4th COMPLEX PCI
Make It Simple!
Technical Forum: A to Z

III. Nightmare Complications - How to Survive?

Saving Coronary Artery:

TAVR-related Coronary Obstruction

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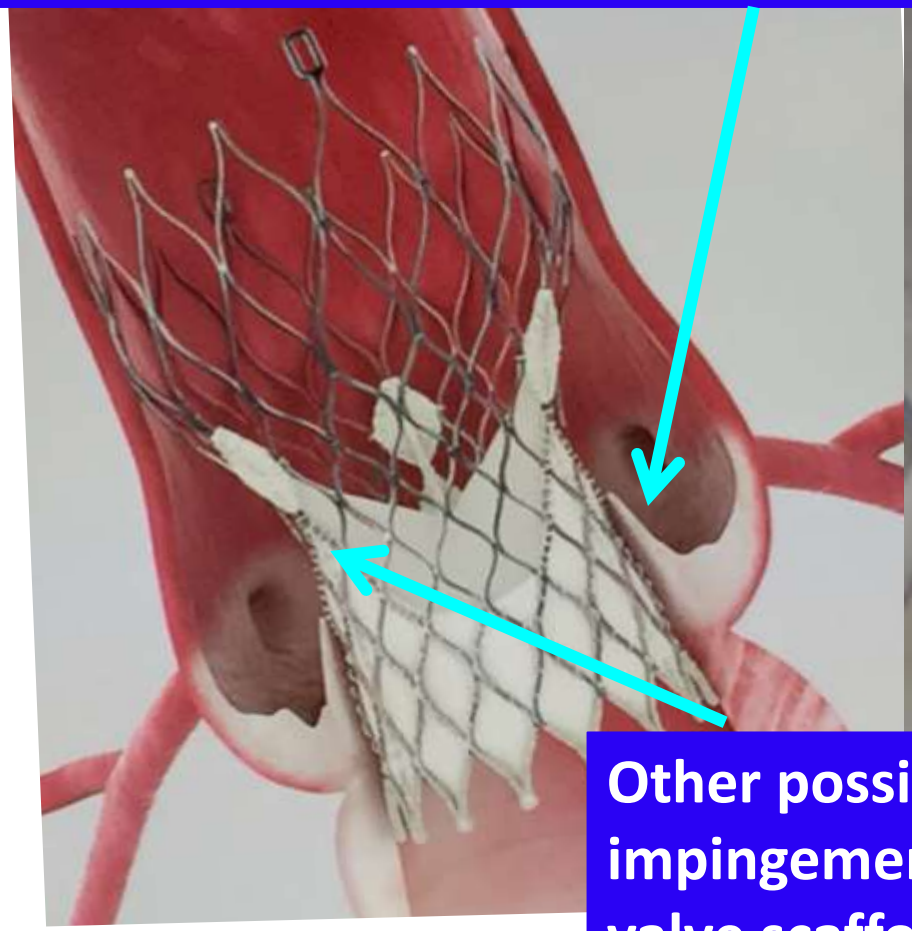
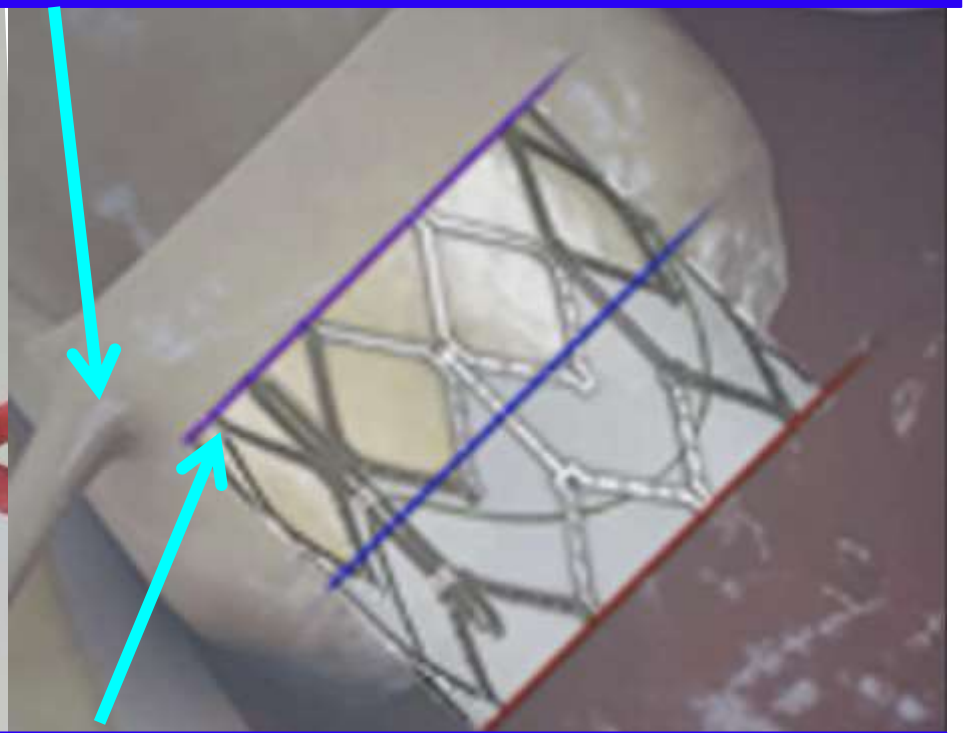
CHGH

Acute coronary obstruction TAVR – a well-known and feared complication

Displacement of the native calcified valve leaflet over the coronary ostium or by clot forming in the sinus of Valsalva (most common).

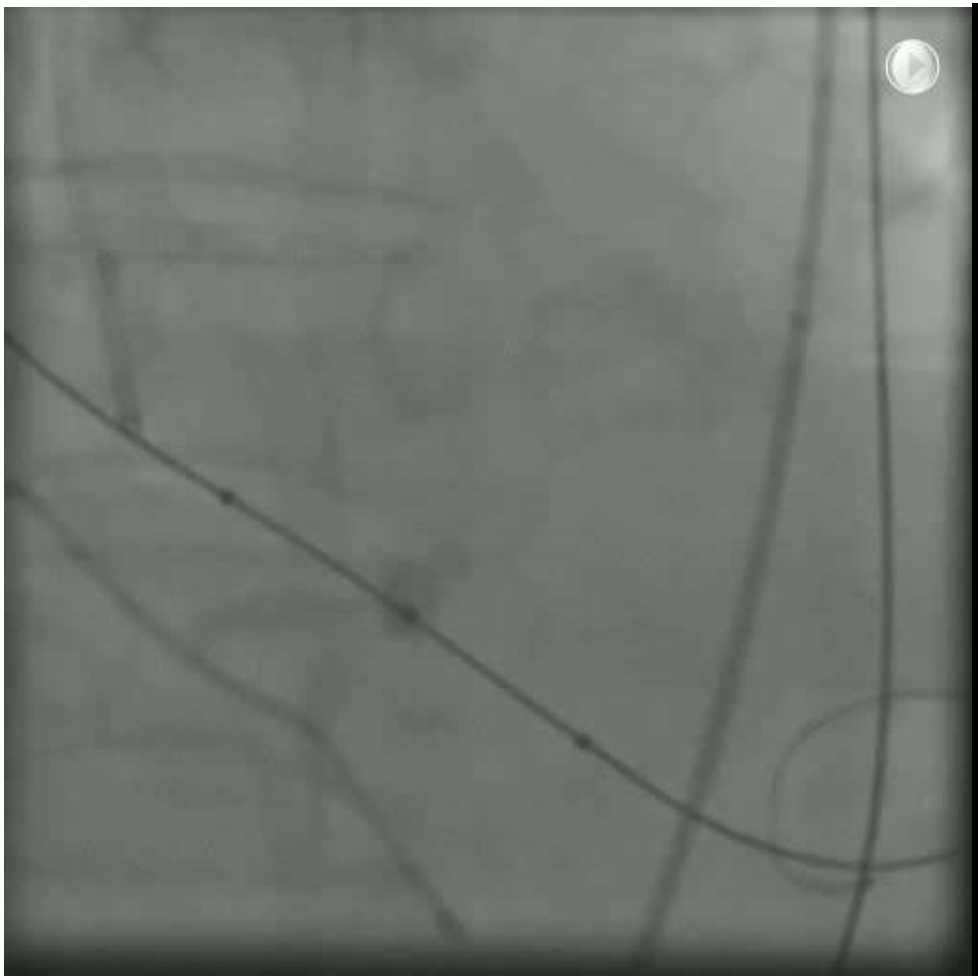




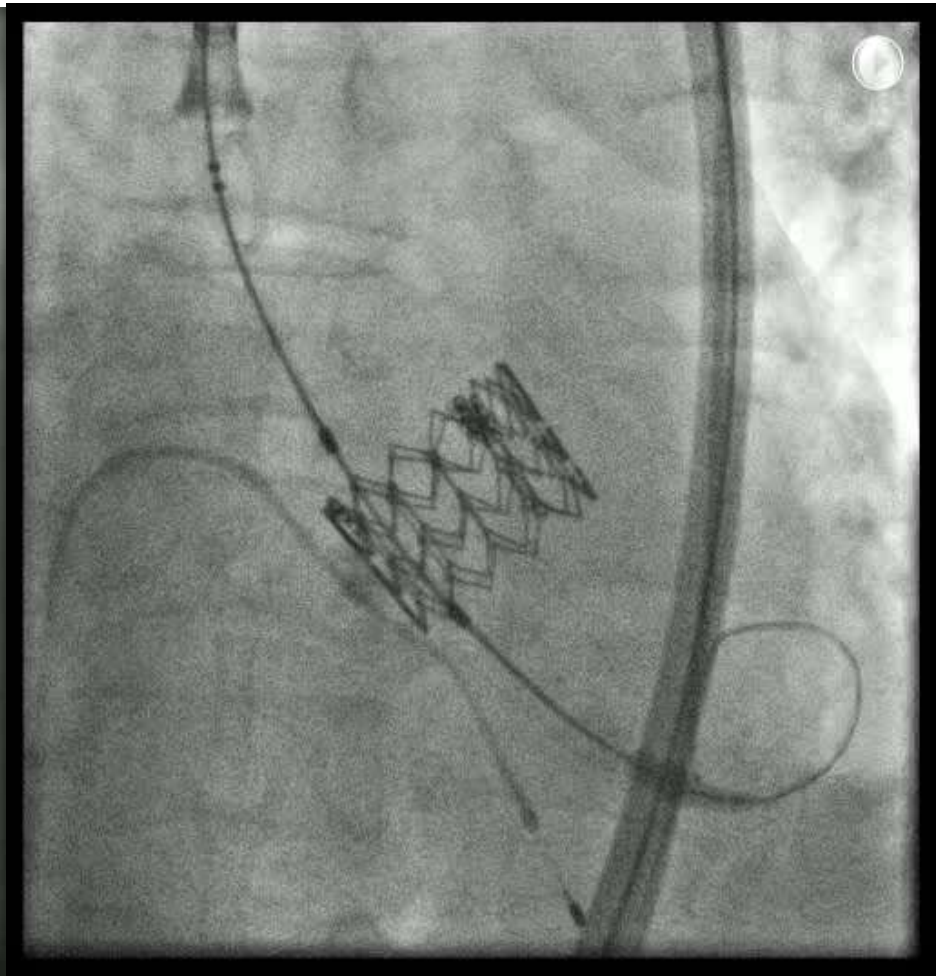
Other possible mechanisms include impingement of the coronary ostium by the valve scaffold, commissural post, or leaflets.

Acute coronary obstruction TAVR – a well-known and feared complication

Balloon occlusion test



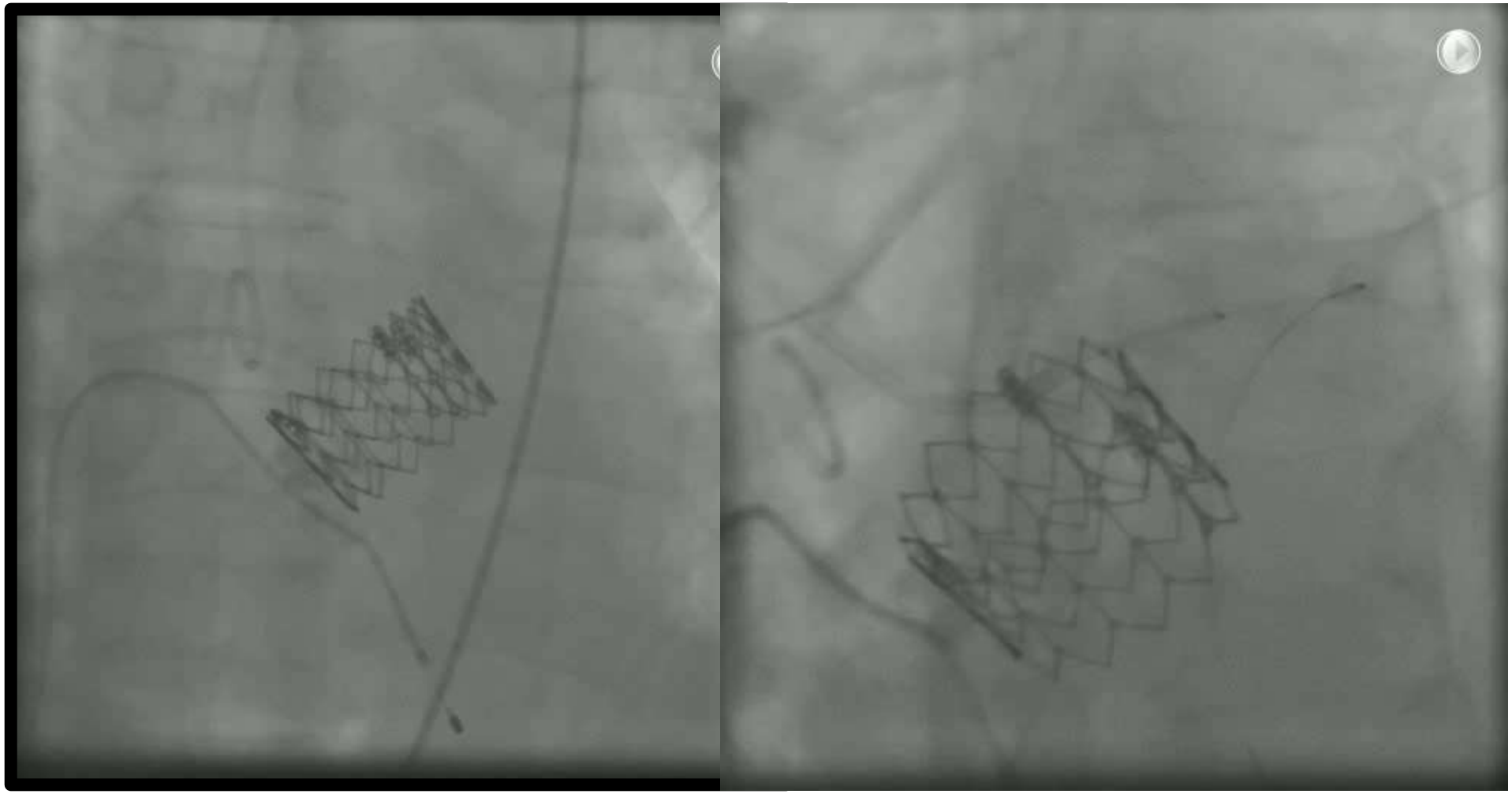
Post-dilatation



Acute coronary obstruction TAVR – a well-known and feared complication

Coronary occlusion

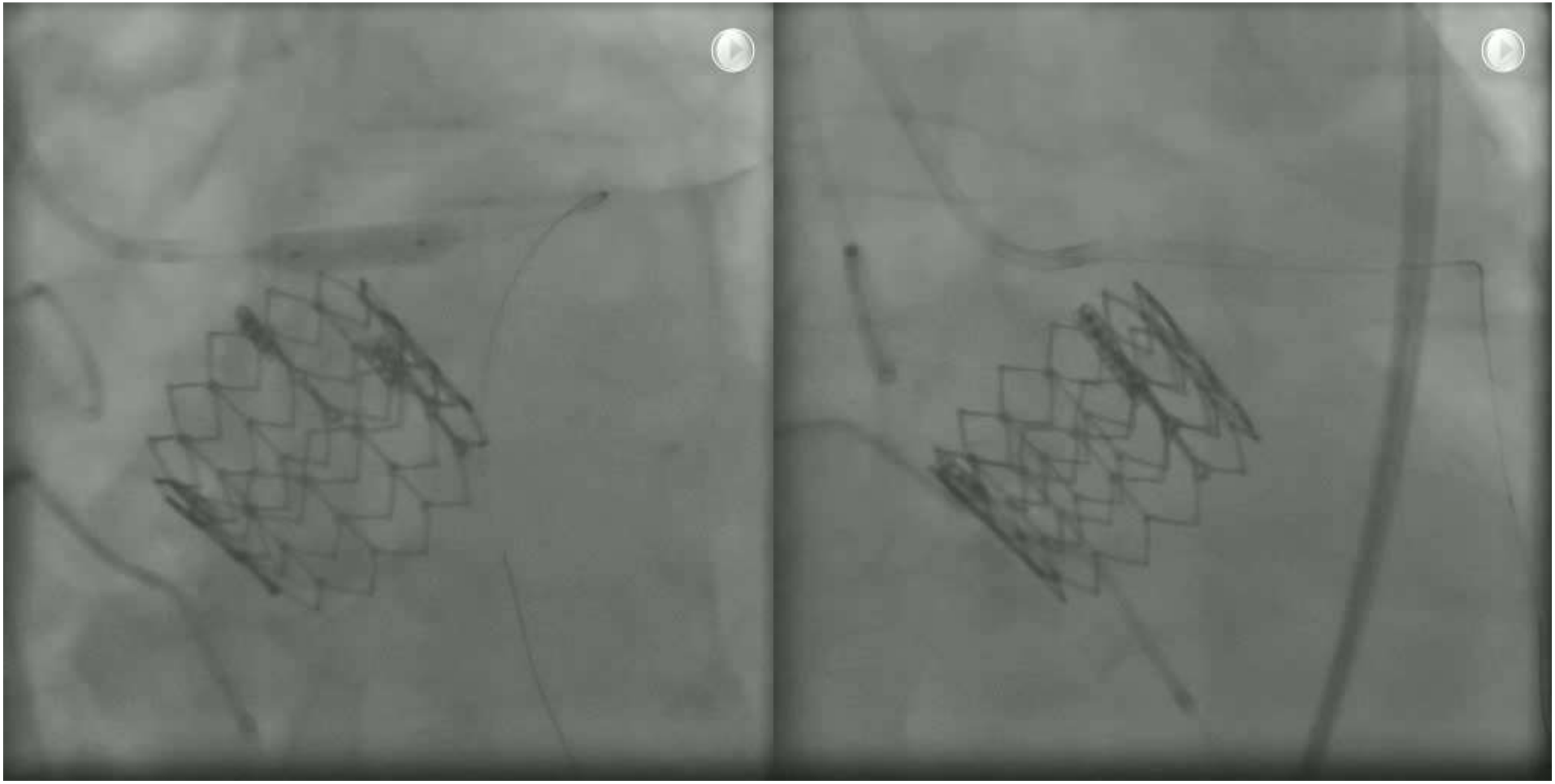
Left main stenting



Acute coronary obstruction TAVR – a well-known and feared complication

Left main stenting

Final angiogram



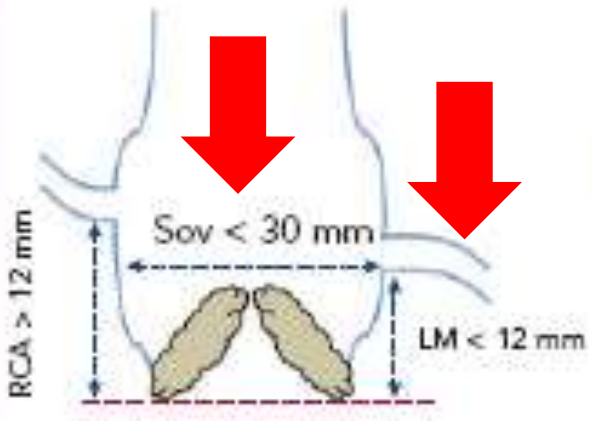
ANATOMICAL RISK FACTORS ON CT

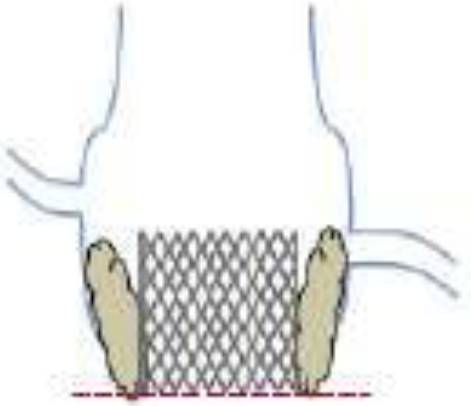
- Coronary height ≦ 10mm
- Sinus of Valsalva < 30mm
- Narrow Sino-tubular junction
- Aortic Valve-in-valve

D

Shallow sinuses of Valsalva

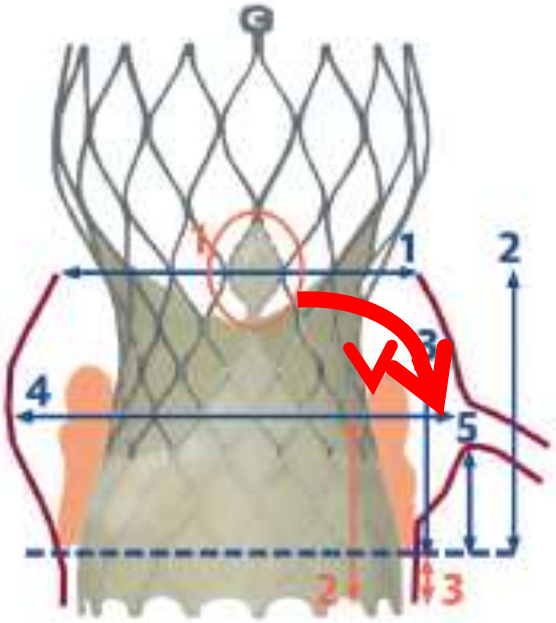
Low coronary ostium height





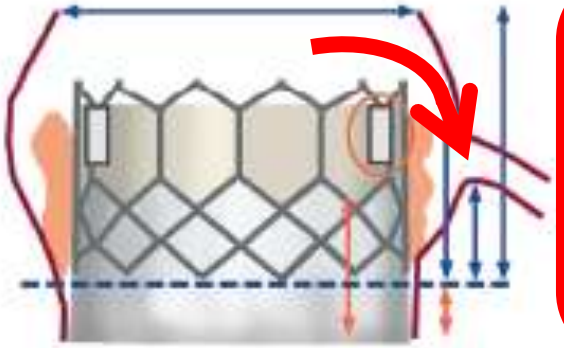
Factors Impacting Coronary Access

Imaging Evaluation



Anatomical

1. Sinotubular junction dimensions
2. Sinus height
3. Leaflet length and bulkiness
4. Sinus of Valsalva width
5. Coronary height

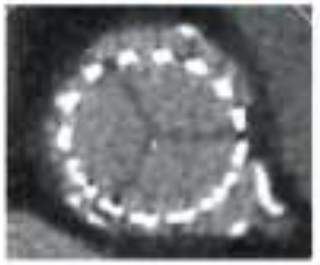


Device and Procedural

1. Commissural tab orientation
2. Sealing skirt height
3. Valve implant depth

Fluoroscopy

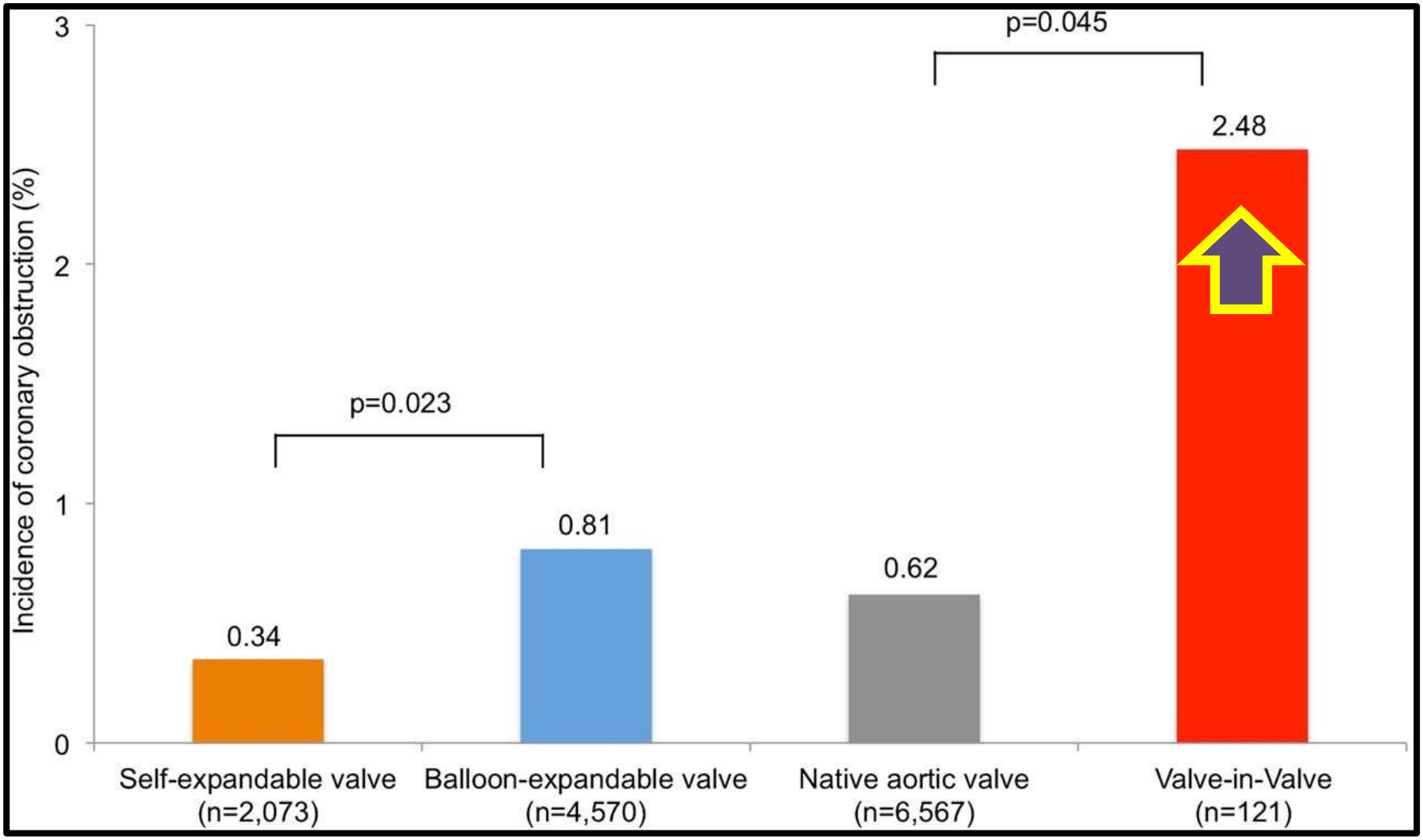
MDCT



Yudi, M.B. et al. J Am Coll Cardiol. 2018;71(12):1360-78.

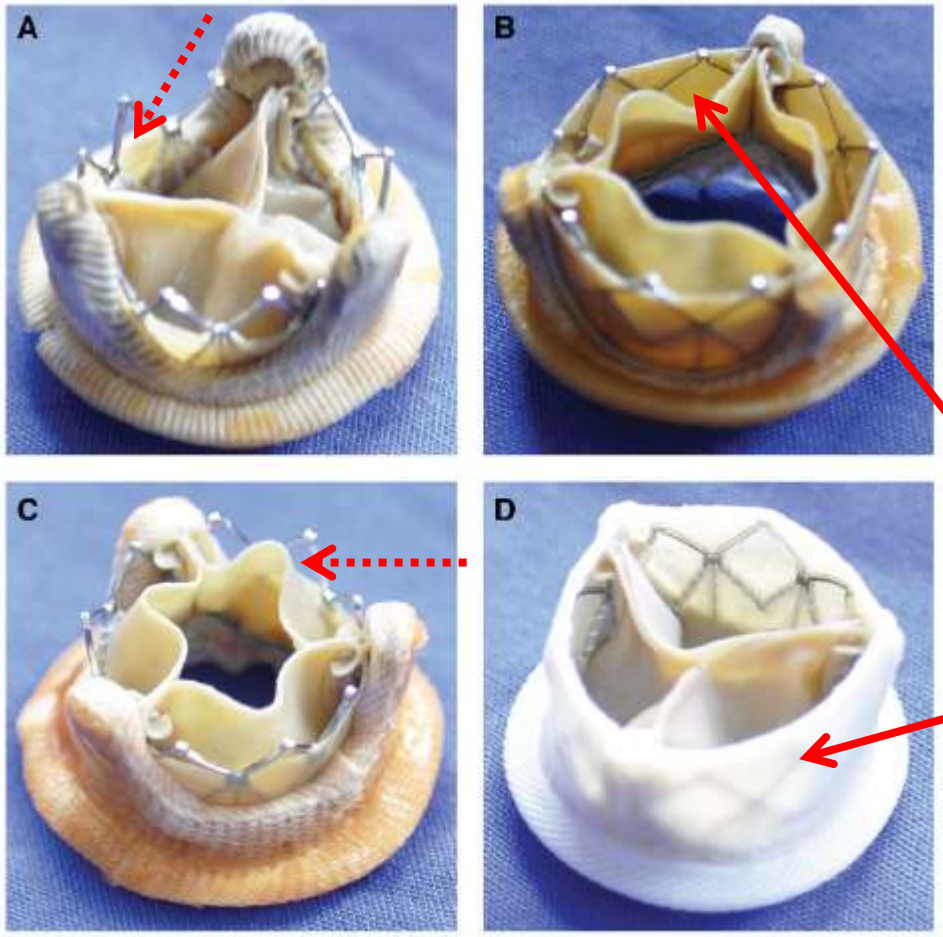
Higher implant will be problematic in pats w/ low coronary take-off !

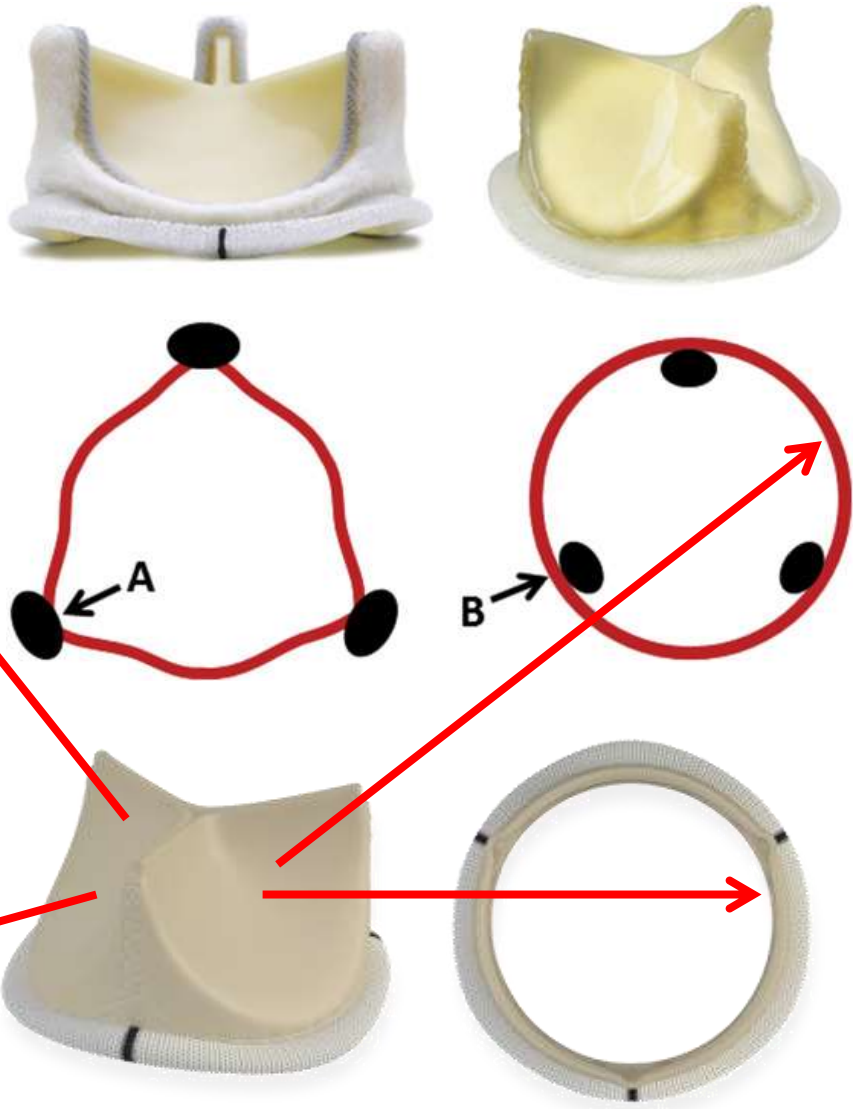
Transcatheter Aortic Valve-in-Valve Implantation for Patients With Degenerative Surgical Bioprosthetic Valves



Externally mounted bioprosthesis carries a even higher risk of CO and DCO.

The St. Jude Medical Trifecta 23mm has bovine pericardial leaflets that are mounted externally to the stent frame and carries a higher risk of CO.

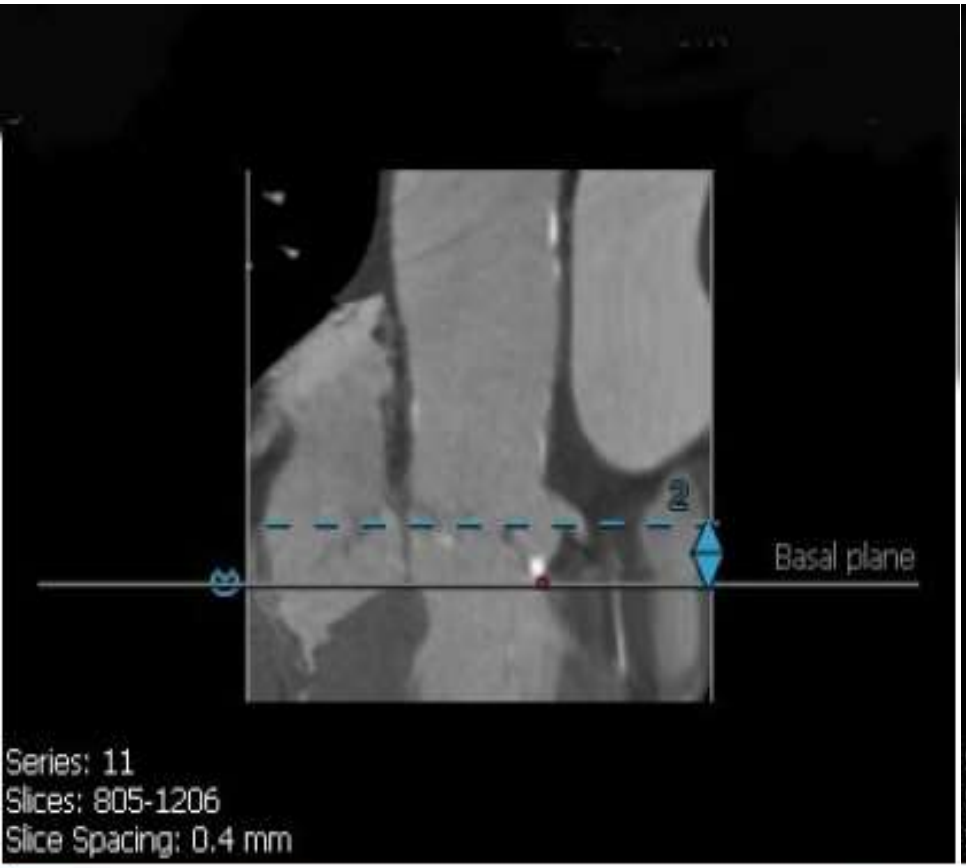


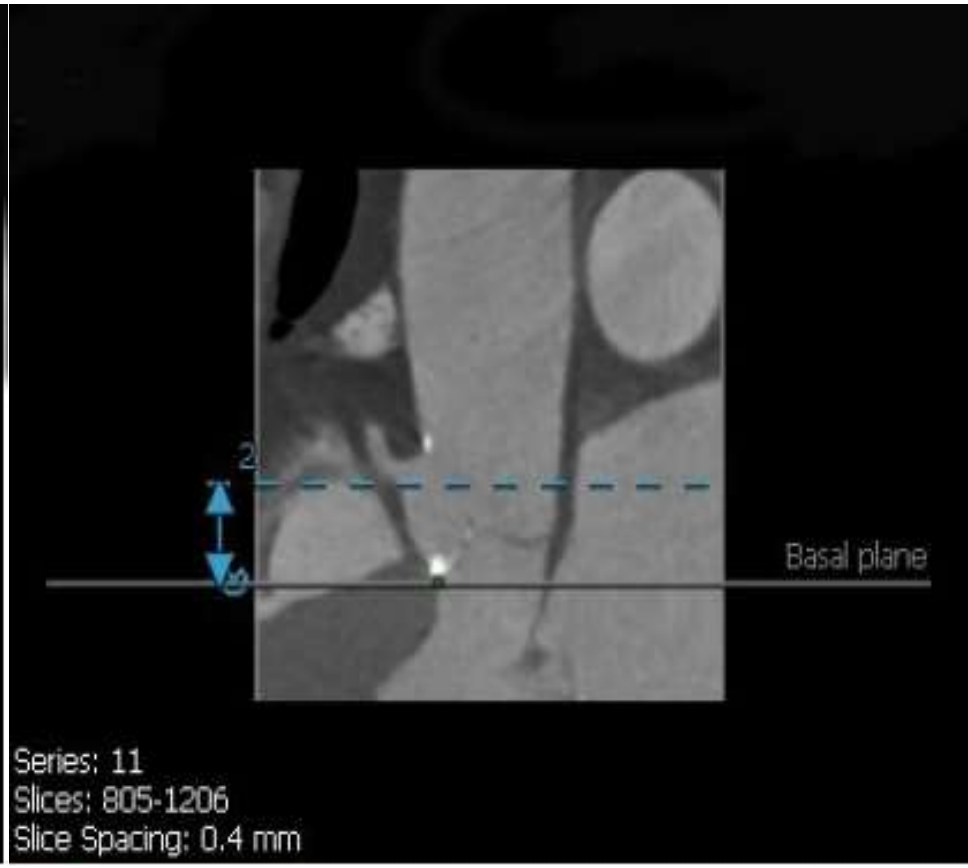


HOW TO PREVENT IT?

- **Careful pre-procedural image studies and planning.**
- **Performing contrast aortography during balloon aortic valvuloplasty (balloon occlusion test) to assess the patency of the coronary arteries.**
- **Use of a transcatheter valve that can be retrieved or repositioned after valve implantation, such as the CoreValve Evolut R (Medtronic) or Lotus Edge (Boston Scientific Corporation), in high-risk cases.**
- **Coronary protection.**

Coronary Protection to avoid coronary obstructdion





ID Type	
2	Vessel Le

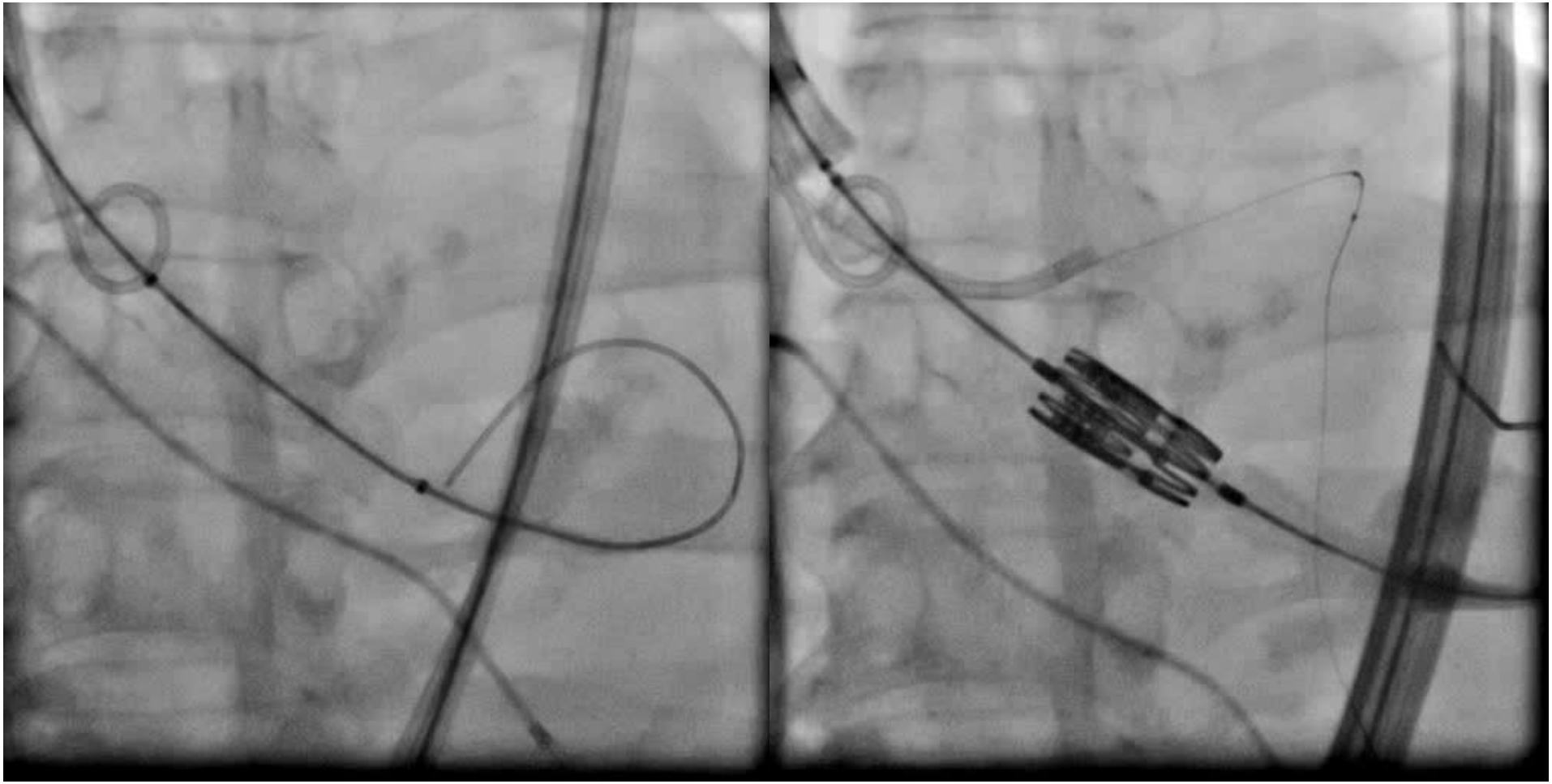
Coronary High for LCA :11.0mm and RCA: 18.2mm

Value
18.2 mm

Coronary Protection to avoid coronary obstructdion

23mm balloon for BAV

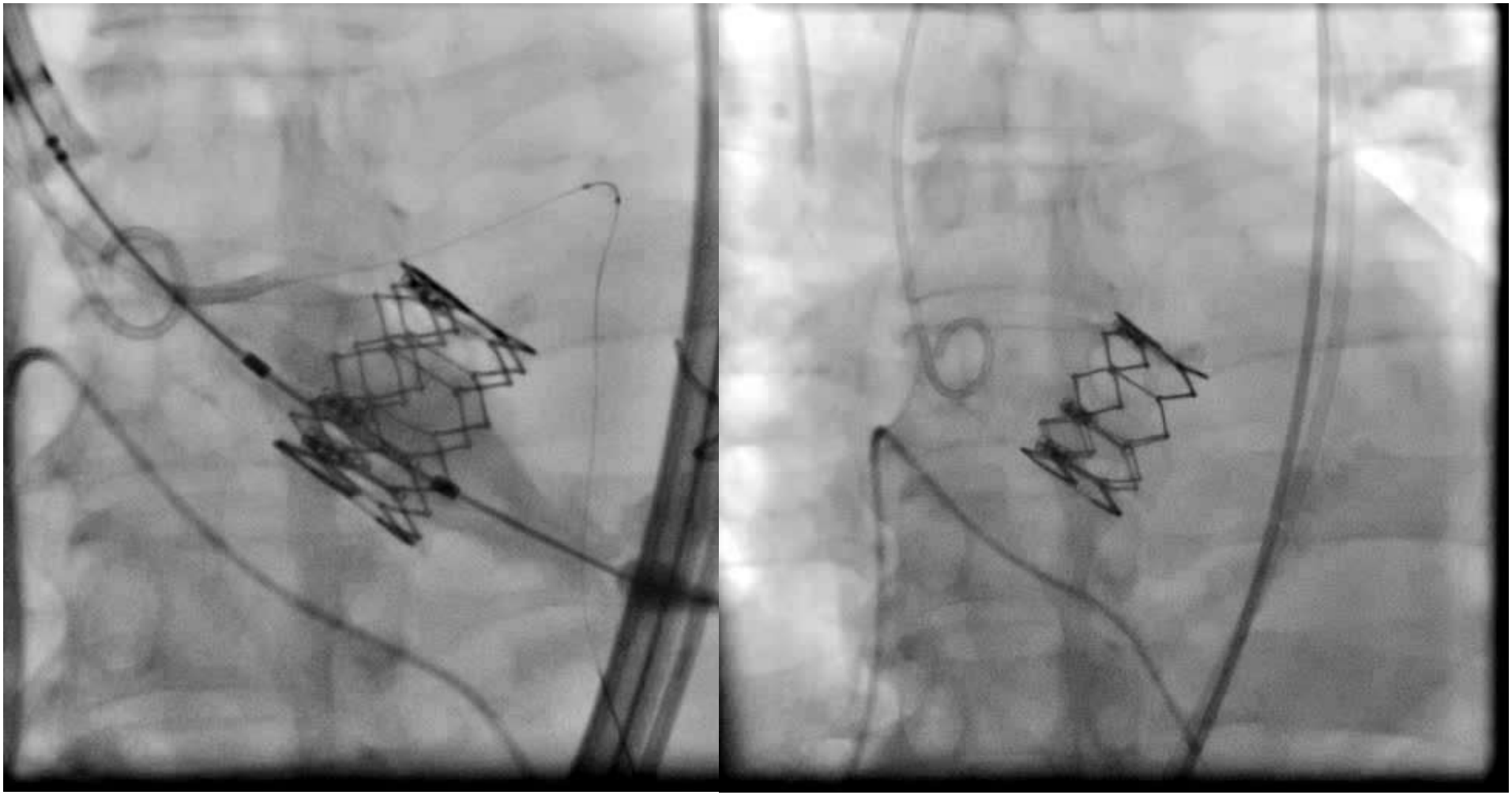
26mm Sapien XT (underfilled 2c.c) with coronary protection



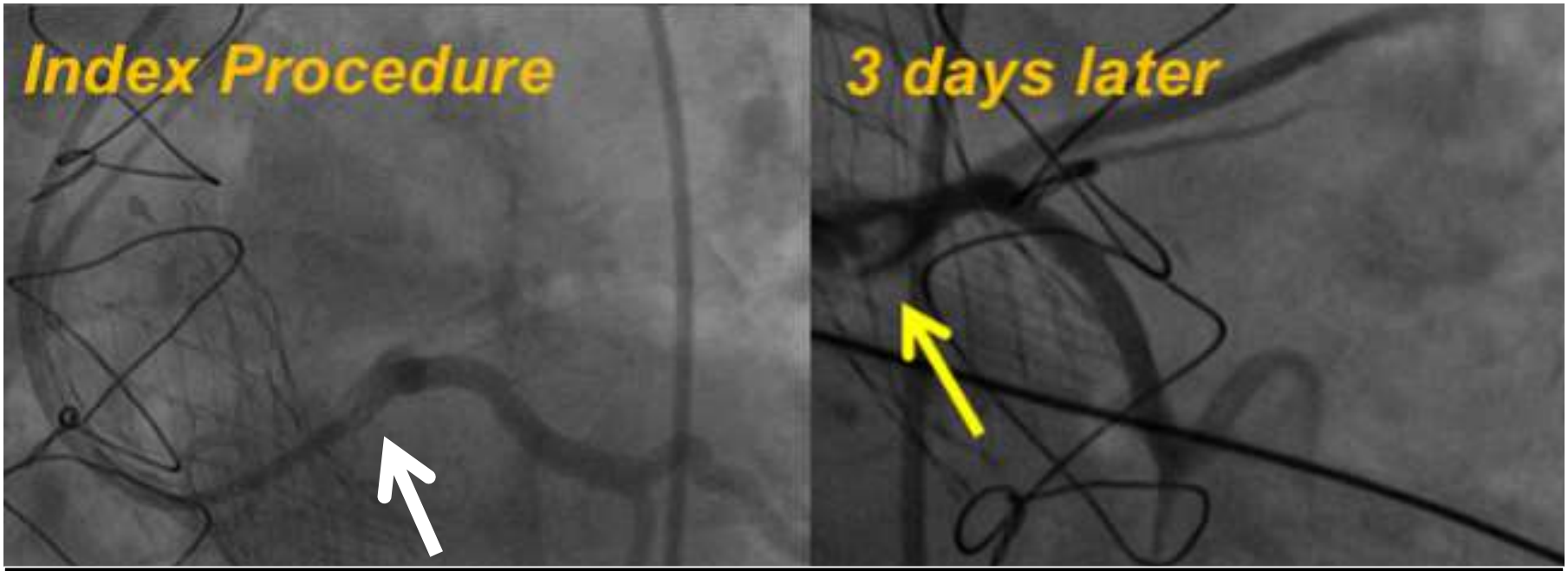
Coronary Protection to avoid coronary obstructdion

Post –dilatation with full volume

Final Angiogram



Delayed Coronary Obstruction (DCO) – a rare and deadly complication

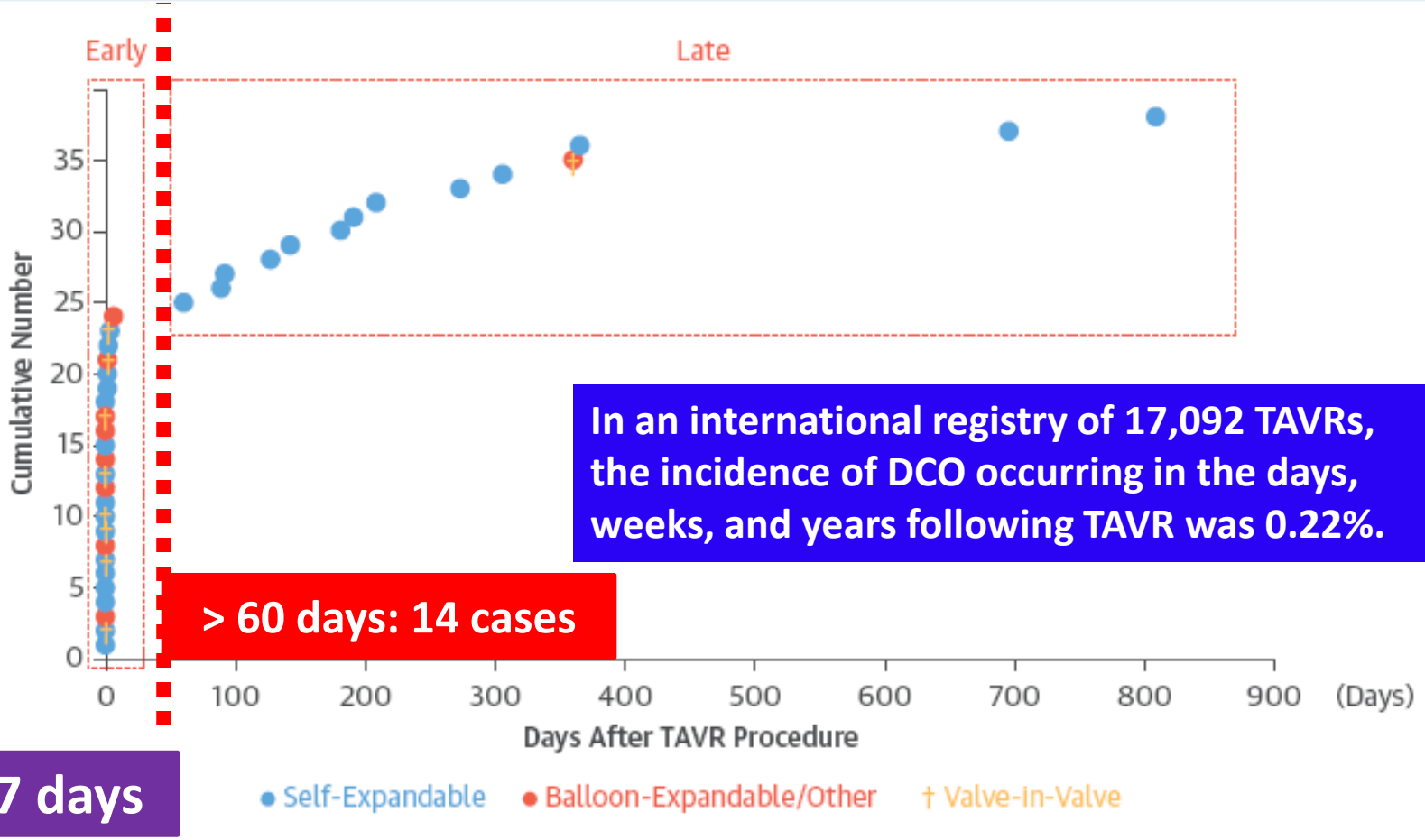


Even the post-implant aortography or selective cannulation of both coronary arteries had confirmed a lack of obstruction…….

Coronary obstruction may occur after the patient has left the procedure suite.

Delayed Coronary Obstruction After Transcatheter Aortic Valve Replacement

FIGURE 2 Timing of Delayed Coronary Obstruction Events Following TAVR Procedure (J Am Coll Cardiol 2018;71:1513-24)



In an international registry of 17,092 TAVRs, the incidence of DCO occurring in the days, weeks, and years following TAVR was 0.22%.

> 60 days: 14 cases

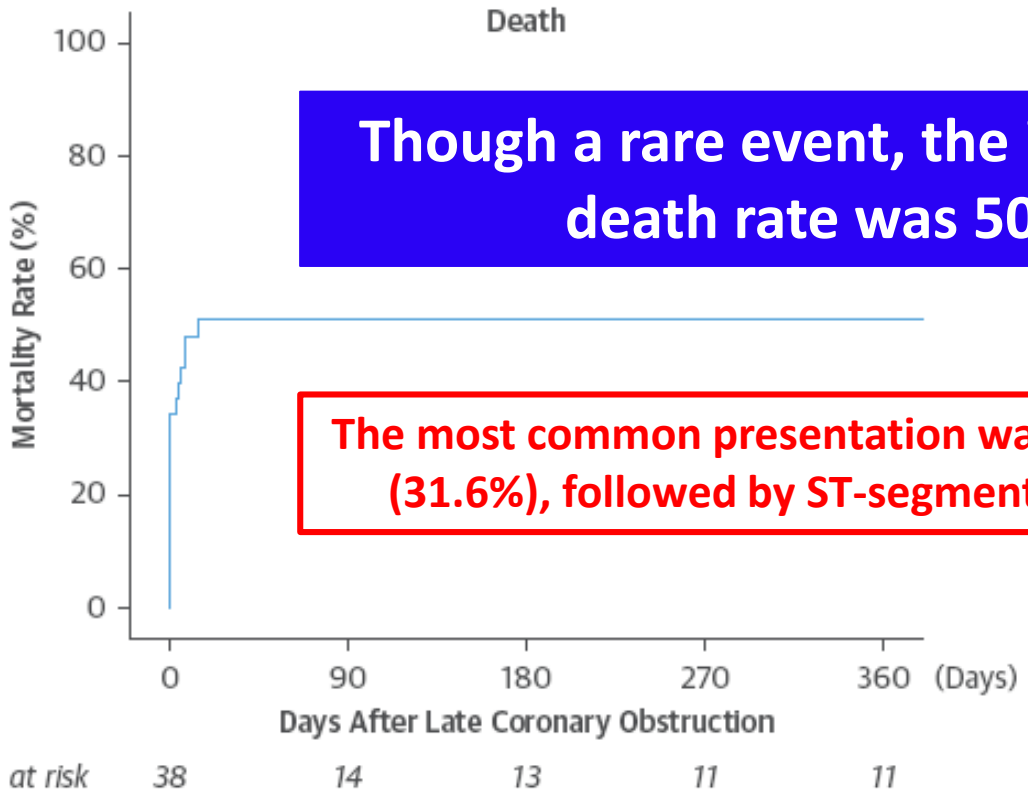
< 7 days

18 cases occurring within 24 hours of the procedure, and 6 cases from 24 hours to 7 days.

nscatheter aortic valve replacement (TAVR) procedure
, there were no cases of delayed coronary obstruction
e-in-valve index procedure).

Delayed Coronary Obstruction After Transcatheter Aortic Valve Replacement

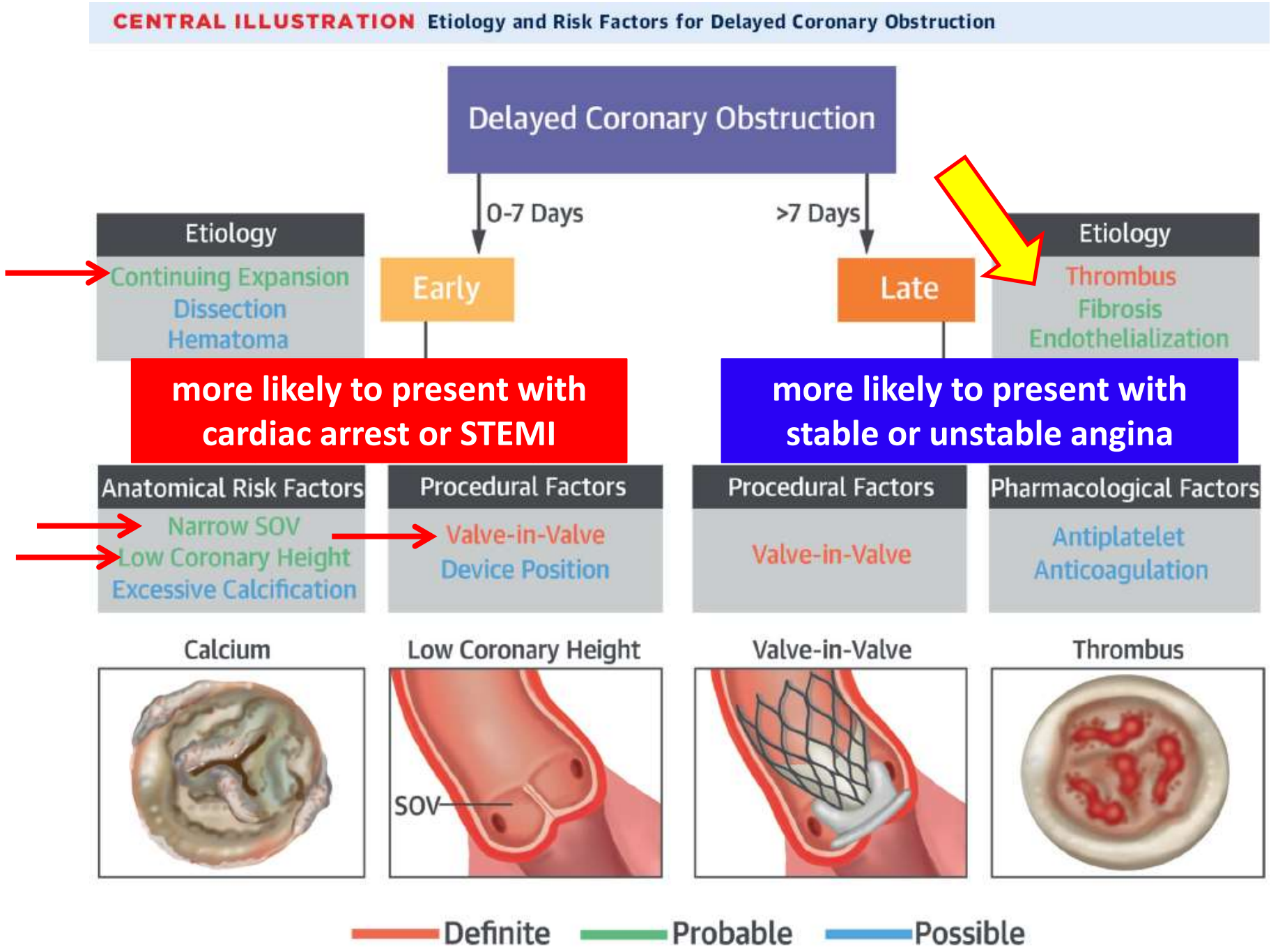
FIGURE 3 Kaplan-Meier Curve of All-Cause Death After DCO (J Am Coll Cardiol 2018;71:1513-24)



Though a rare event, the in-hospital death rate was 50%.

The most common presentation was cardiac arrest (31.6%), followed by ST-segment MI (23.7%).

The in-hospital death rate was 50% (n = 19). The median follow-up of the survivors following delayed coronary obstruction (DCO) was 375 days (interquartile range: 35 to 1,026 days), and no case of stent thrombosis or death occurred in any patient who survived to hospital discharge. One patient underwent target-vessel revascularization during the follow-up period.

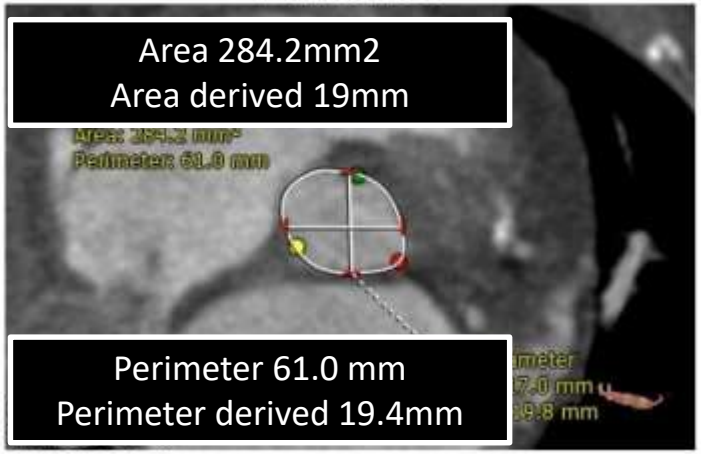


Jabbour, R.J. et al. J Am Coll Cardiol. 2018;71(14):1513-24.

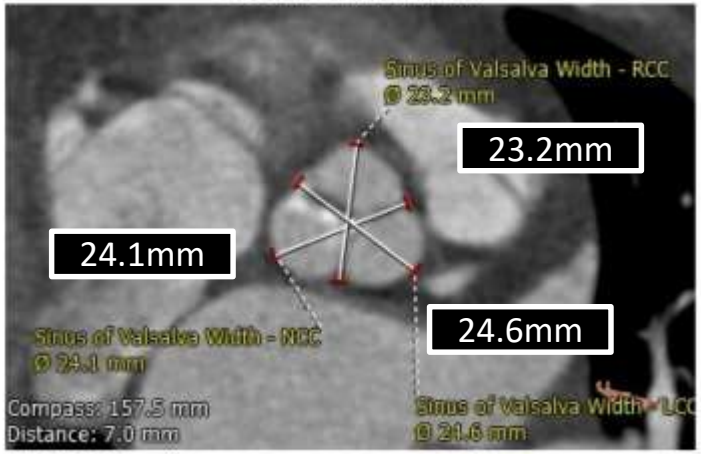
Case 1 Presentation (2)

F84 w/ HF

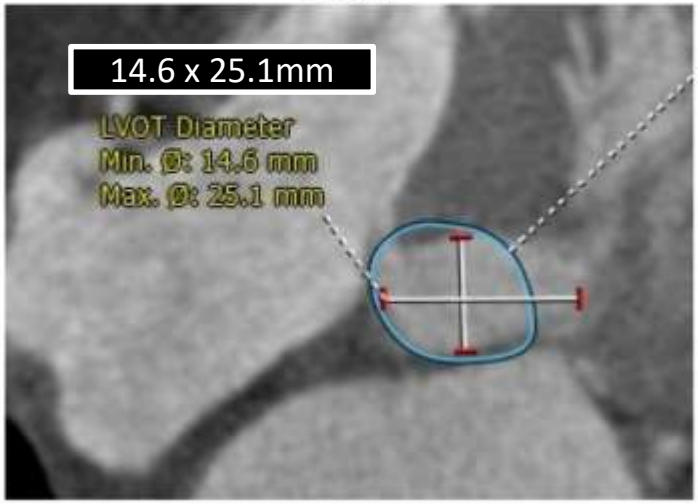
ANNULUS



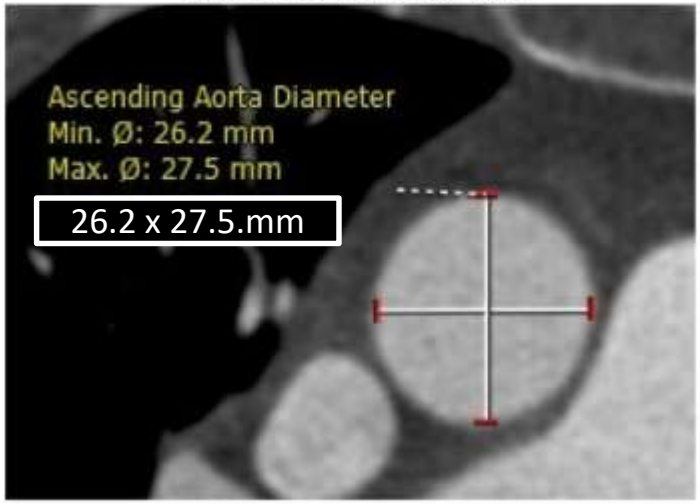
SOV DIAMETER



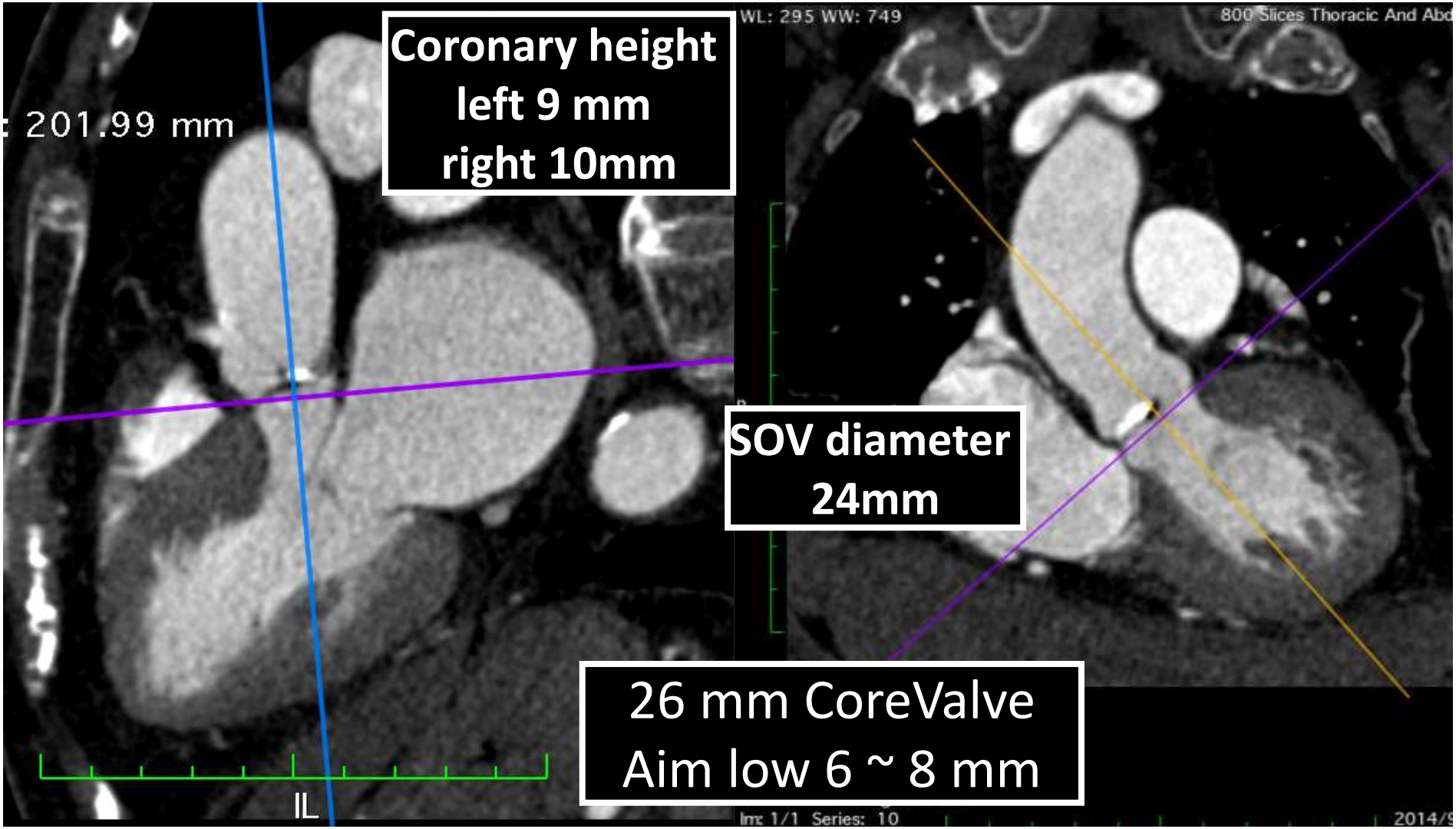
LVOT



ASCENDING AORTA



Case 1 Presentation (3)



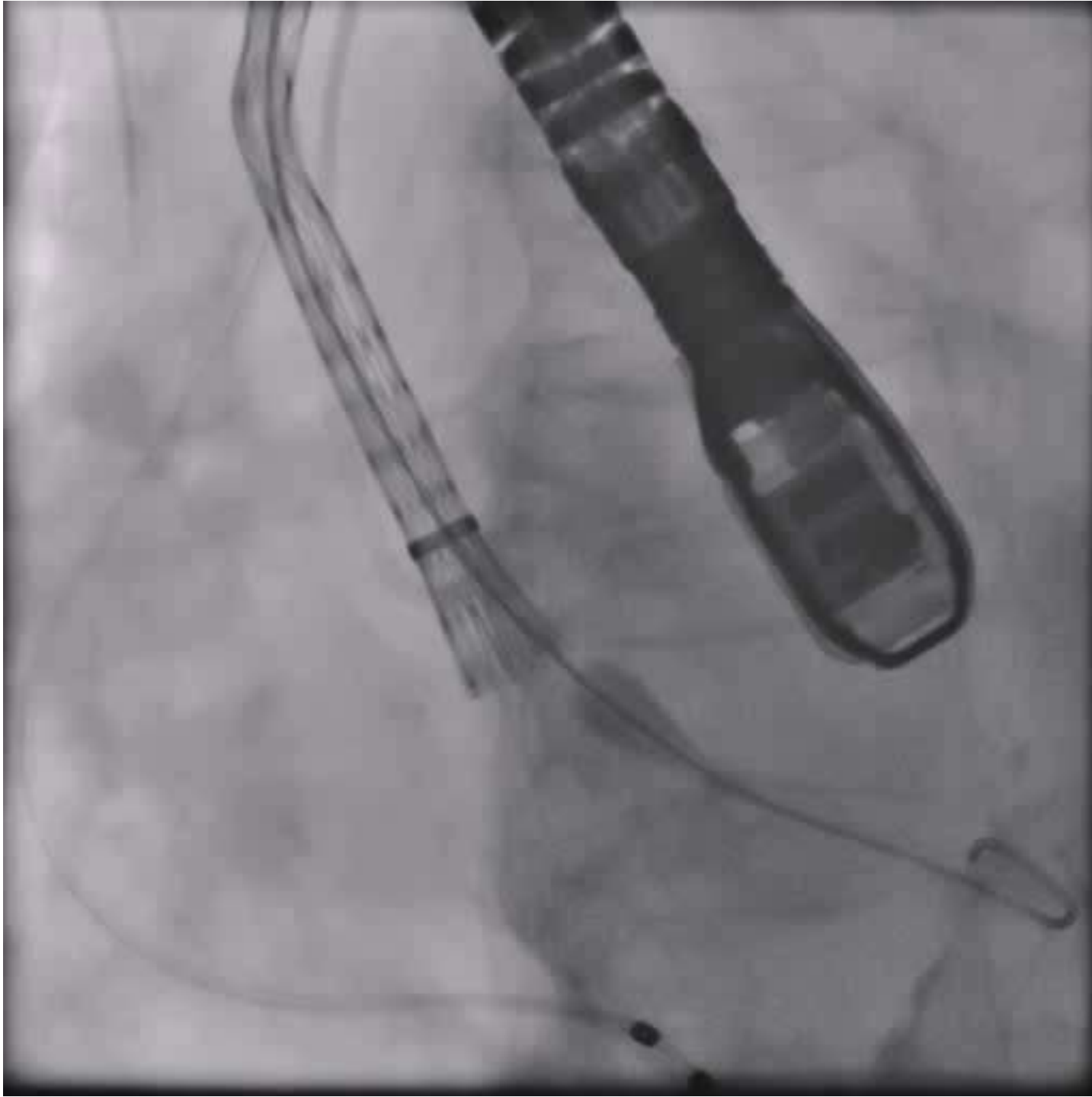
DCO Case

F 84, presented with heart failure and effort angina

After stenting for LAD, TAVI was done.

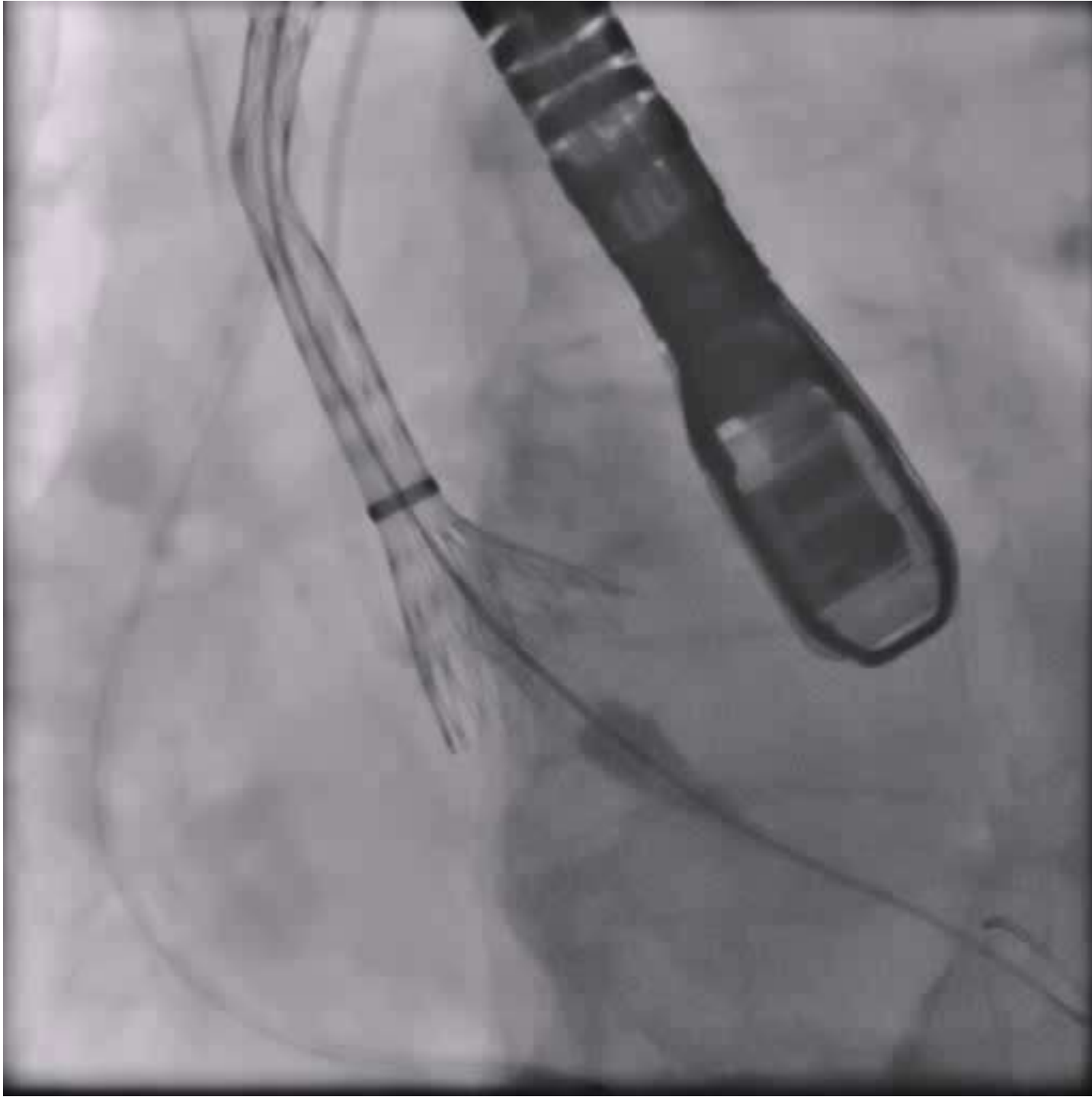
DCO Case

Started at 2-4mm



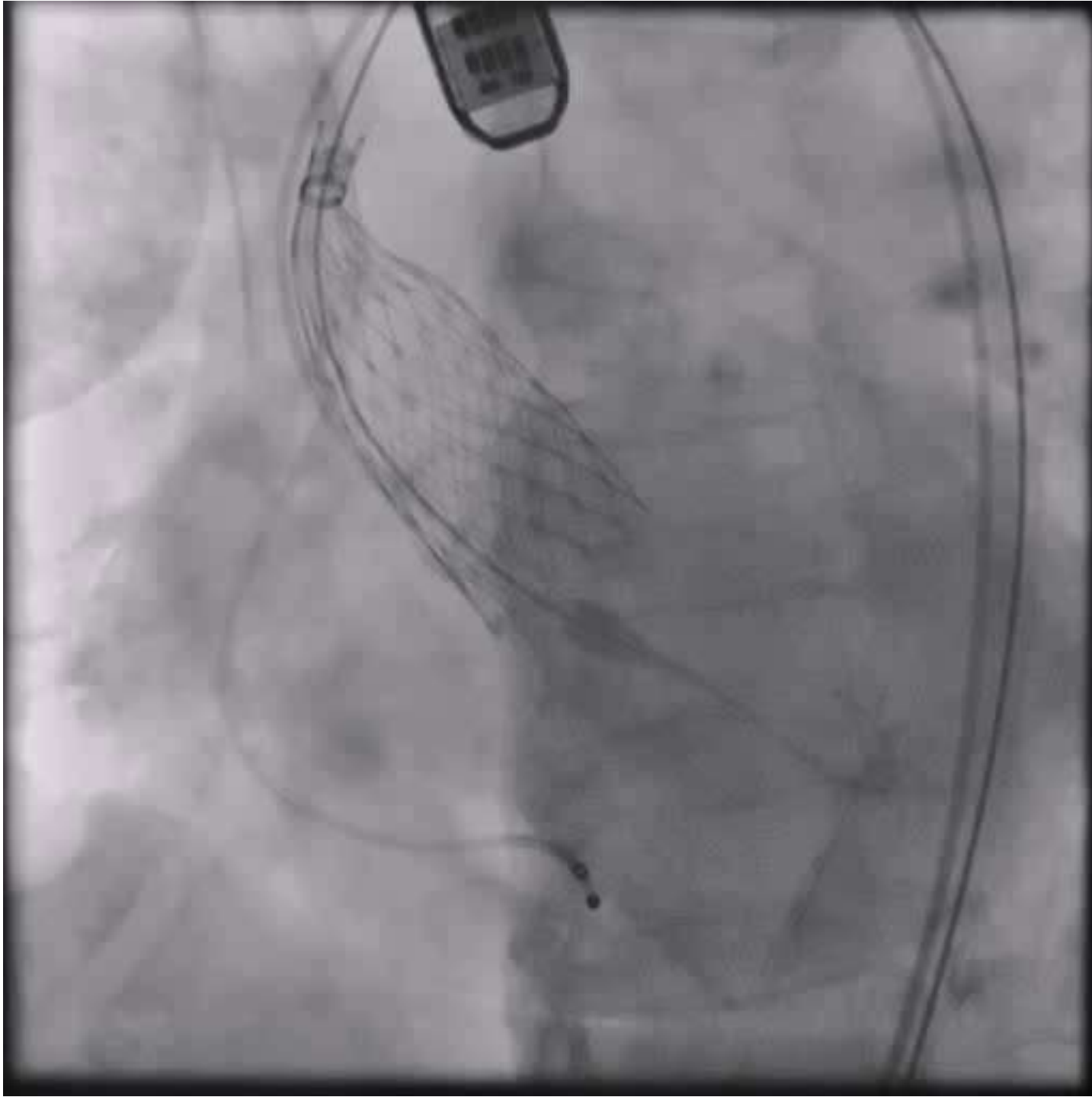
DCO Case

Releasing



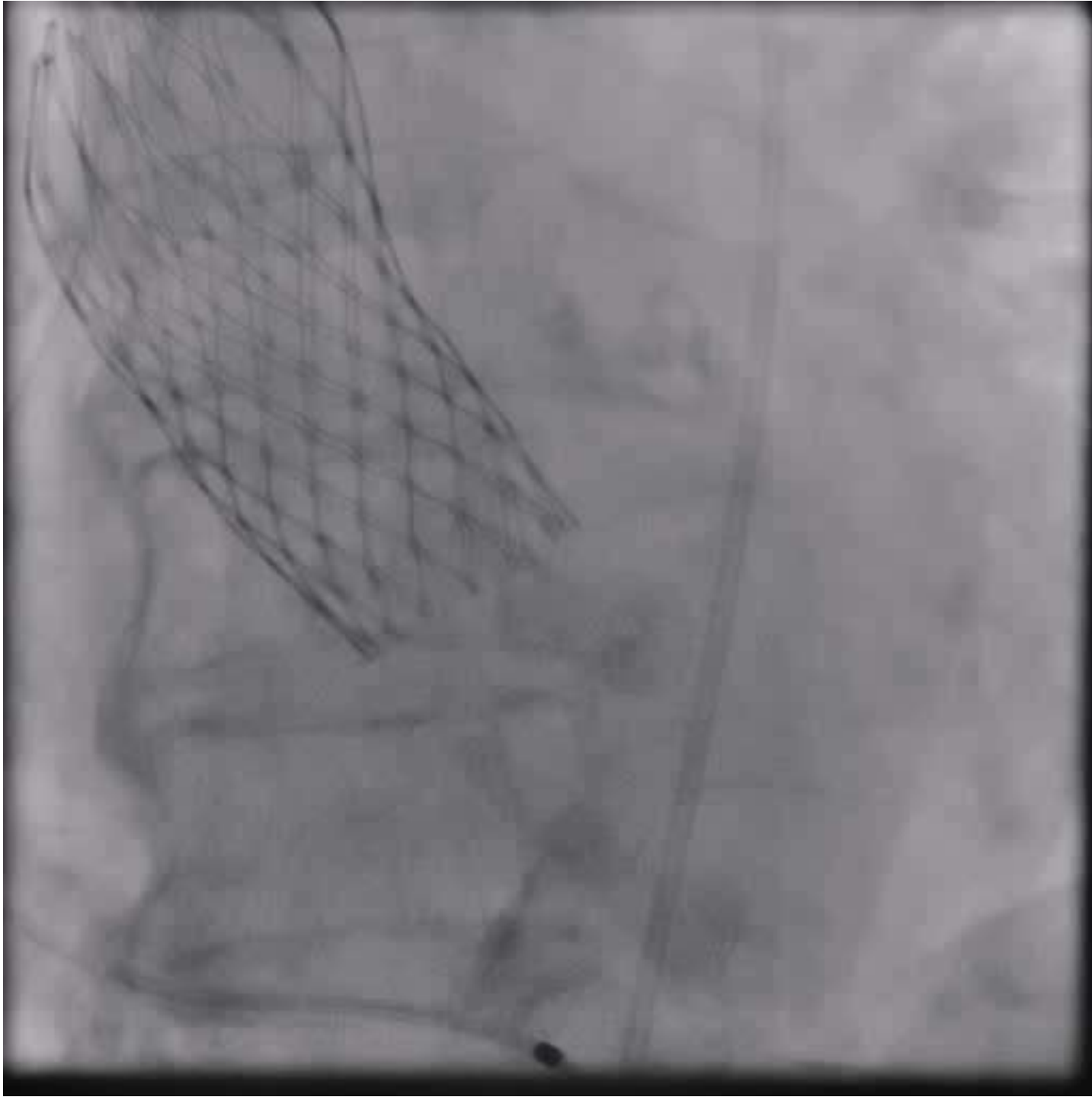
DCO Case

End-up at 4mm



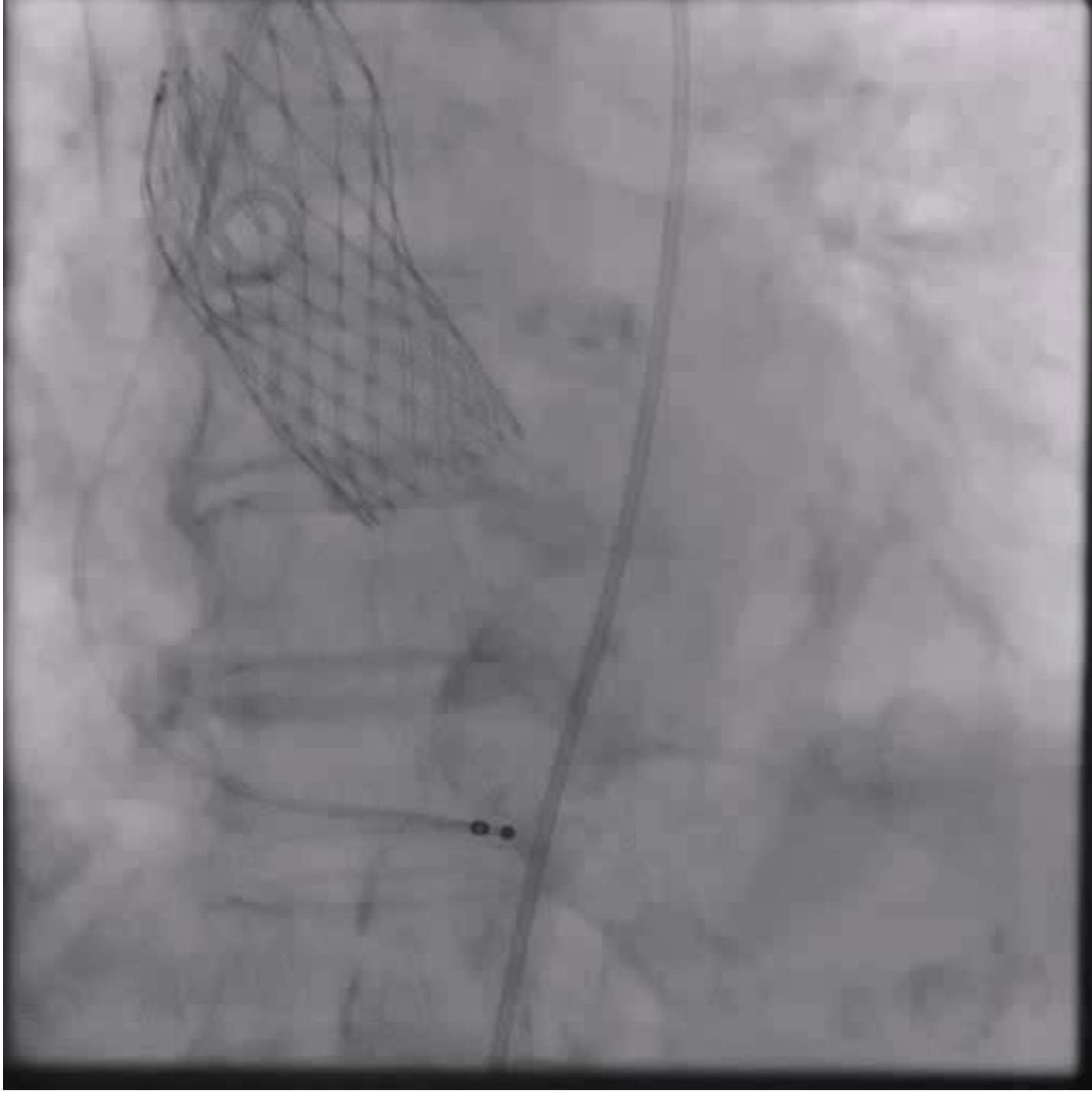
DCO Case

Final angiogram at the end of TAVI



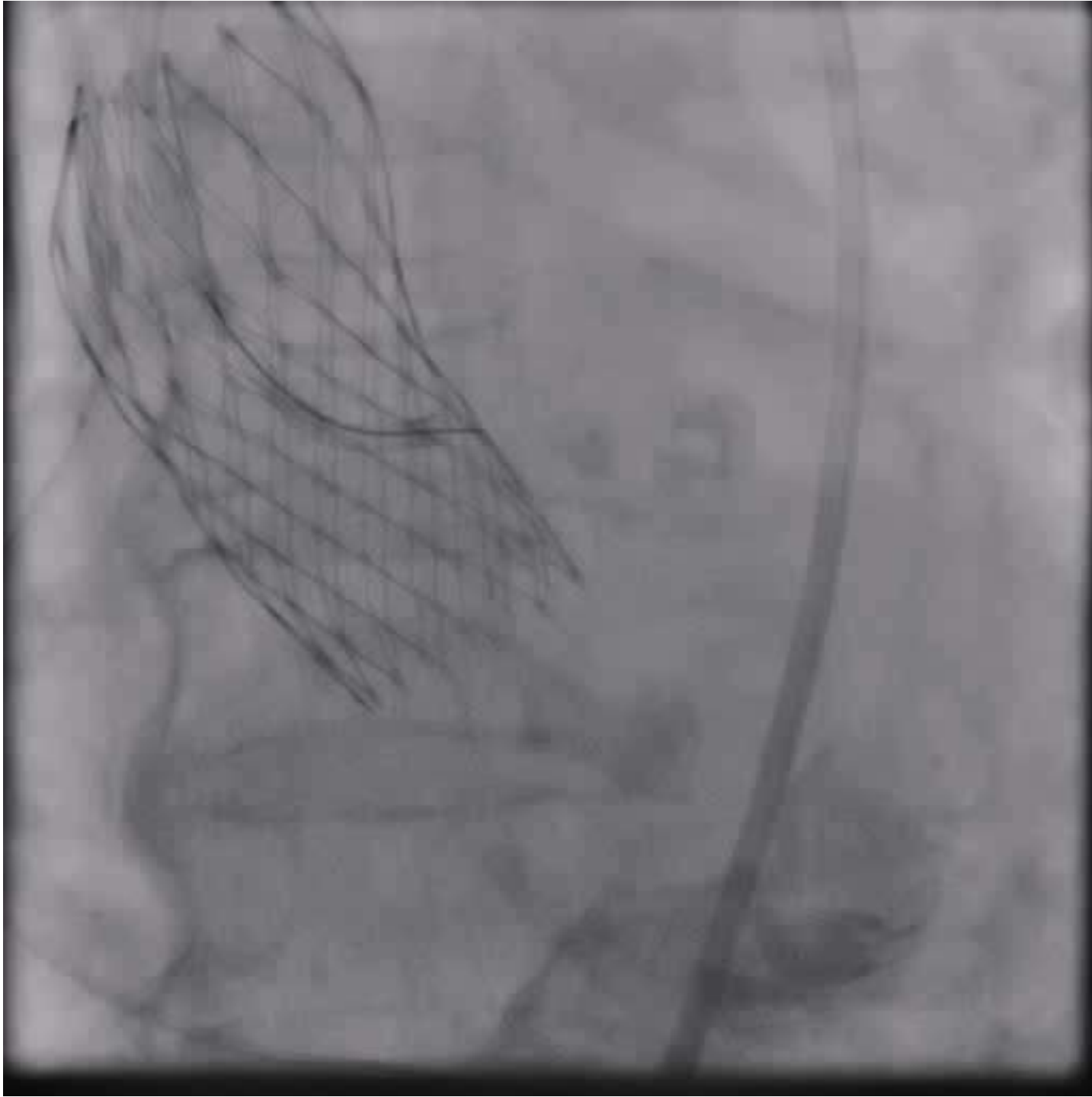
DCO Case

30 minutes after TAVI, cardiogenic shock and then cardiac arrest developed.
An angiogram was done.



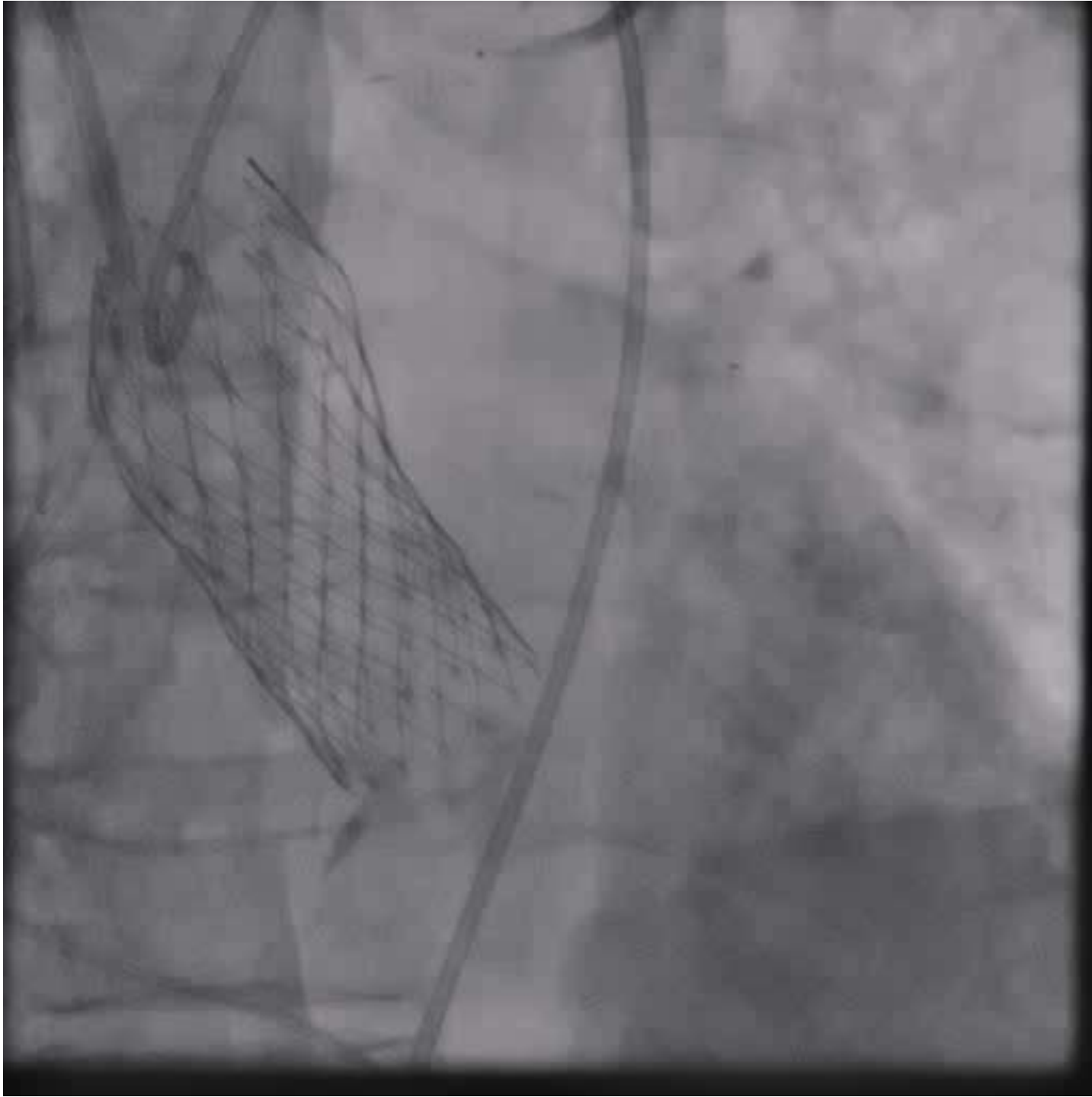
DCO Case

Emergency PCI was attempted, but failed.



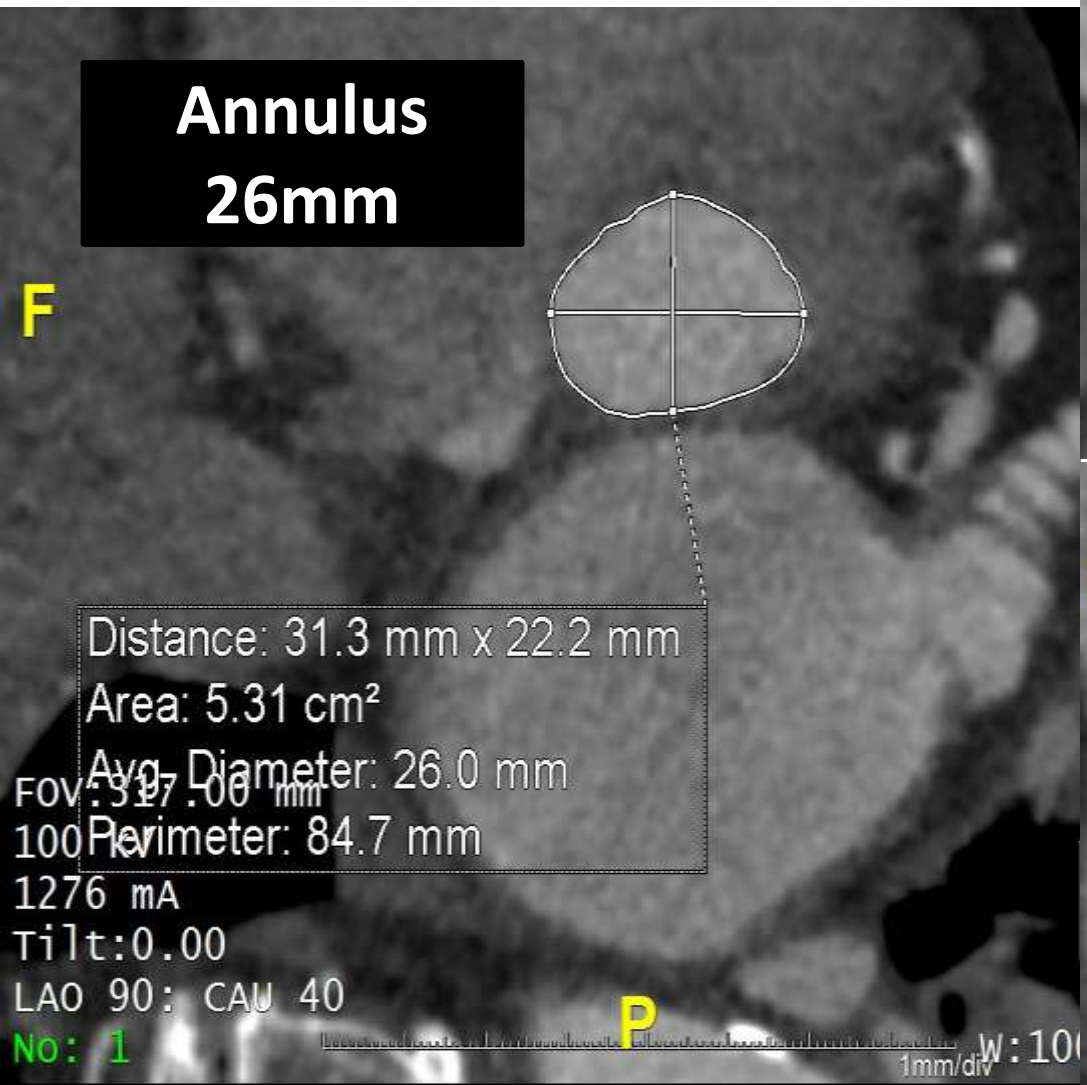
DCO Case

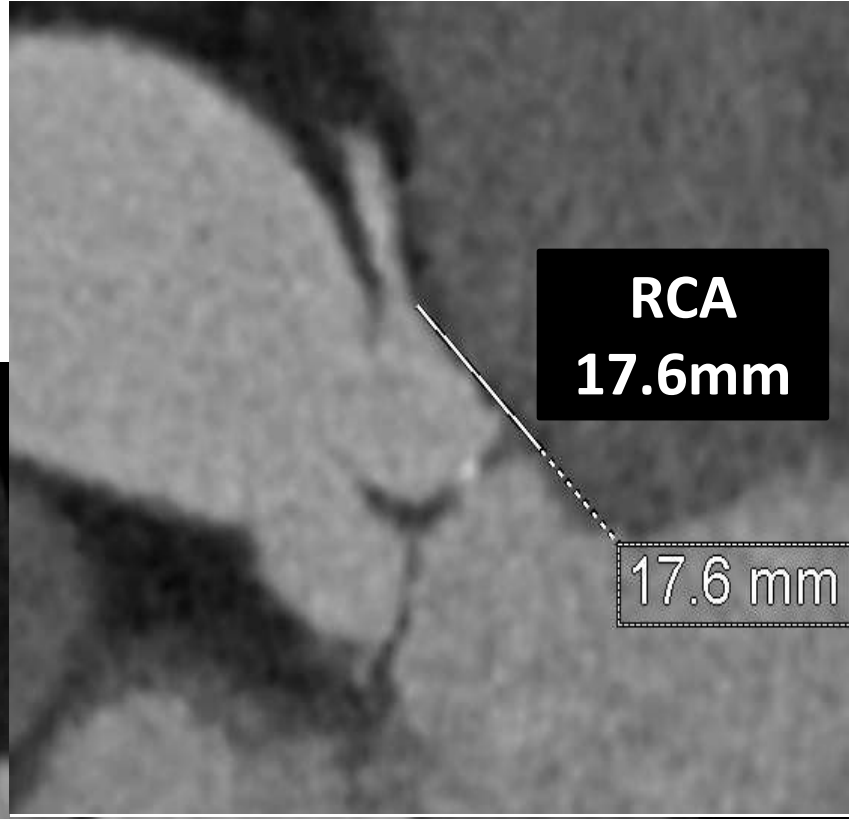
Emergency CABG and reposition of the CoreValve manually was done with success.

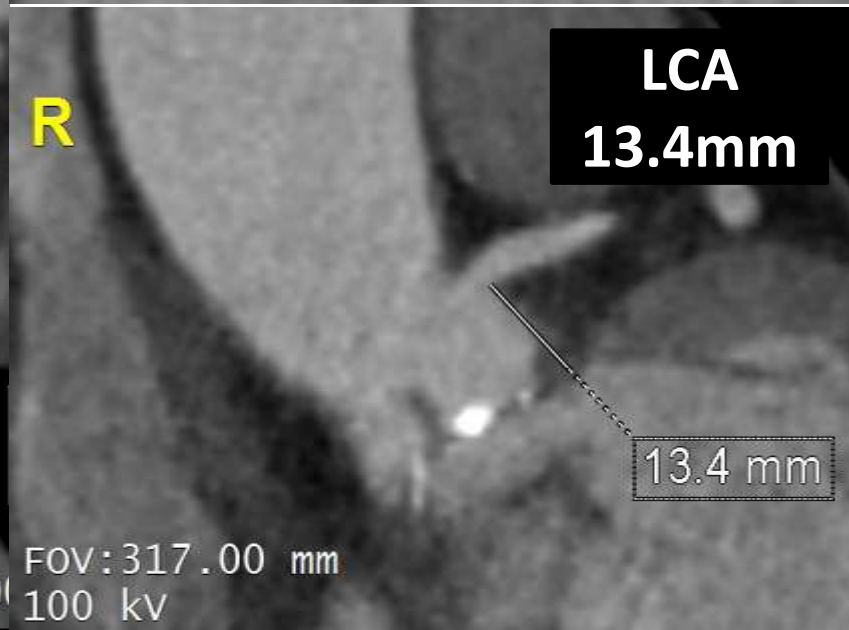


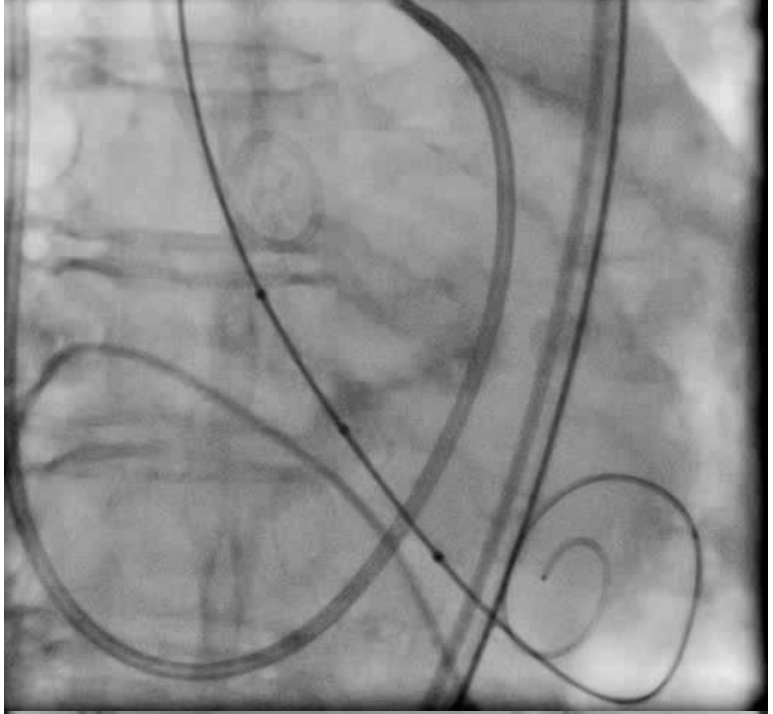
Case 2 Presentation (1)

- LCSJ, 90 years old female



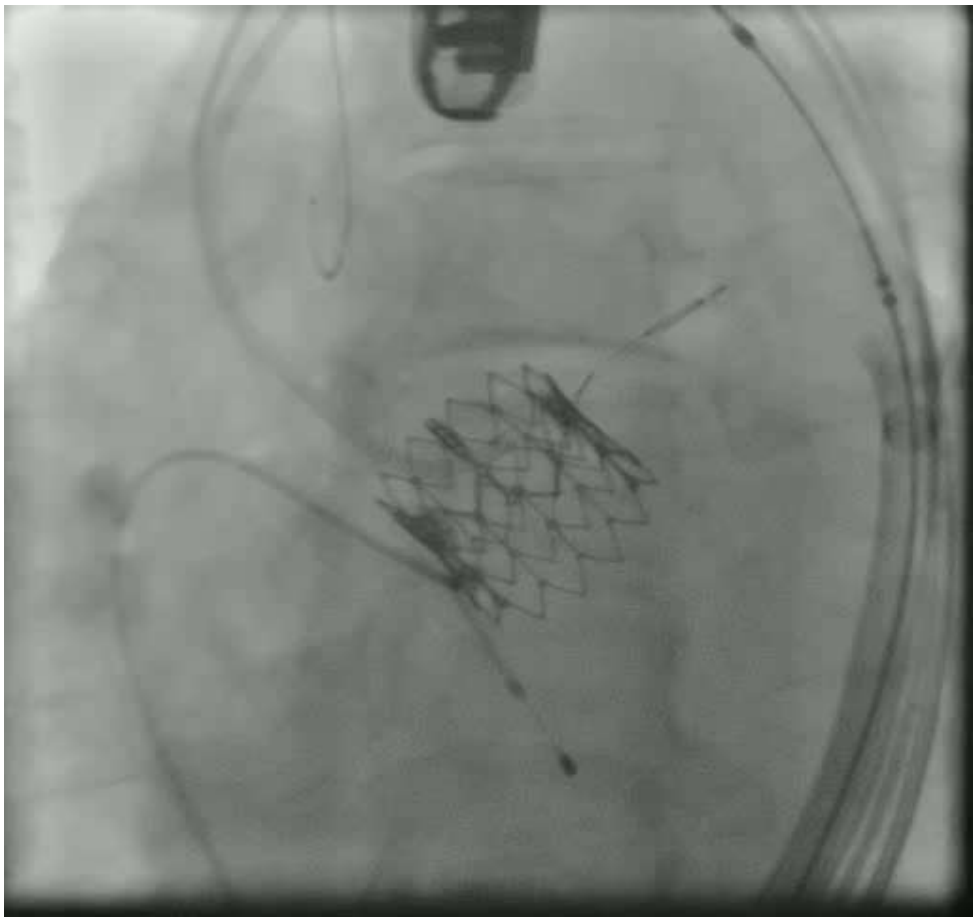






Case 2
Presentation (2)

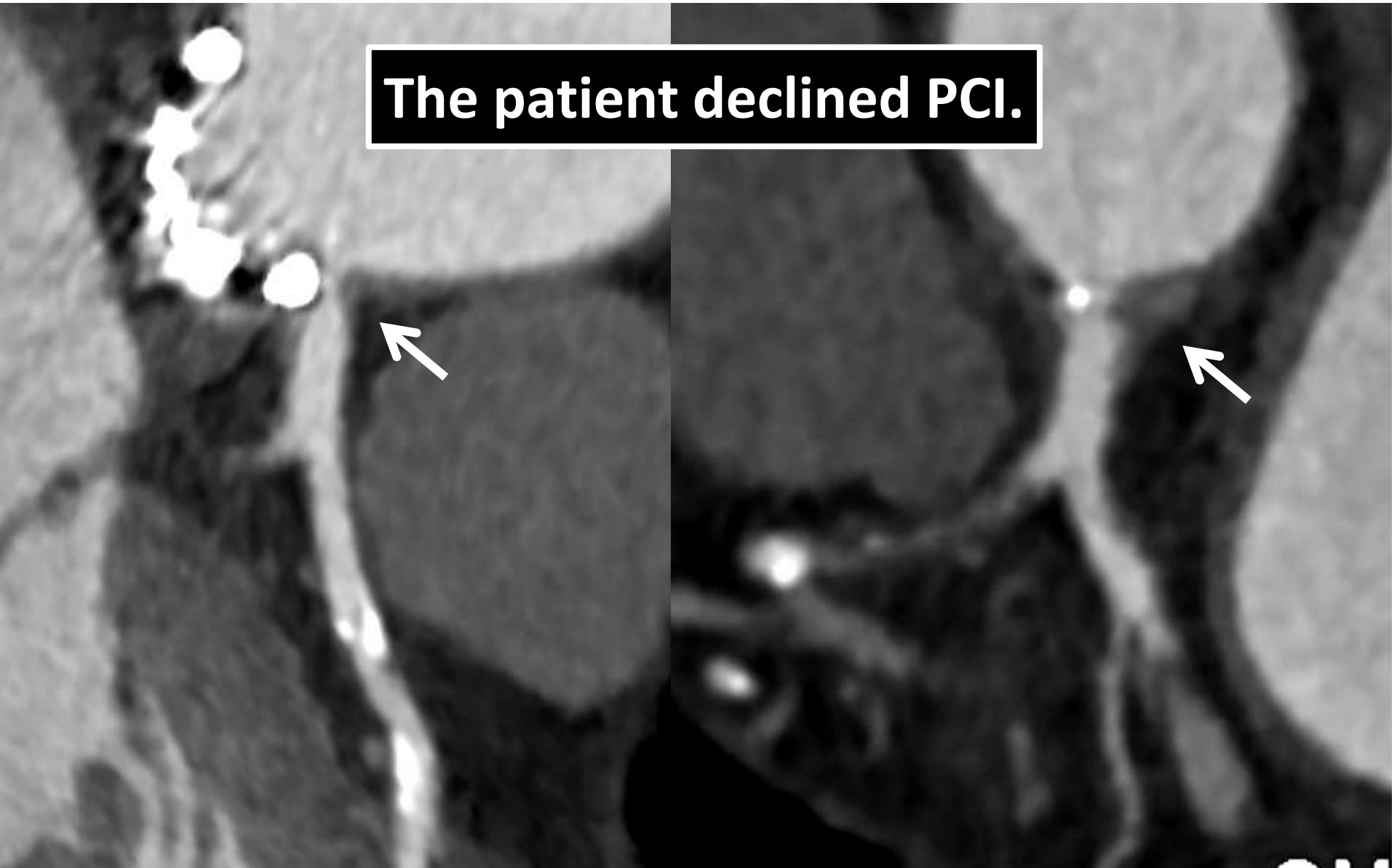
2016/04/19 TAVR with
a 29mm Edwards Sapien XT



Case 2 Presentation (3)

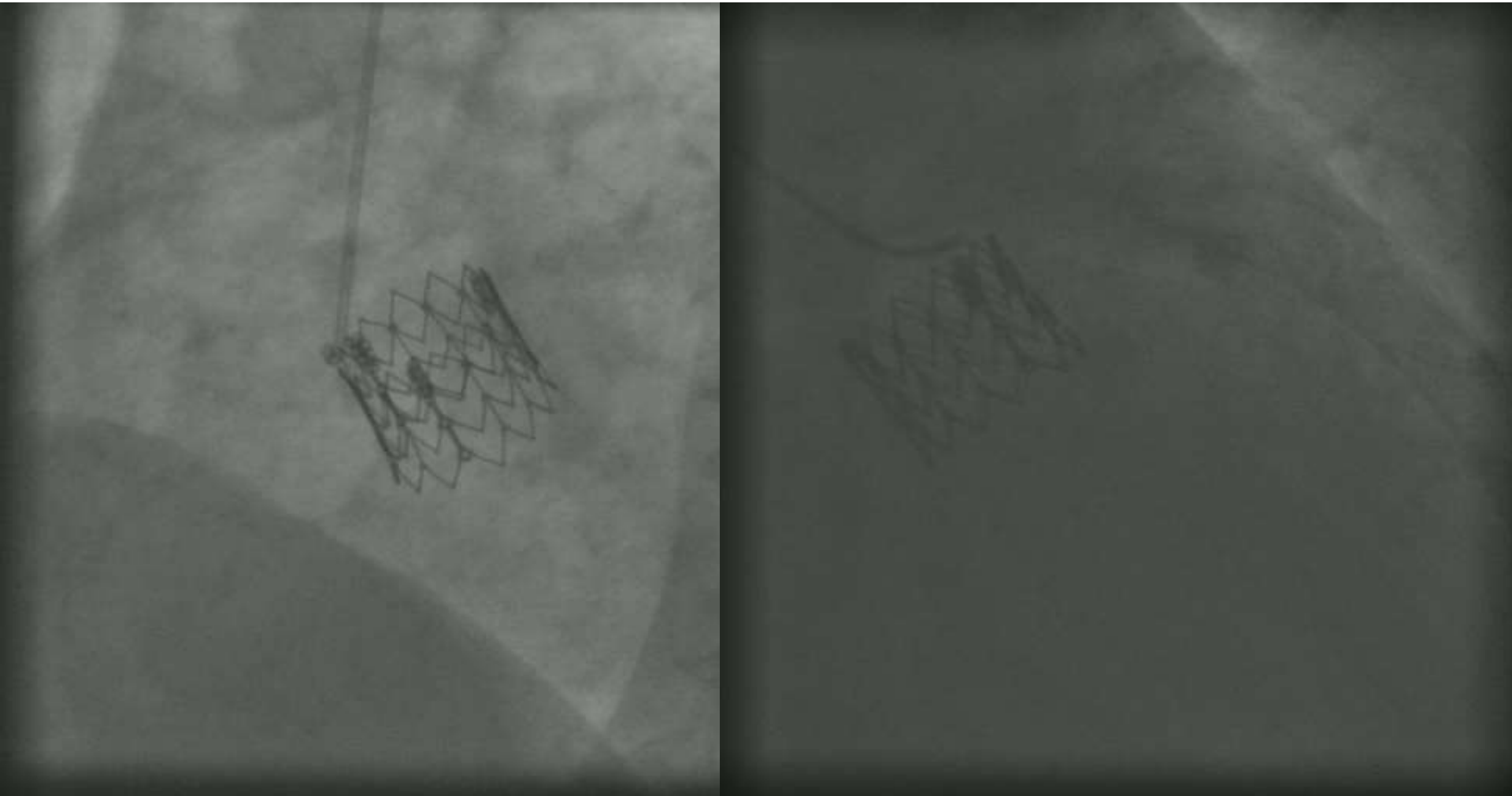
2016/12/08, the patient was asymptomatic, but
a follow-up MSCT showed new tissue growth near the ostium of LM

Case 2 Presentation (4)



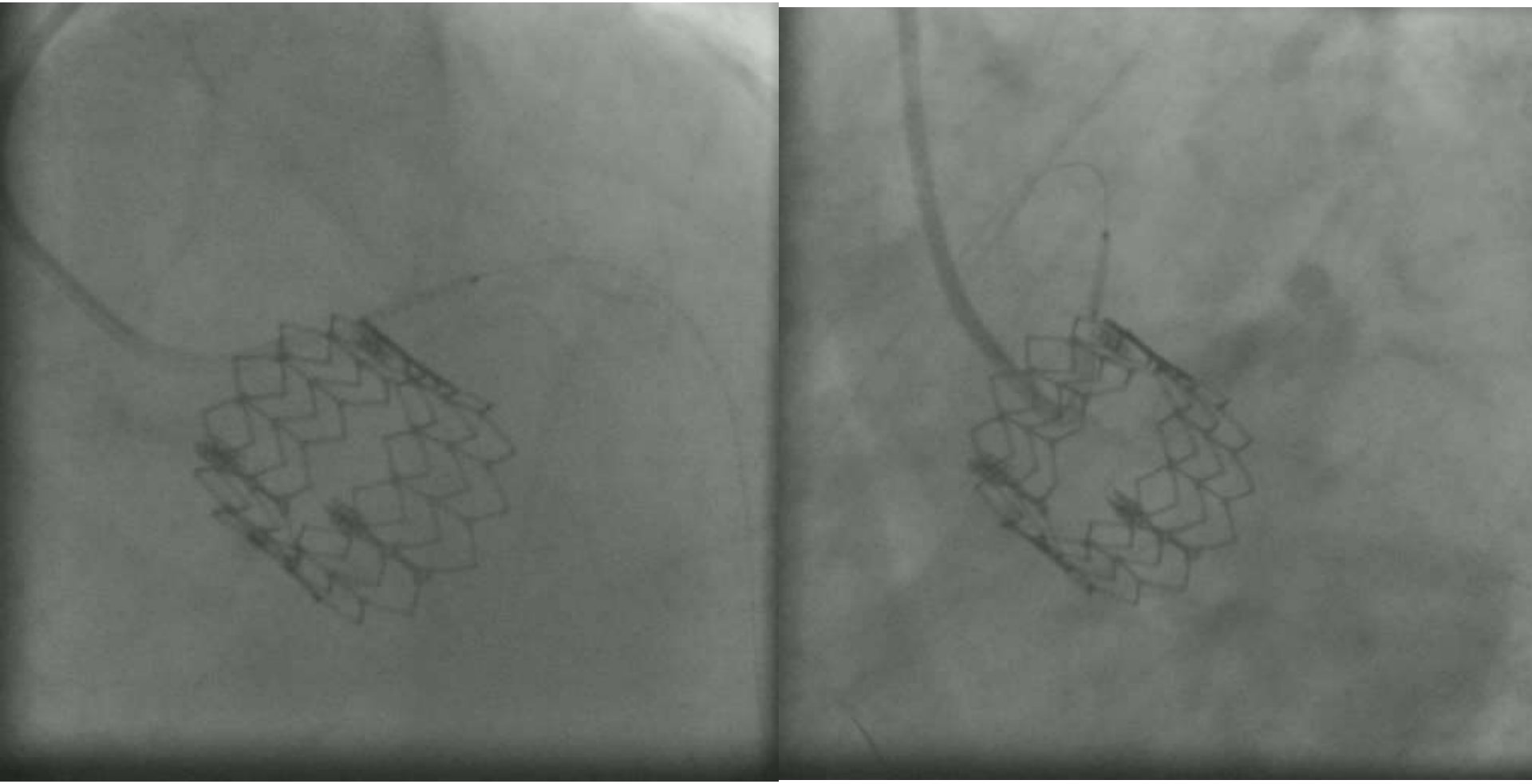
Case 2 Presentation (5)

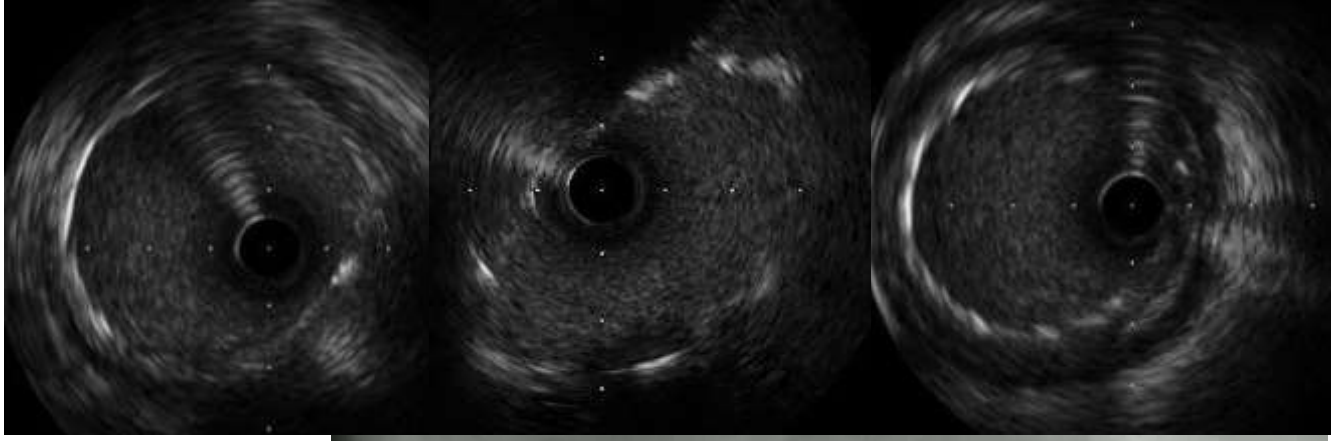
2018/05/17, the patient was admitted for CAG because of Progressive typical angina for one month.



Case 2 Presentation (6)

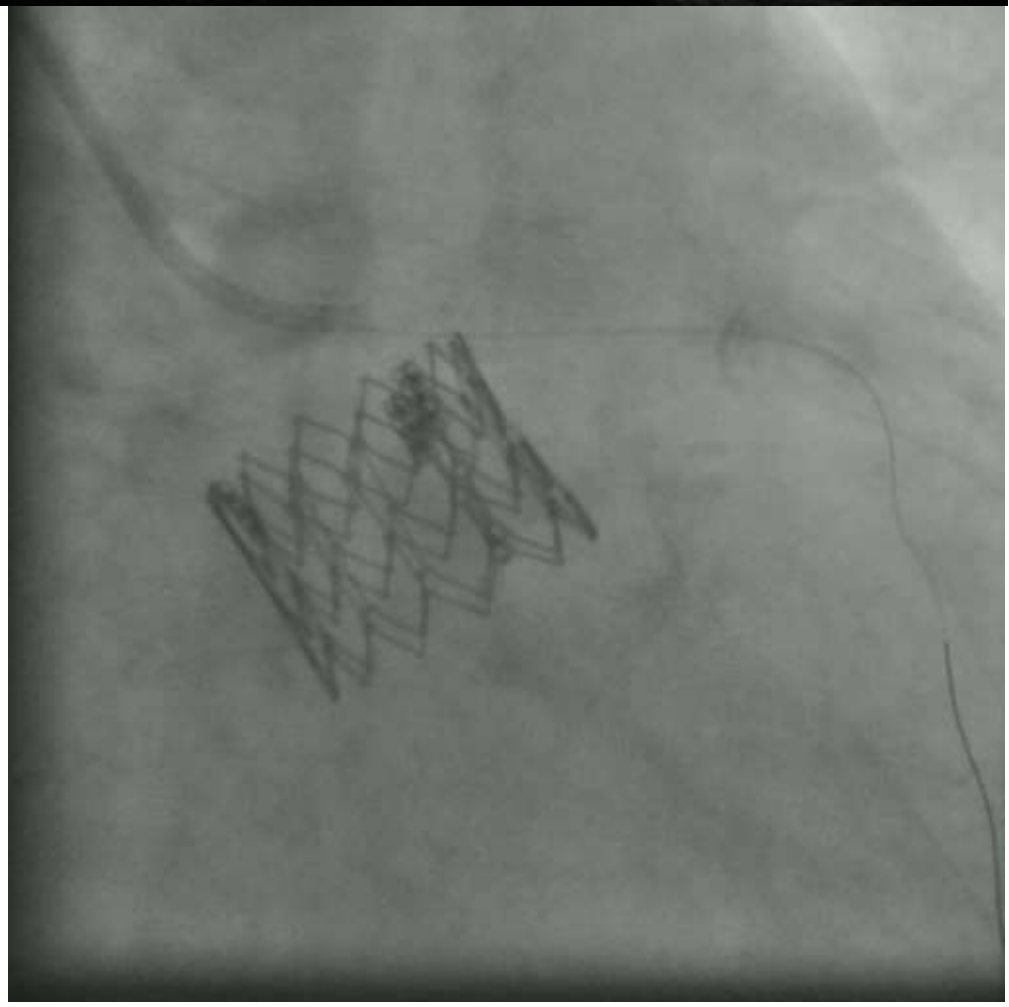
2018/05/18: Direct stenting for LM ostial stenosis with a 4.0x12mm DES and post-dil. with a 4.5mm NC balloon under IVUD guidance.





Case 2
Presentation (7)

Final angiogram and IVUS



Why is DCO important?

- ***It is less rare than we recognize!***
- The incidence of DCO may be higher than reported because **sudden cardiac death outside the hospital** may be the first manifestation and thus DCO may go undiagnosed **if no autopsy** is performed.
- Patients may **be relatively protected** from the symptoms of coronary obstruction if they've had a **prior coronary artery bypass graft**.
- As we move to lower-risk patients, there could be **a greater incidence** of delayed coronary obstruction occurring due to patients having **a longer life expectancy post-TAVR**.
- ***There is no easy preventive strategy.***

When should we consider it?

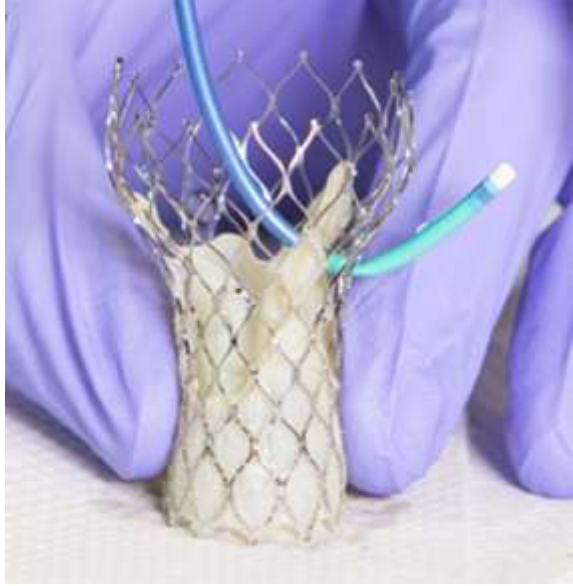
- When someone TAVR patient gets sick or when you're told someone has died, this is something you need to think about.
- When you finish a case and **left with not much sinus of Valsalva and most of the sinus has been obliterated,** you need to give some thought to this possibility.
- *We need to **have a lower threshold for imaging the coronary system post-TAVR!***

How to manage it?

TABLE 5 Delayed Coronary Obstruction Details

	Overall (N = 38)	Early (0–7 Days) (n = 24)	Late (>7 Days) (n = 14)
LM revascularization	35	21	14
PCI	26 (74.3)	17 (81.0)	9 (64.3)
Successful	21 (80.8)	14 (82.4)	7 (77.8)
Unsuccessful	5 (19.2)	3 (17.6)	2 (22.2)
CABG	6 (17.1)†	2 (9.5)	4 (28.6)
Not attempted	4 (11.4)	2 (9.5)	2 (14.3)
RCA revascularization	10	7	3
PCI	6 (60.0)	4 (57.1)	2 (66.7)
Successful	1 (16.7)	1 (25.0)	0 (0.0)
Unsuccessful	5 (83.3)	3 (75.0)	2 (100.0)
CABG	3 (30.0)‡	1 (14.3)	2 (66.7)
Not attempted	3 (30.0)	3 (42.9)	0 (0.0)
Outcome			
In-hospital death	19 (50.0)	15 (62.5)§	4 (28.6)§

Tips and techniques for CAG or PCI after CoreValve/Evolute R



- Use aortography to confirm ostia takeoff points.
- Engage the coronary ostium coaxially through the middle of the frame cell:
  JL4 → JL3.5/4.5
- If there is difficulty with the frame cell that is directly coaxial to the ostium, use the frame cell to the left or right, or above the ostium.
- Attempt a partial selection, then engage with the wire.
- Use an extension when extra support is needed or when the distance between the frame and the coronary ostia is large — commonly with RCA.
- After PCI, disengage the guide catheter from the ostium over the guidewire prior to removing through the frame cell.

Chimney stenting

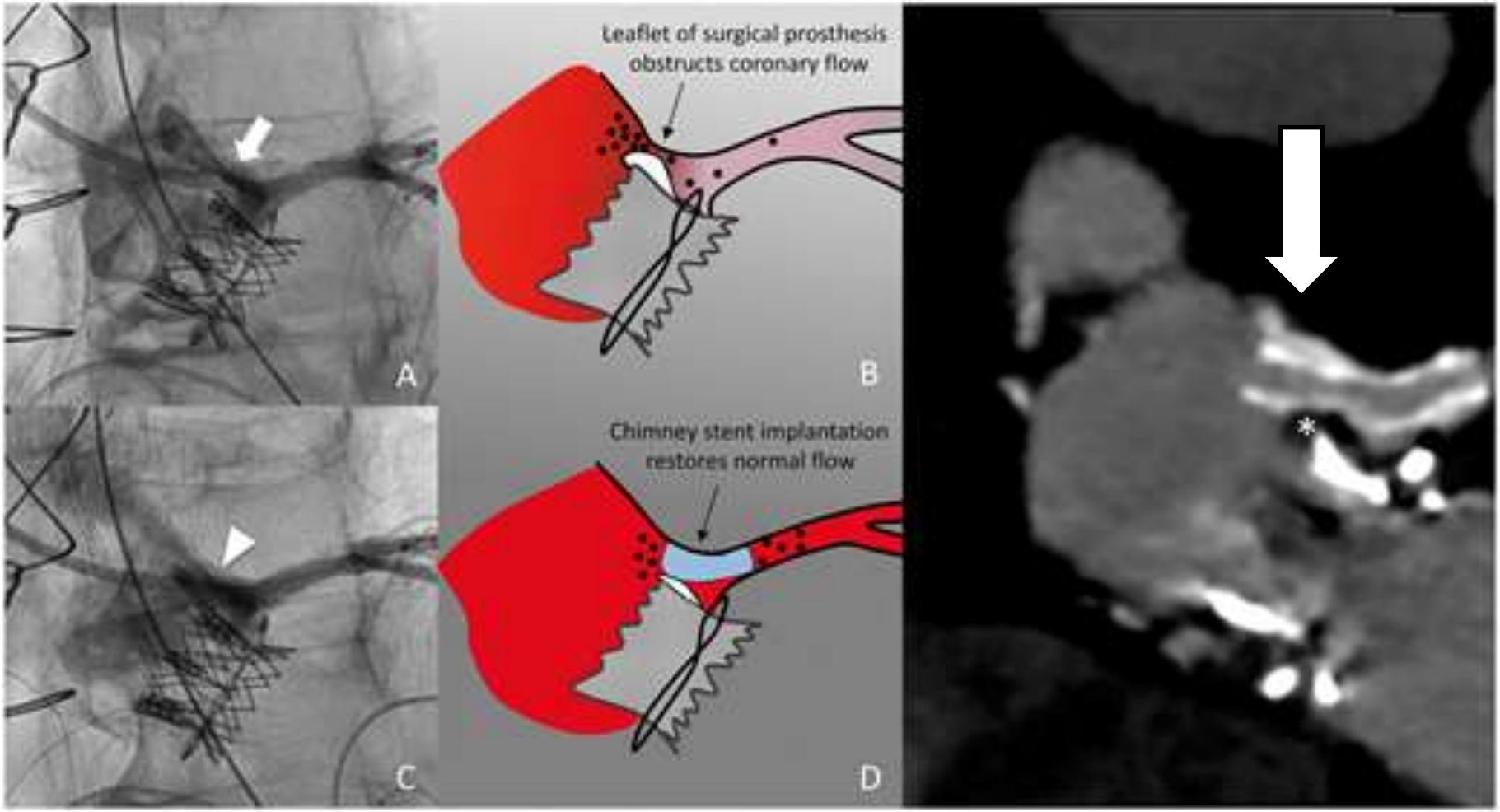
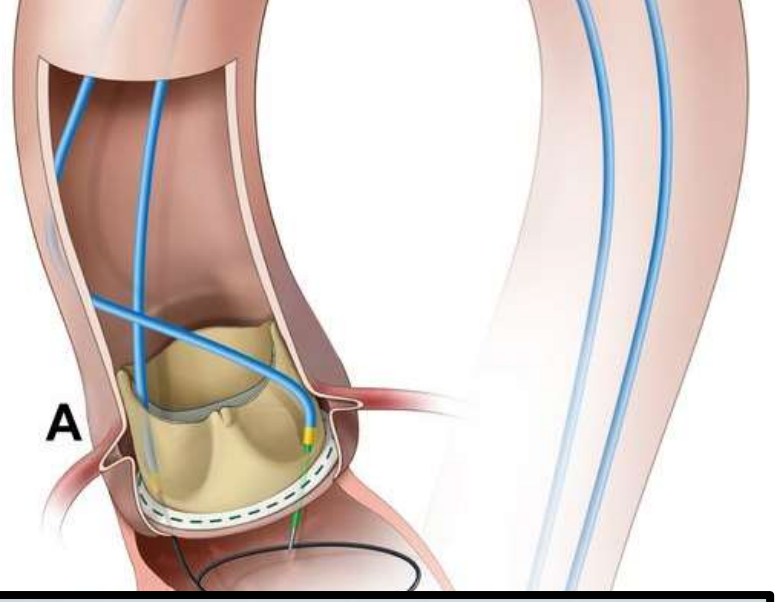


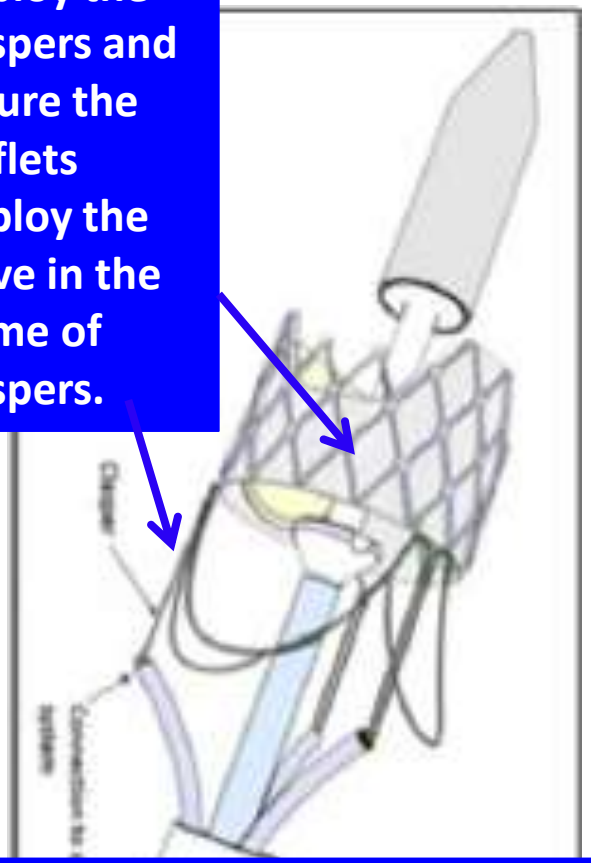
Illustration of the BASILICA Procedure

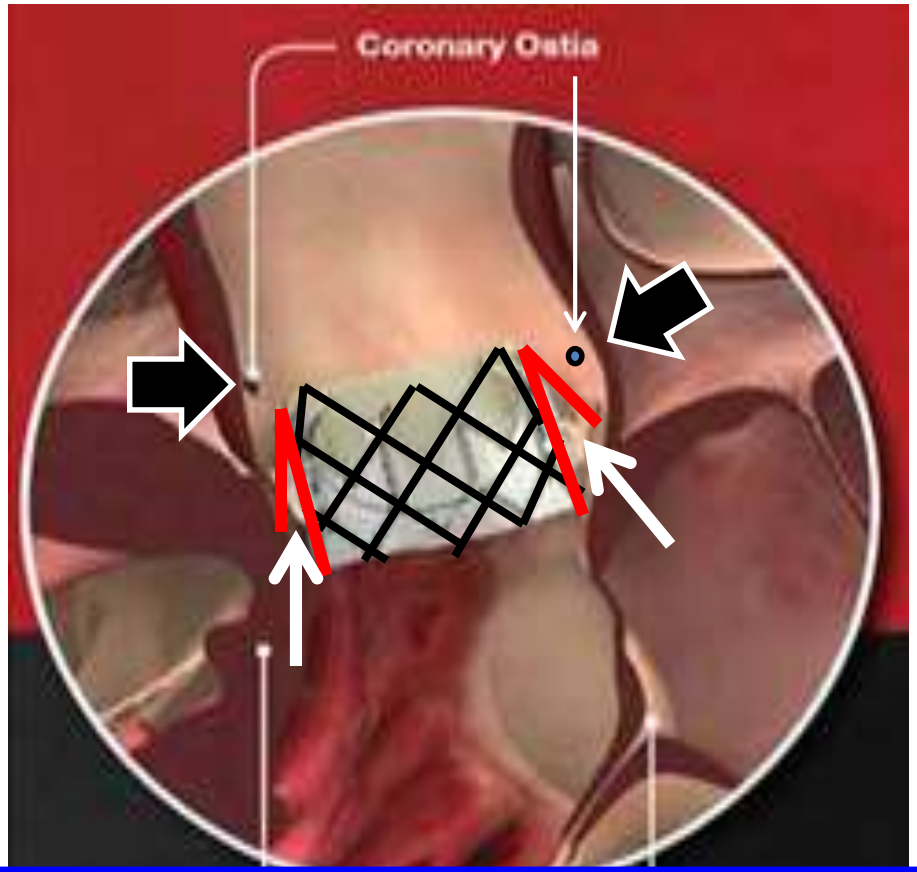


A catheter directs an electrified guidewire through the base of the left aortic cusp into a snare in the left ventricular outflow tract **(A)**. After snare retrieval **(B)**, the mid-shaft of the guidewire is electrified to lacerate the leaflet **(C)**. The leaflet splays after TAVR permitting coronary flow **(D)**.

The advantages of J-valve in coronary protection

1. Deploy the claspers and secure the leaflets
2. Deploy the valve in the frame of claspers.





The low frame design and the direct anchoring mechanism that grasping the native or surgical prostehtic leaflets (ViV) between three claspers and valve stent can prevent the valve tissue from protruding into the sinus of Valsalva, which would mitigate the risk of coronary obstruction and facilitate future coronary reaccess.

TAKE HOME MESSAGES

- **Acute coronary obstruction (ACO)** after TAVR is a well-known and feared complication.
- It can be prevented by careful pre-procedural image studies and **planning** and **coronary protection** if needed.
- **Delayed CO** following TAVR is a **rare** phenomenon that is associated with a **high** in-hospital mortality rate.
- Clinicians should be aware that **DCO can occur after the originally successful TAVR procedure** and **have a low threshold for performing coronary angiography when clinically suspected**.
- Future studies should explore prosthesis design or delivery options for patients undergoing TAVR to reduce the occurrence of iatrogenic coronary ostial obstruction.