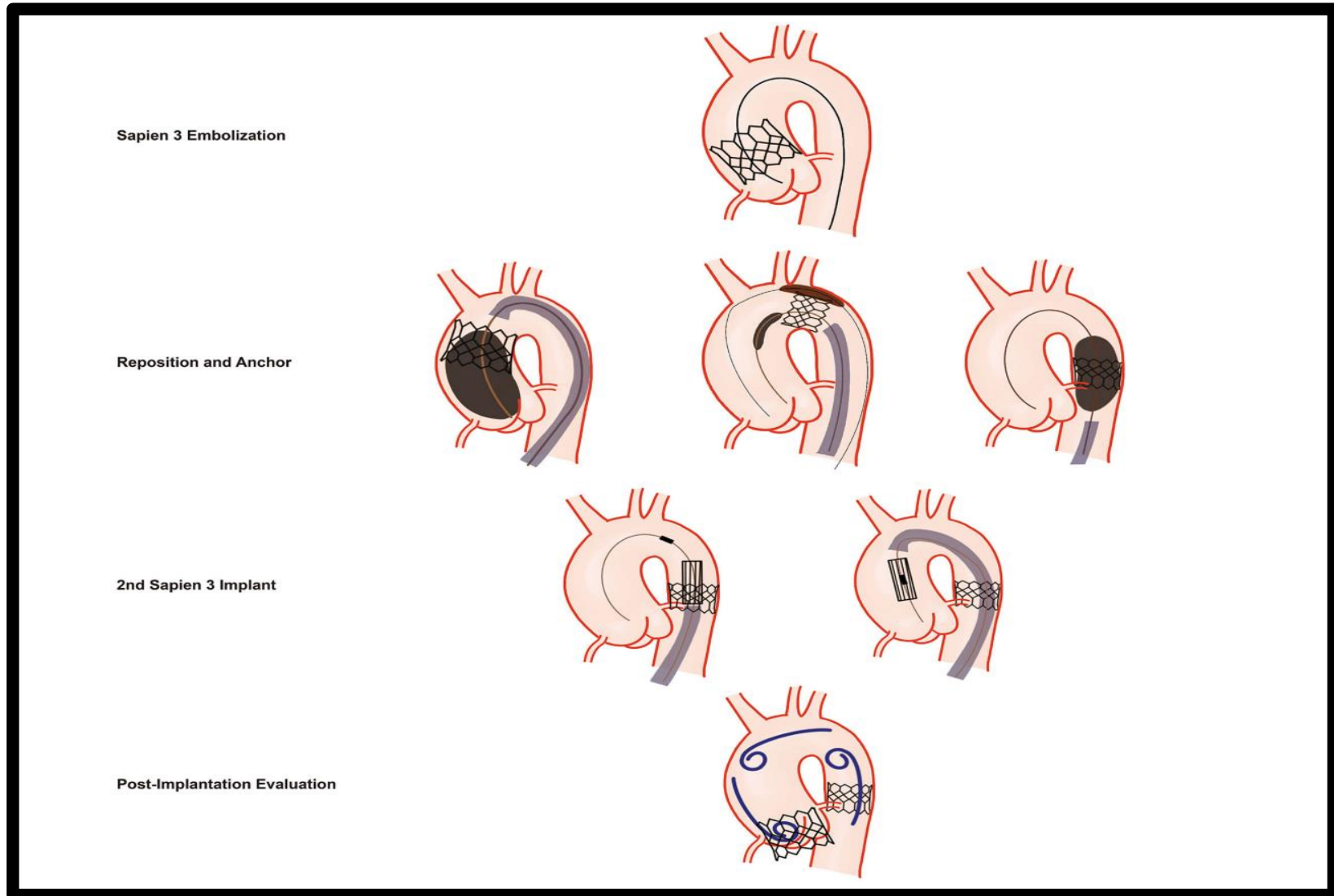


# TAVR

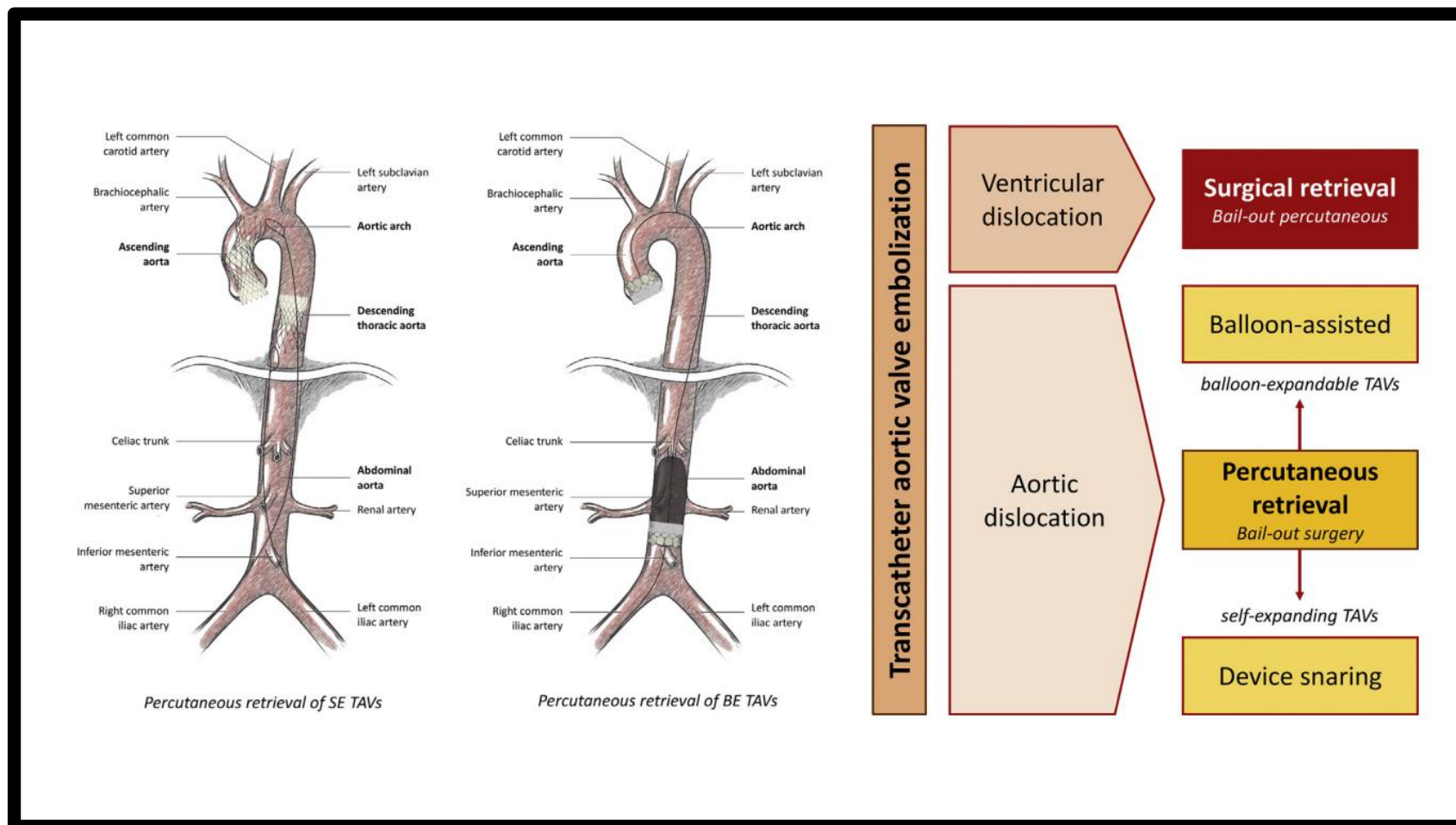


**THV pop-up into ascending aorta during implantation**

# Management of Embolized THV



# Management of Embolized THV



A fully percutaneous approach performed at experienced centers is feasible and safe, and is associated with favorable results

JACC Case Resp. 2021;3:636-638

**Thank you for your attention**