

28<sup>th</sup>  
**TCTAP**

**MAY 6-9, 2023**  
GRAND WALKERHILL SEOUL,  
KOREA



# Is TEVAR Safe and Durable in Long Term?

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# History of TEVAR

1951

Drs., Cooley and DeBakey performed the first open abdominal aortic aneurysm repair, termed "tangential excision and lateral aortorrhaphy"

1991, *Annals of Vascular Surgery*

Parodi et al detailed five cases of successful AAA exclusion with endovascular graft placements in Buenos Aires, Argentina, 15 years after Drs., Parodi started "intraluminal graft" experiments in canine models (1976)

1999

FDA approved endovascular stent-grafts for EVAR

2008, *Journal of Vascular Surgery*

Gore TAG trial reported 2.8% aneurysm-related mortality in TEVAR patients compared to 11.7% in open thoracic aneurysm repair at five years

1950

1952

Drs., Cooley and DeBakey reported successful repair of a thoracic aortic aneurysm

1990

1994, *NEJM*

Dake et al reported 13 cases of endovascular repair of the descending thoracic aortic aneurysm with customized home-made endovascular grafts

2000

2005

FDA approved endovascular stent grafts for TEVAR

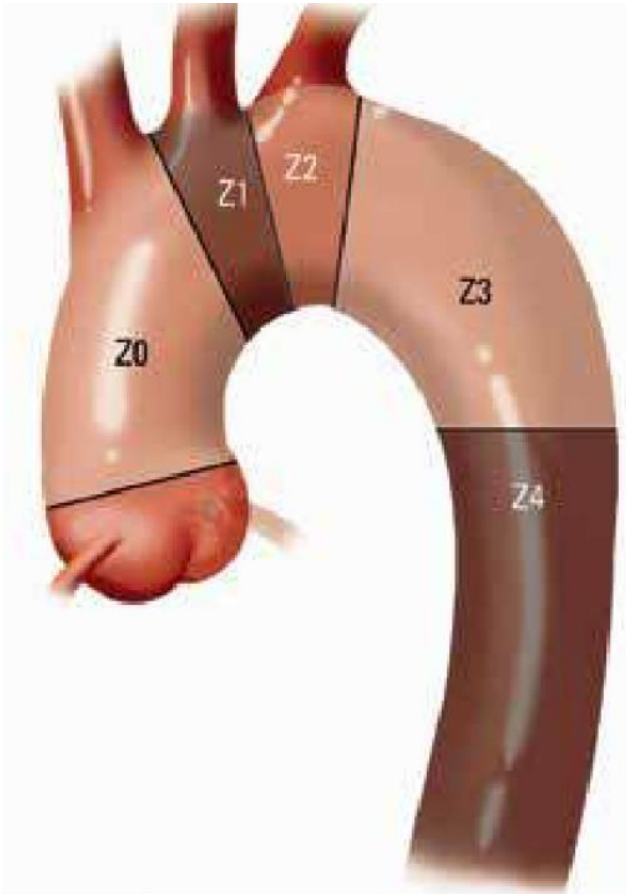
2010

2010, *ACCF/AHA Guideline*

Society guidelines related to TEVAR were first published in 2006 and exponentially increased in 2010s with the popularization of TEVAR

# General Approach in TEVAR: Landing Zone

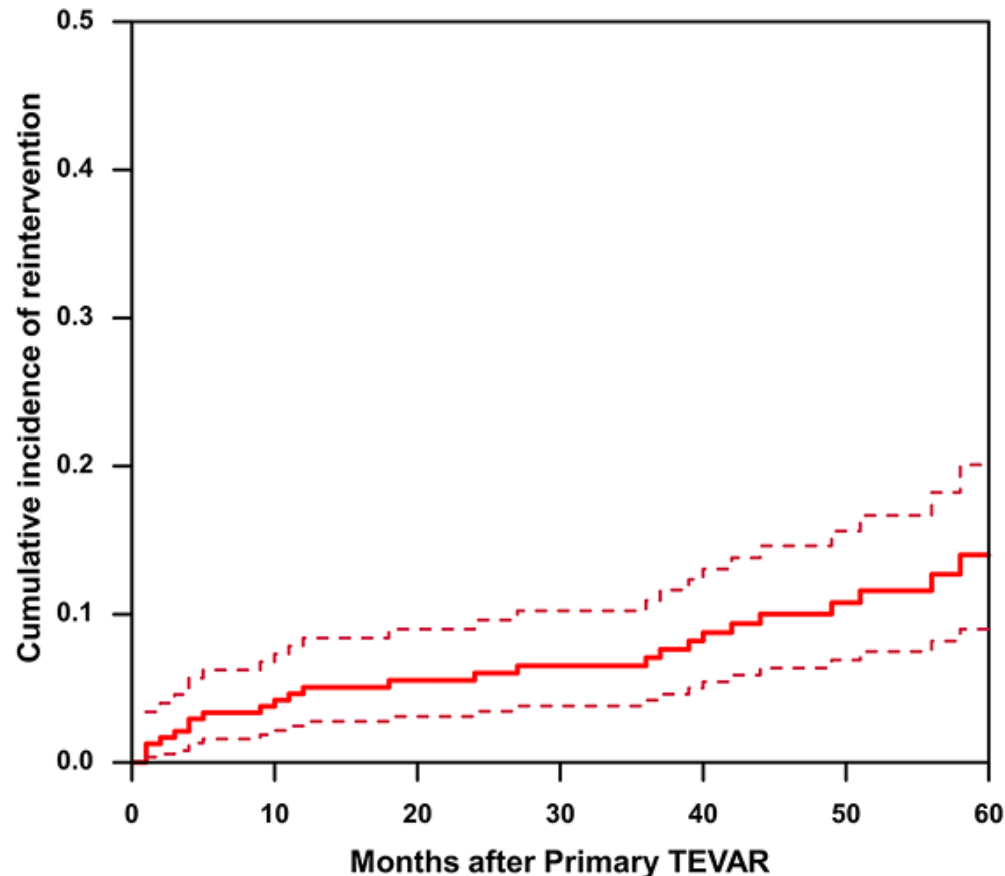
## Ideal proximal and distal landing zones



- Uniform diameter over a straight segment of the vessel
- Nonaneurysmal
- Relatively free of calcification or thrombus
- Sufficiently long enough to create a 20mm seal zone

# Risk of Re-Intervention after TEVAR

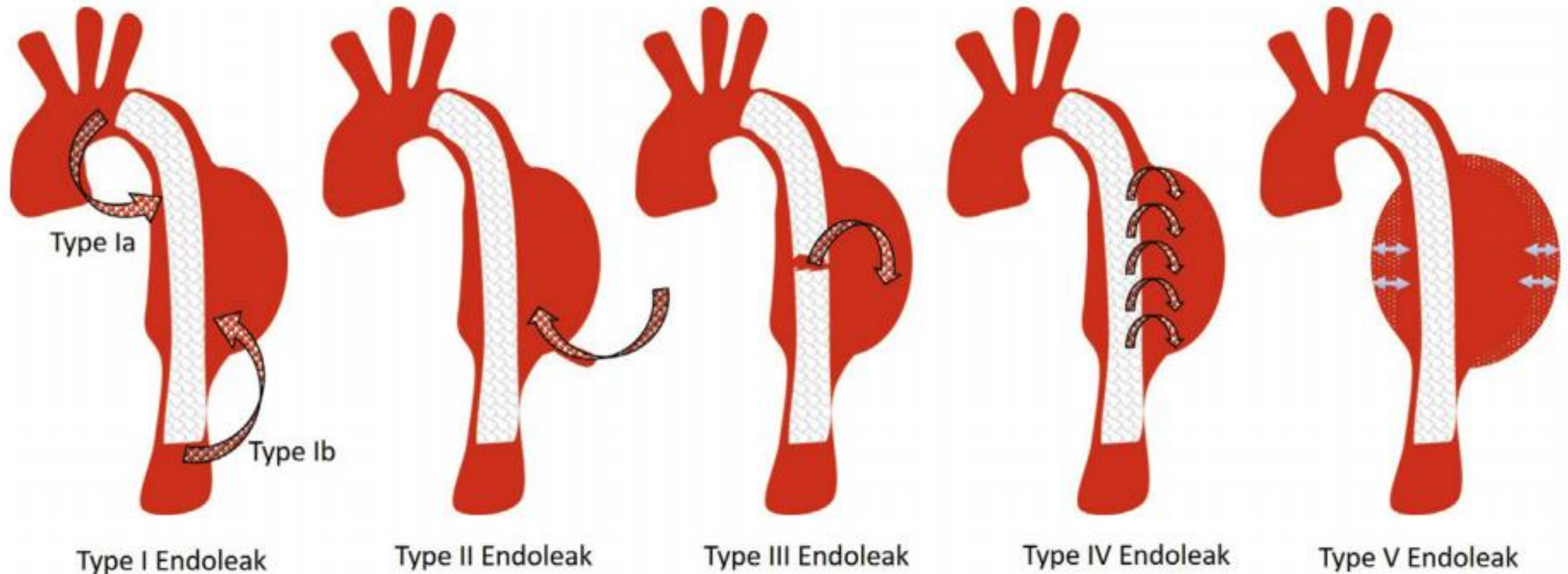
Risk of re-intervention after TEVAR increases as times goes by



- Single center retrospective analysis
- TBAD, 238 patients enrolled
- Mean follow up:  $63.7 \pm 25.9$  months
- 27 (11.3%) cases of re-intervention
- Cumulative incidence 5%, 7%, 14% in 1-,3-,5 years

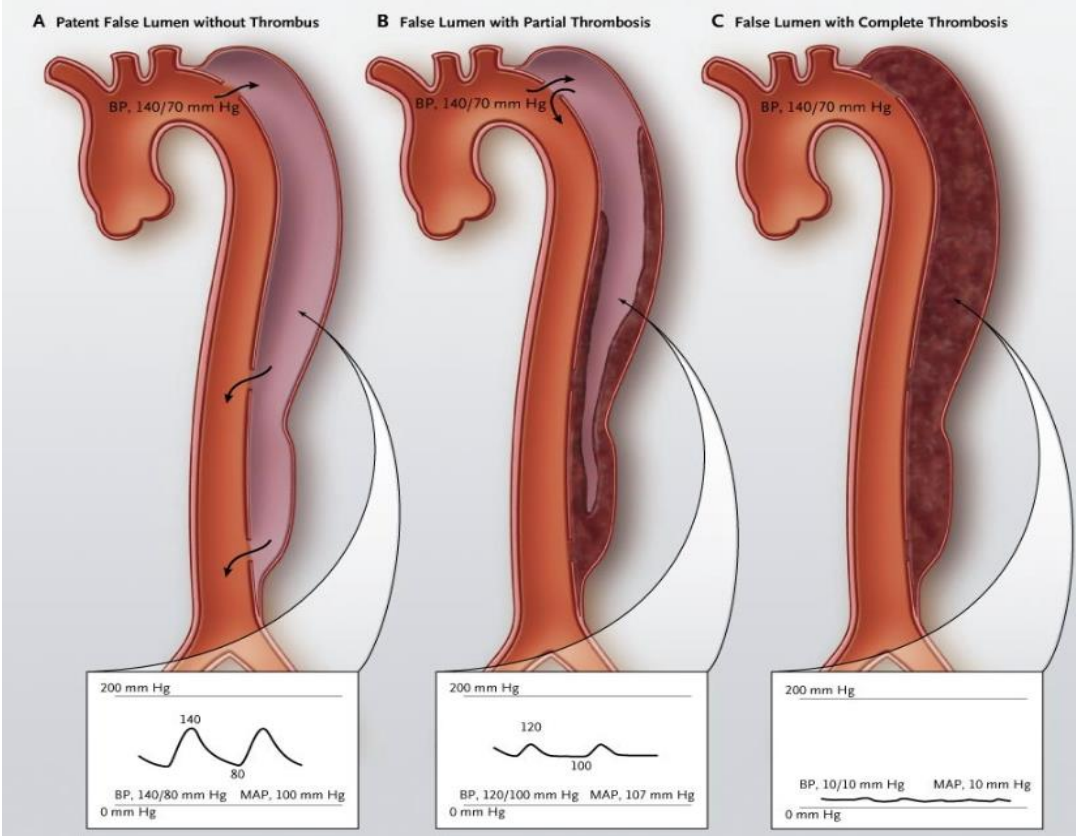
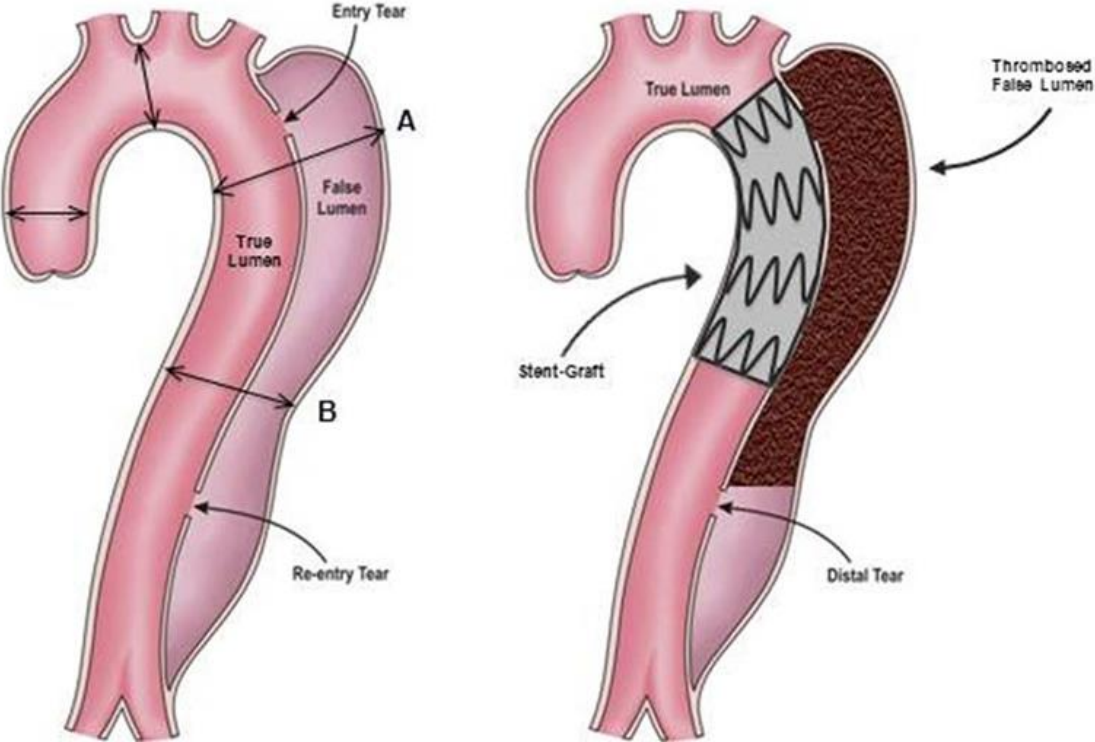
# Re-Intervention in TEVAR: Endoleak

## Classification of endoleak in TEVAR



# Re-Intervention in TEVAR: FL enlargement

## Partial thrombosis vs. Complete thrombosis



## A 53-year-old male Patient

**C/C**

Abrupt onset chest & back pain

**P/H**

Hypertension

**S/H**

N-S

**F/H**

N-S

**HPI**

He presented with abrupt onset chest & back pain.

**CTA (2005.01.05)**

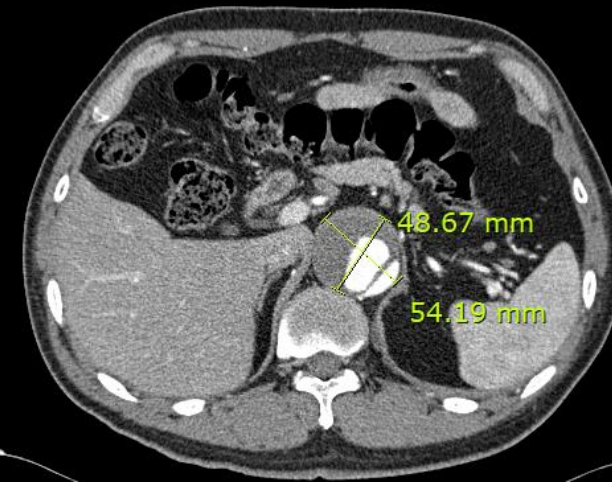
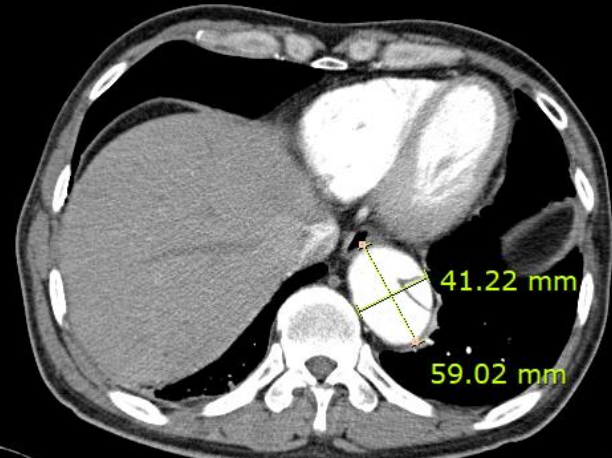
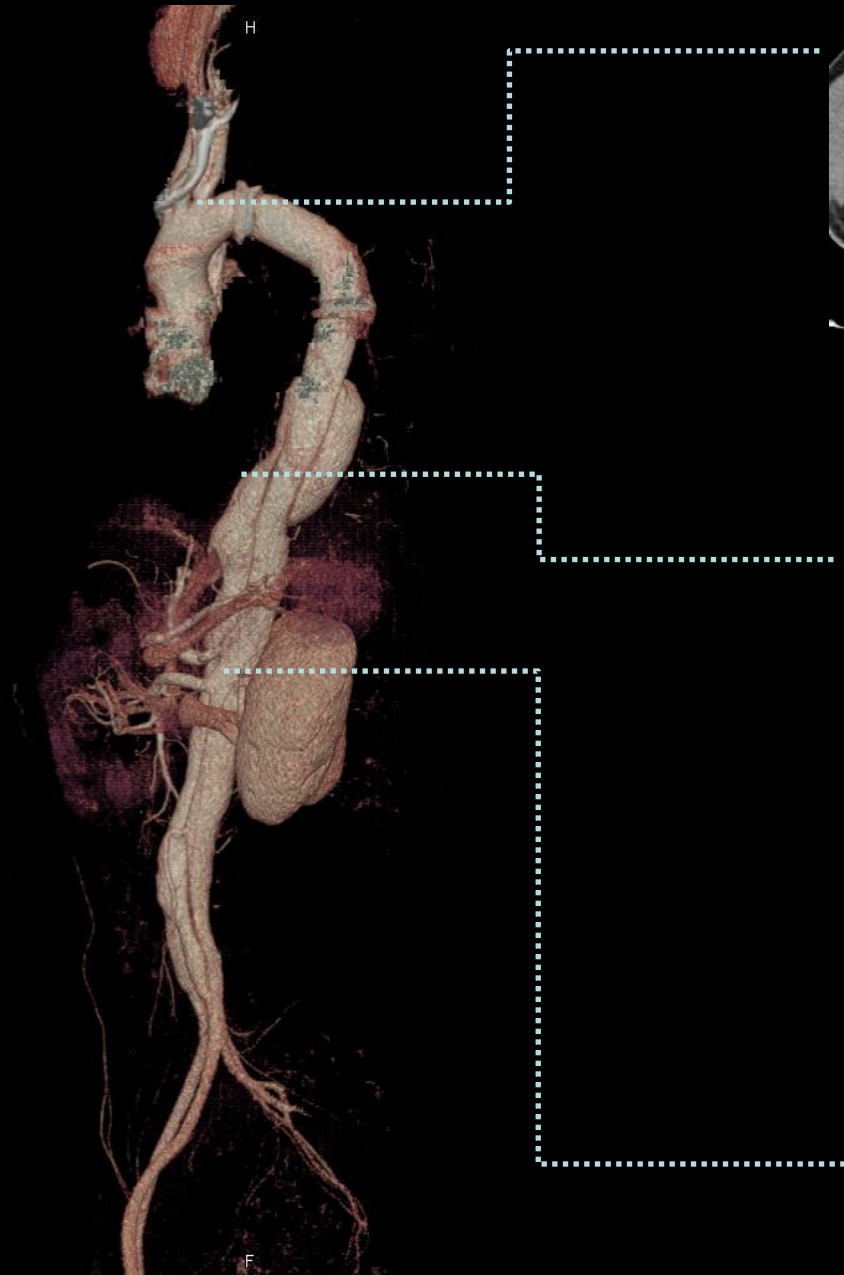


**2005.01.24 OP**

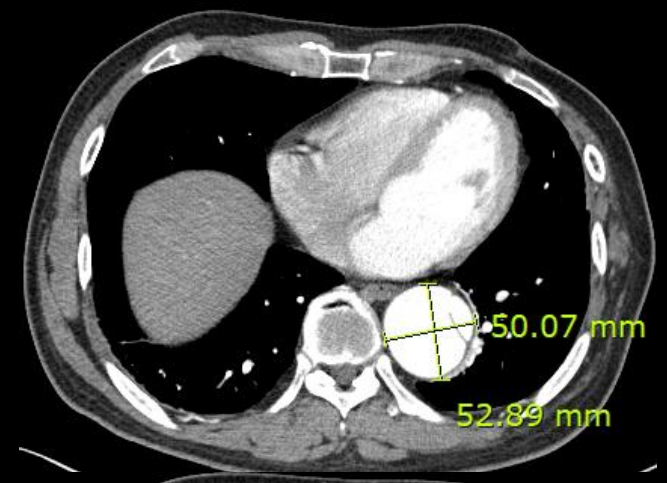
**Graft interposition of  
Descending thoracic aorta**



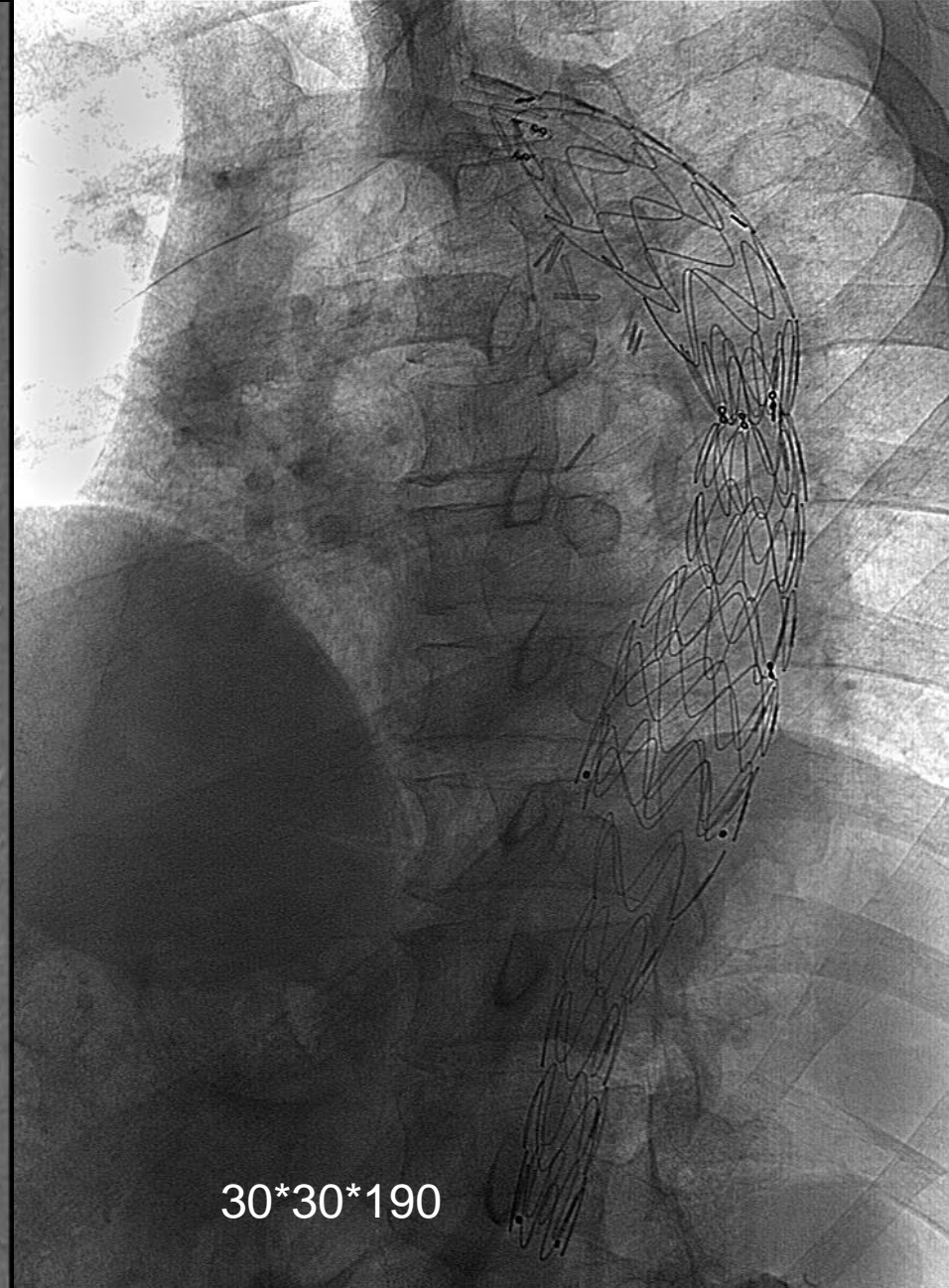
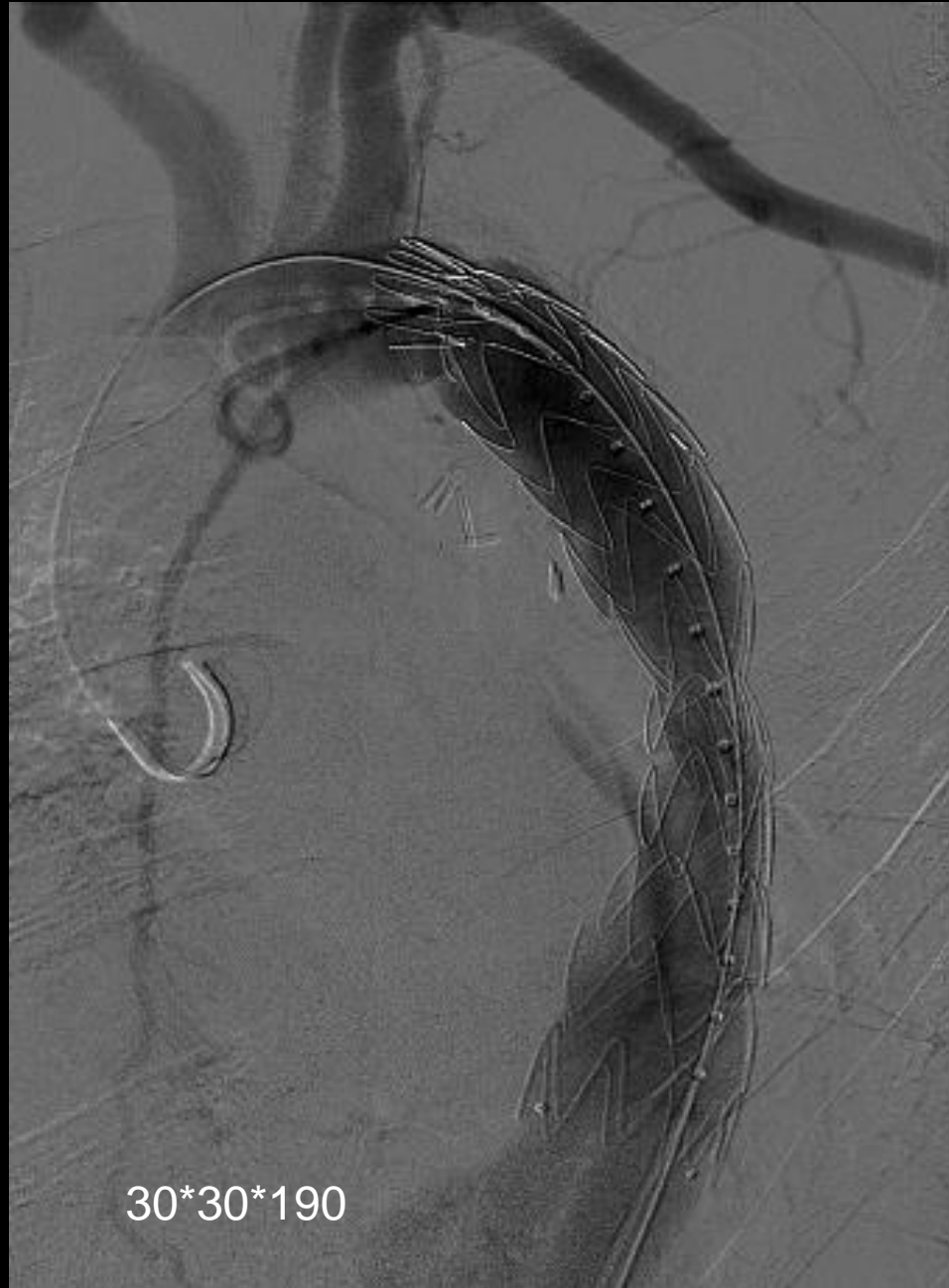
2008.01.23 CTA



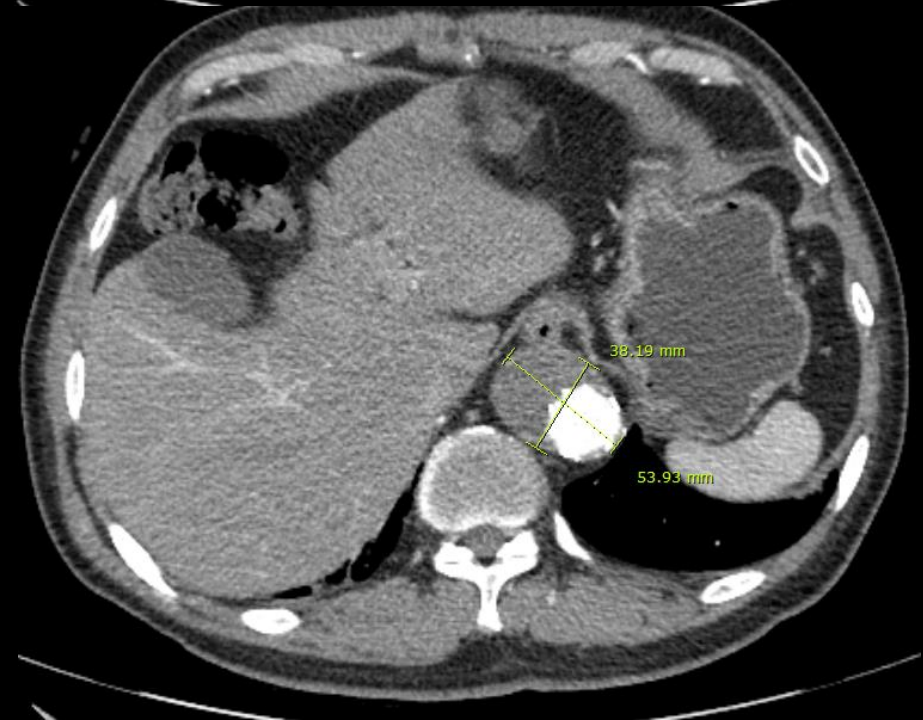
2013.08.07 CT



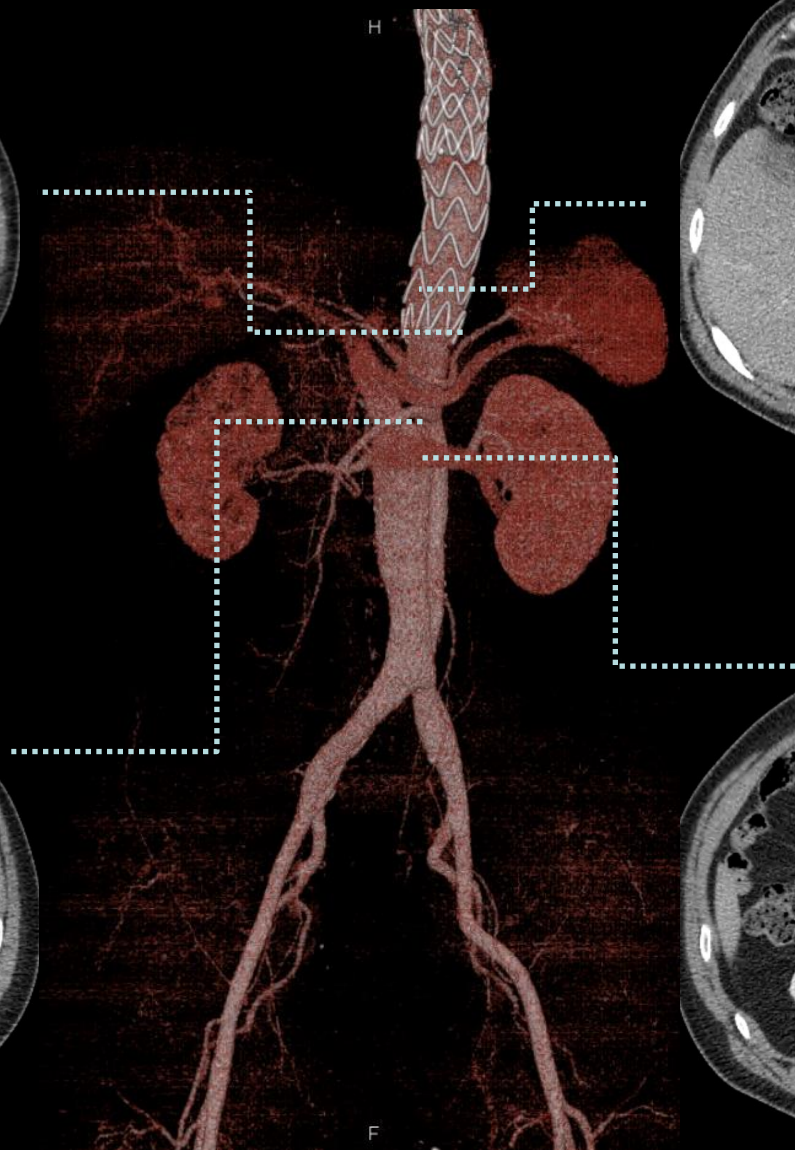
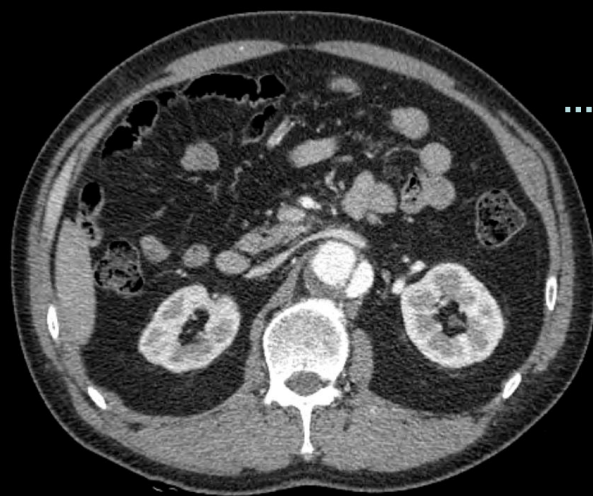
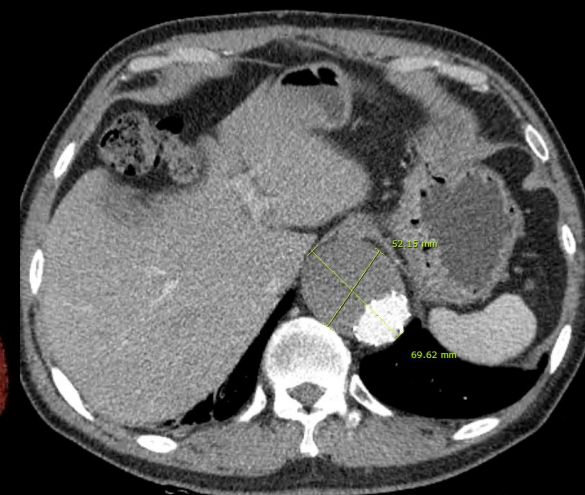
# TEVAR (2013.08.27)



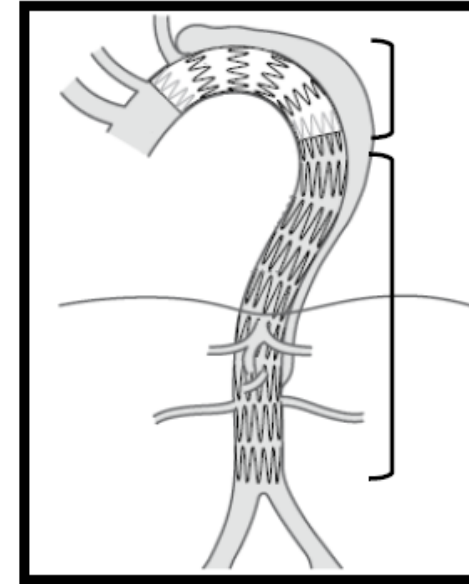
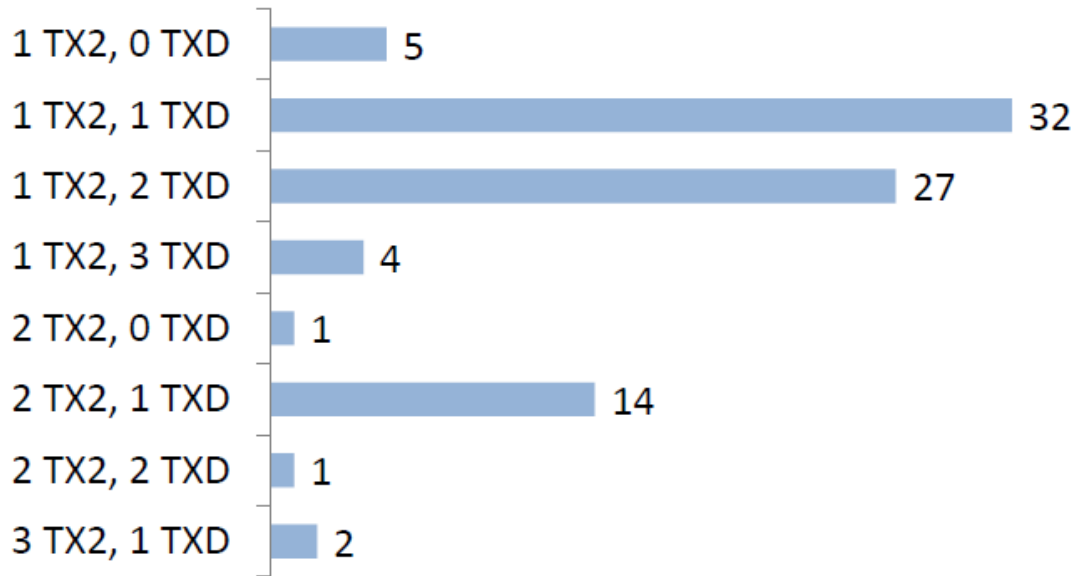
2014.10.29 CT



2016.11.22 CT

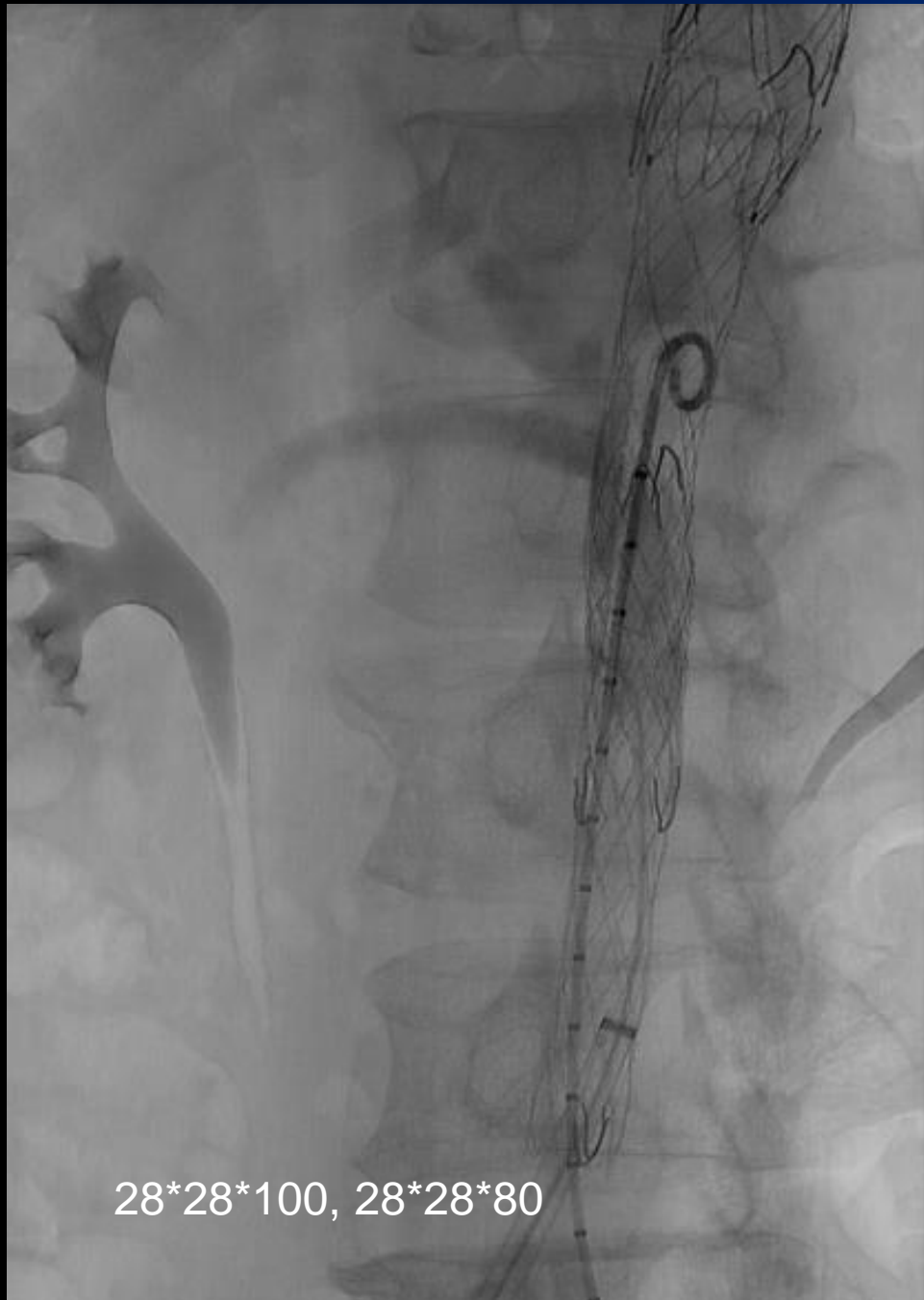


# STABLE I Study - Devices

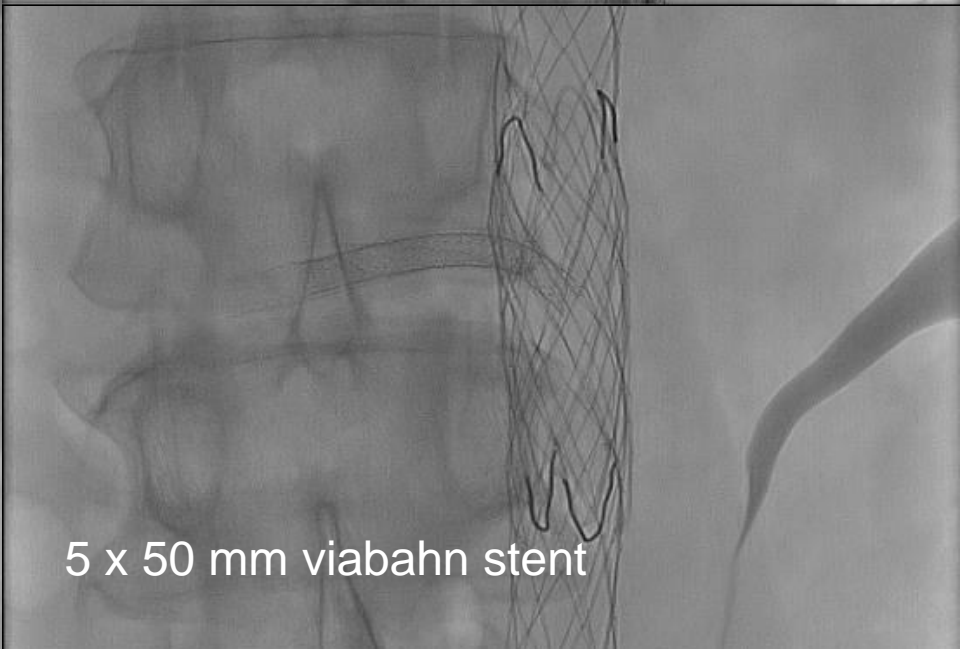


- Dissection stent was placed in 93% of patients  
(6 patients did not receive a dissection stent at physician's discretion)
- A majority of patients received only 1 TX2 component (79%)
- Successful device deployment in all patients, with 100%

# 2016.12.29 EVAR & Rt renal artery stent

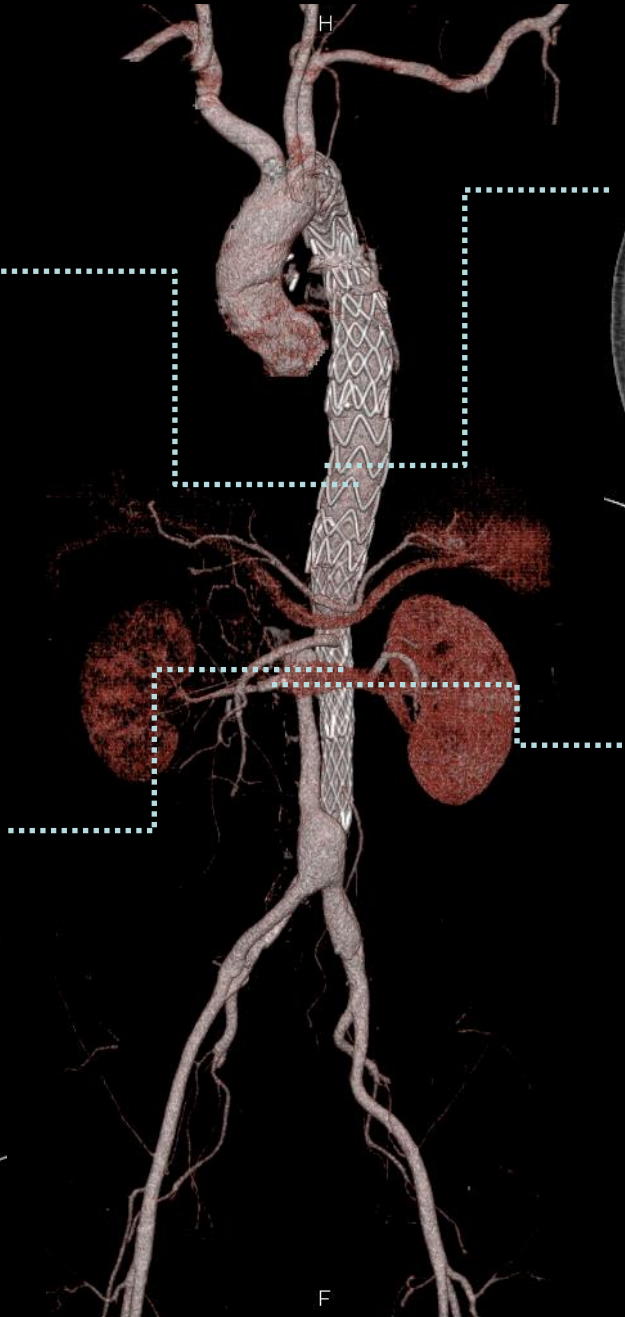
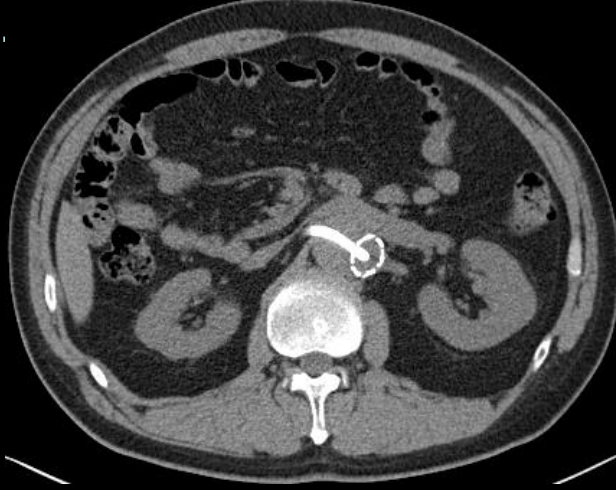
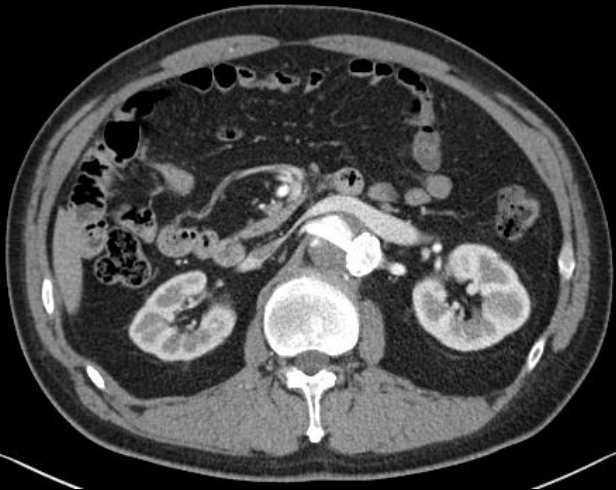


28\*28\*100, 28\*28\*80



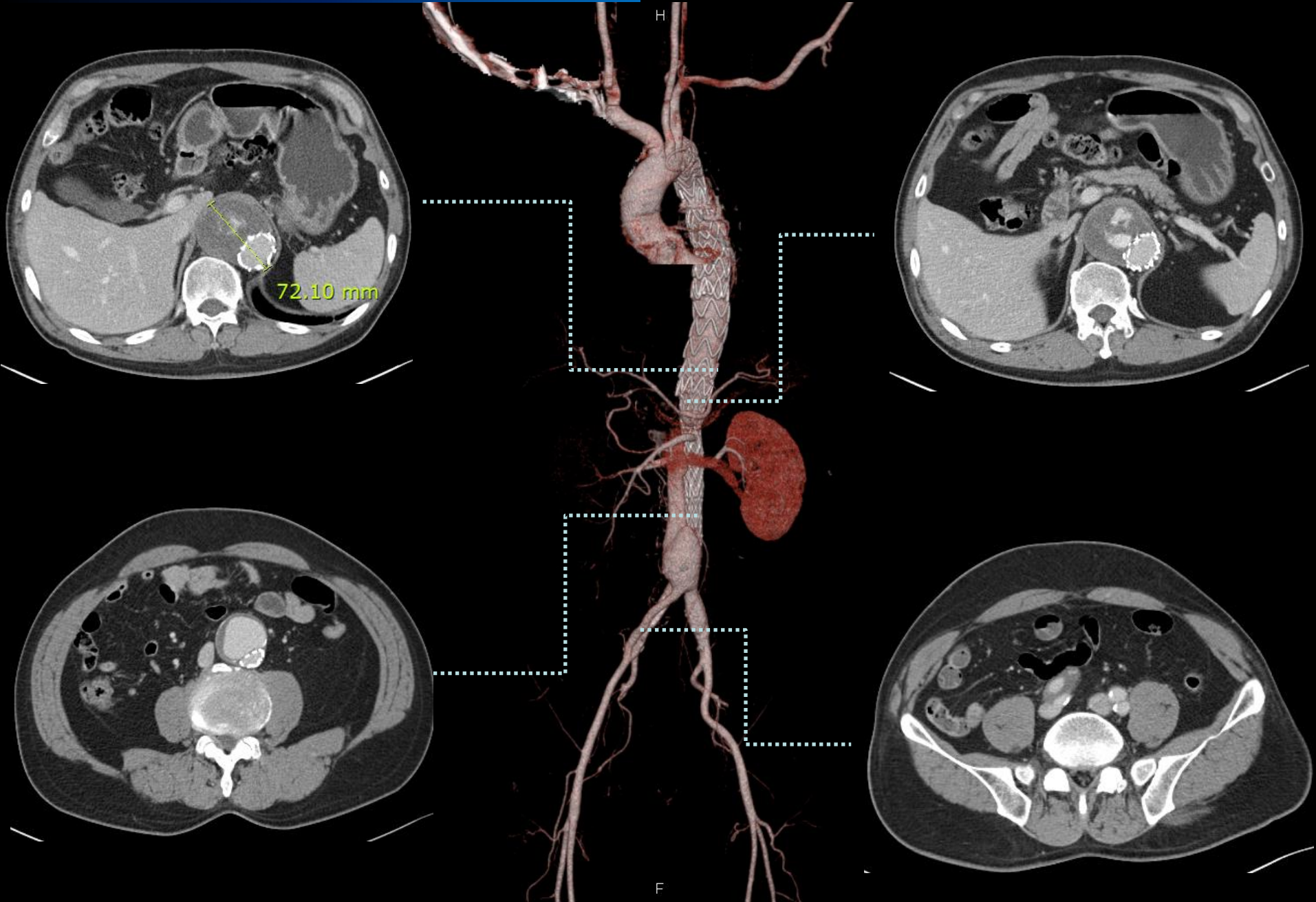
5 x 50 mm viabahn stent

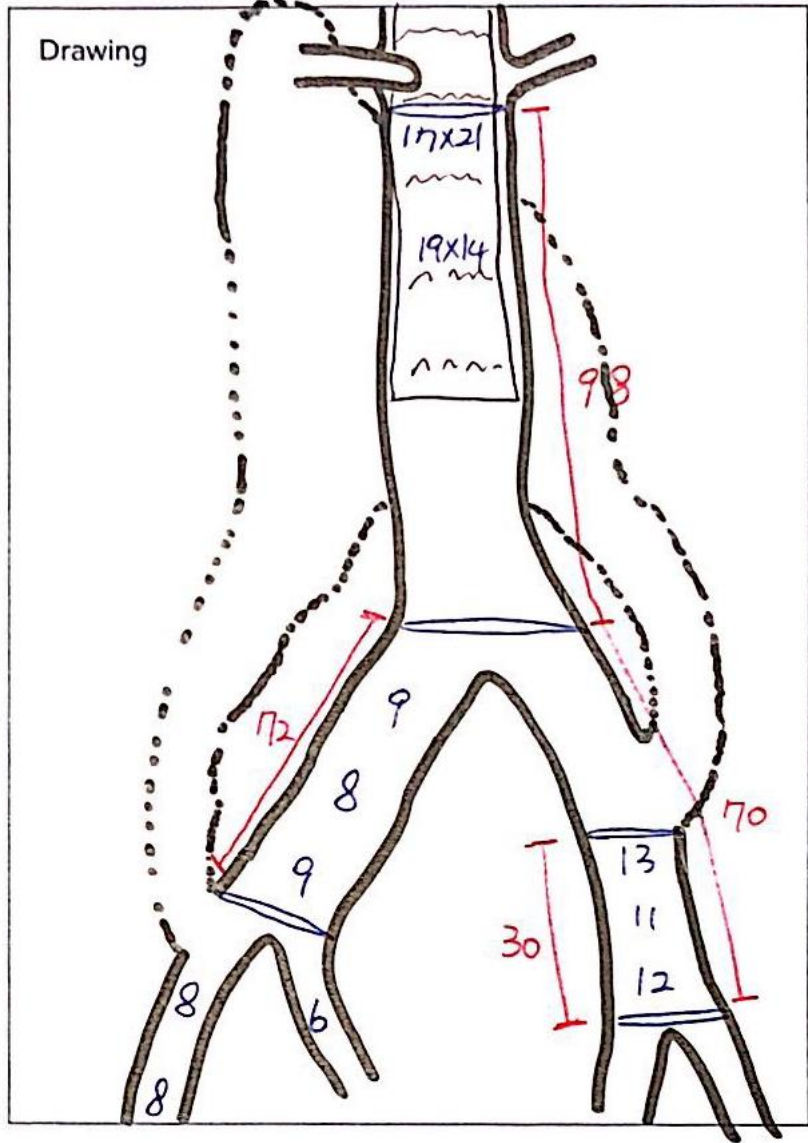
2017.07.12 CT



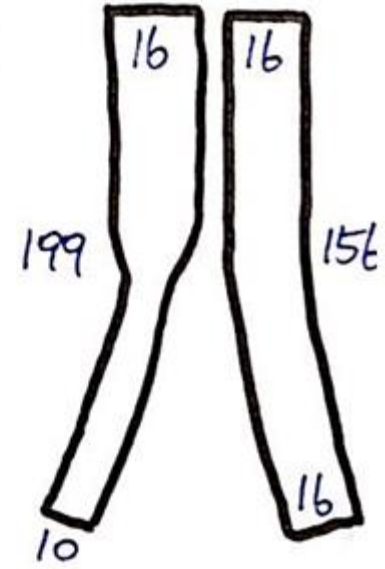
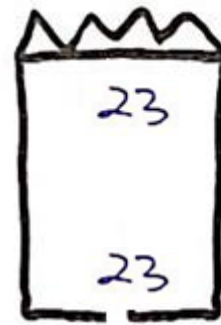


2020.01.09 CT

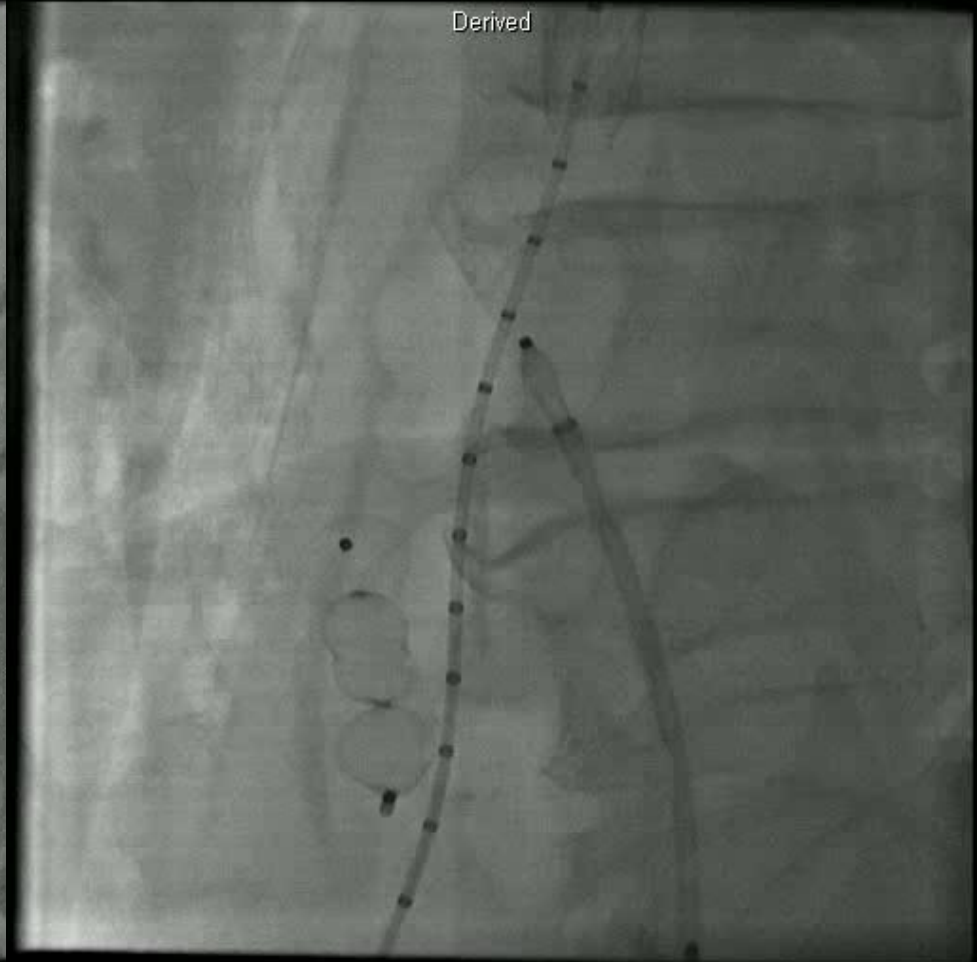




Plane C



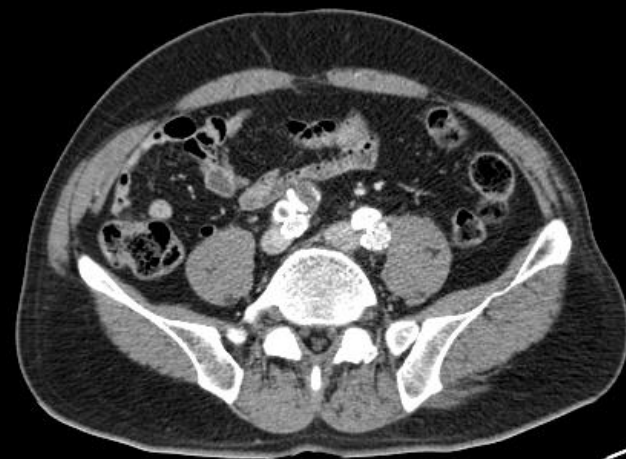
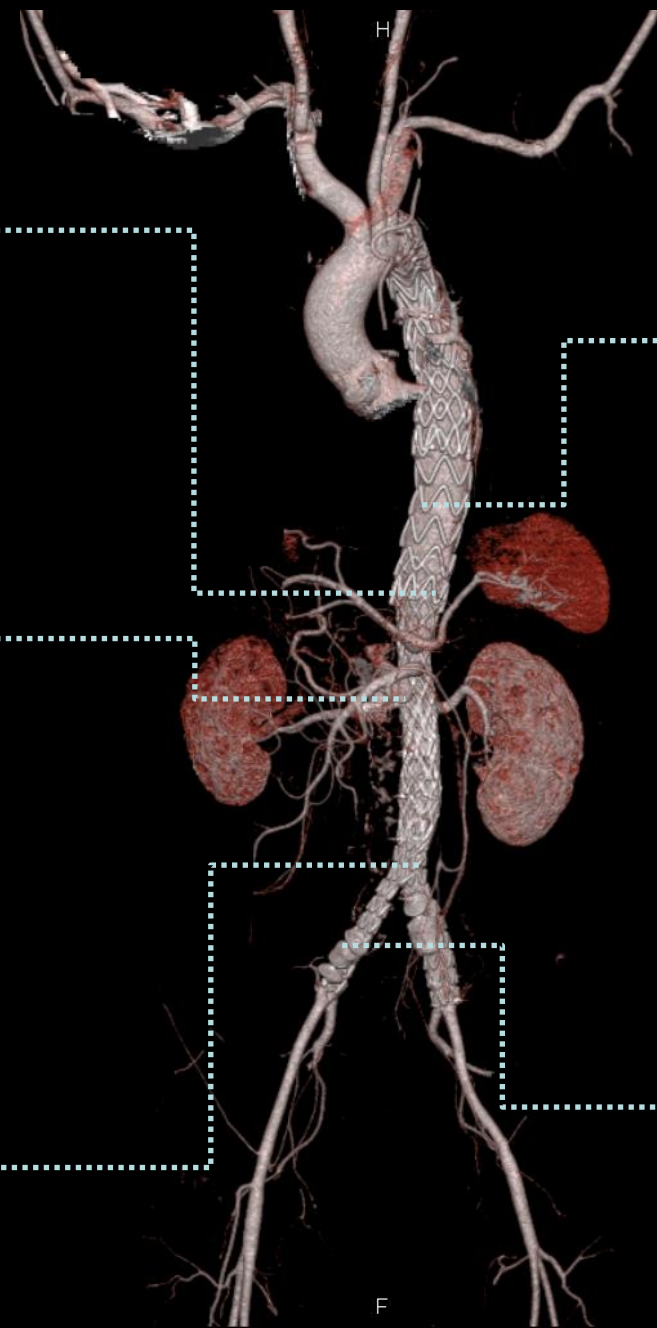
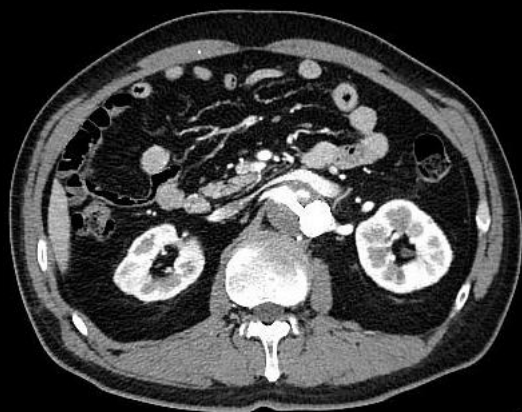
# 2020.03.16 EVAR, Vascular plug insertion



# 2020.03.16 EVAR, Vascular plug insertion

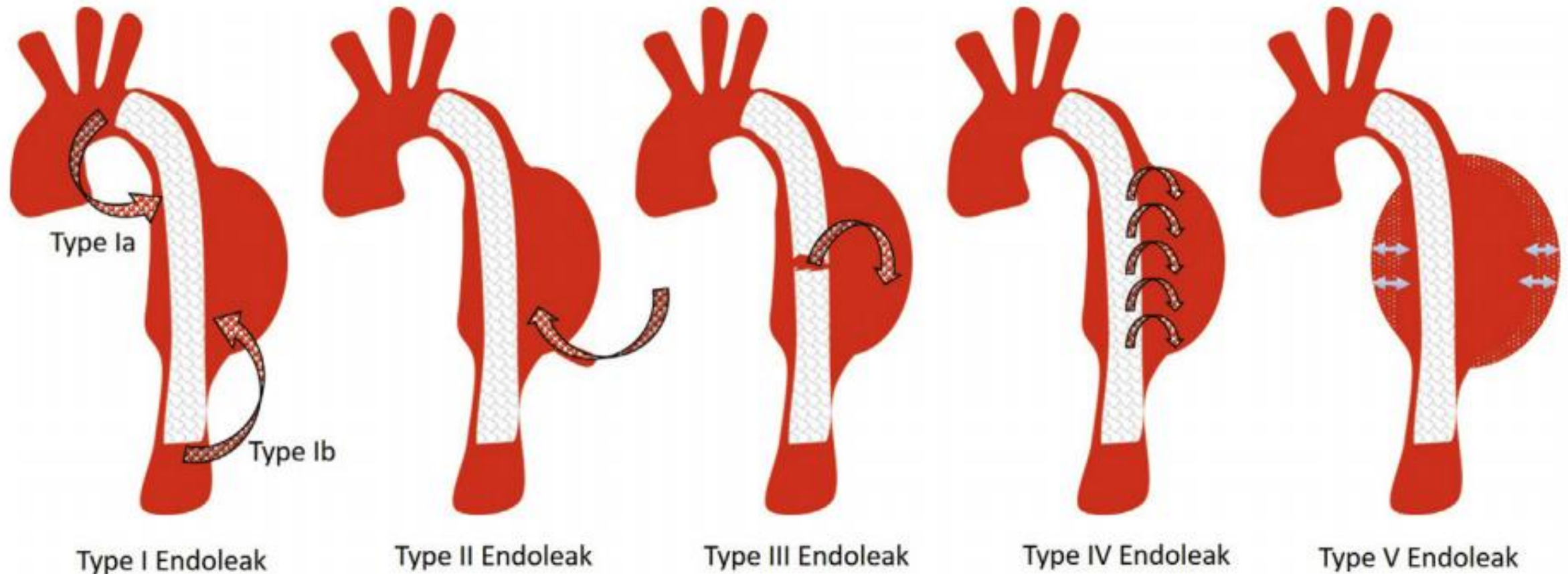


2020.04.20 CT f/u



# Re-Intervention in TEVAR: Endoleak

## Classification of endoleak in TEVAR



## 76/ Male

**C/C** Chest pain

**P/H** HTN

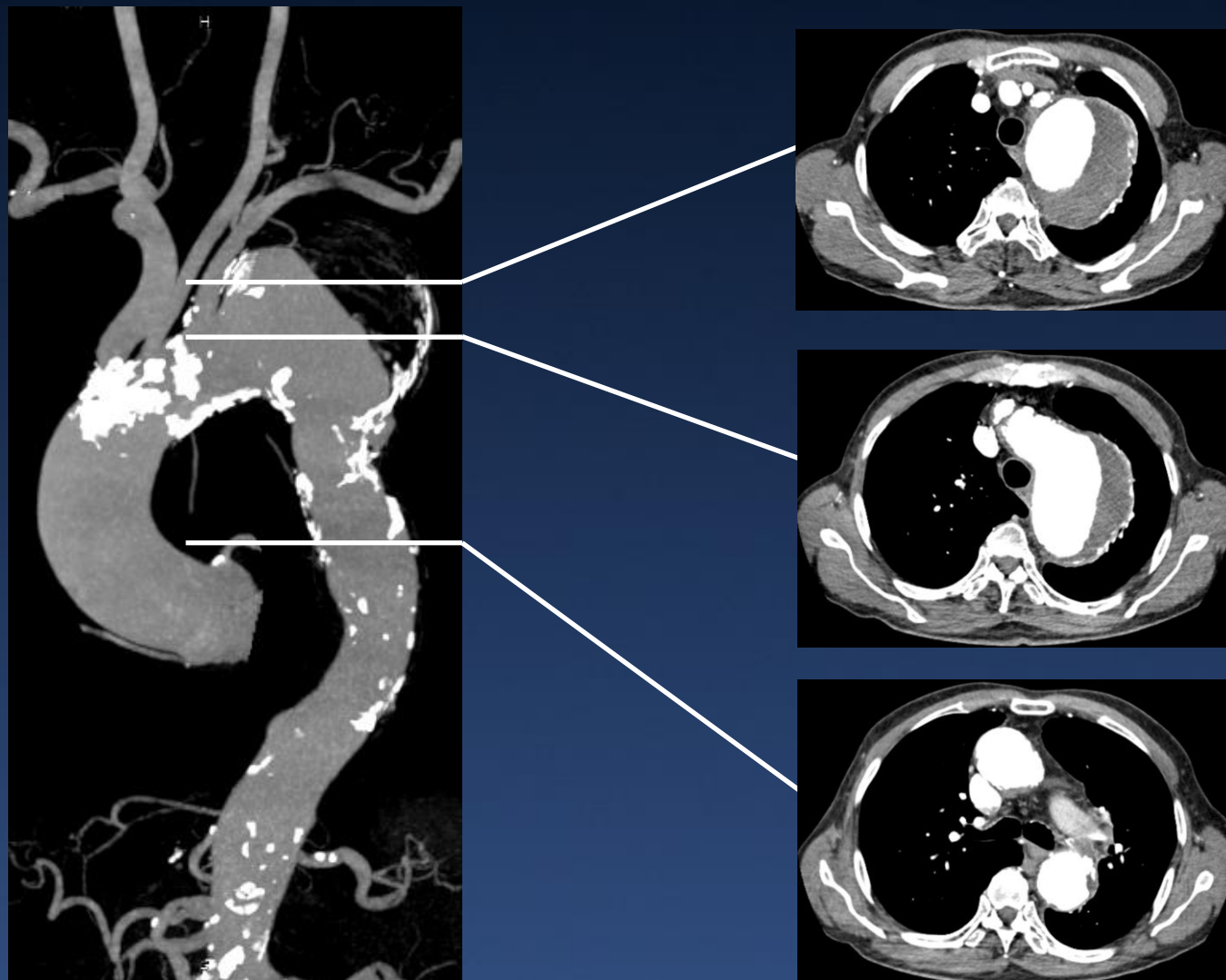
No known Hx of DM, Pul. TBc, Hepatitis,

**S/H** Smoking : None

Alcohol : None

**F/H** Father: HTN

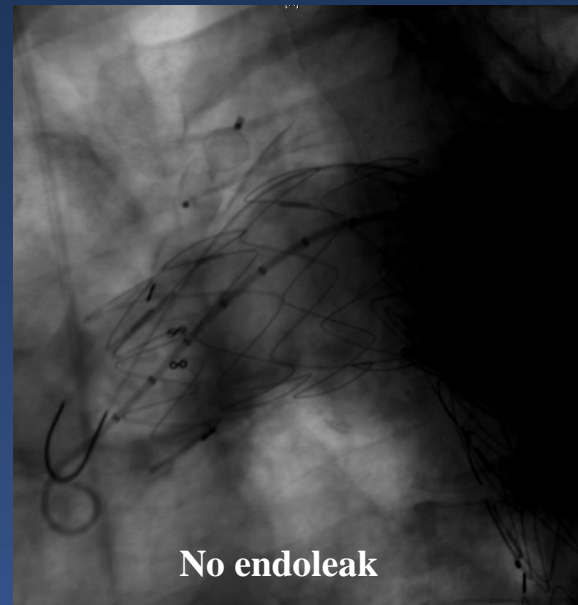
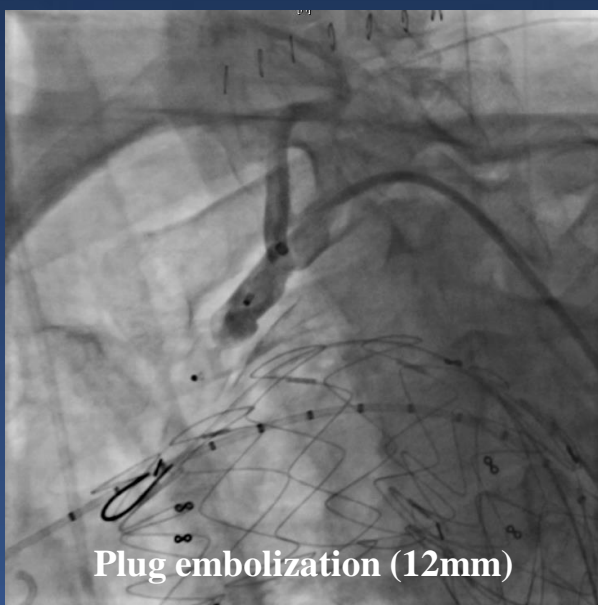
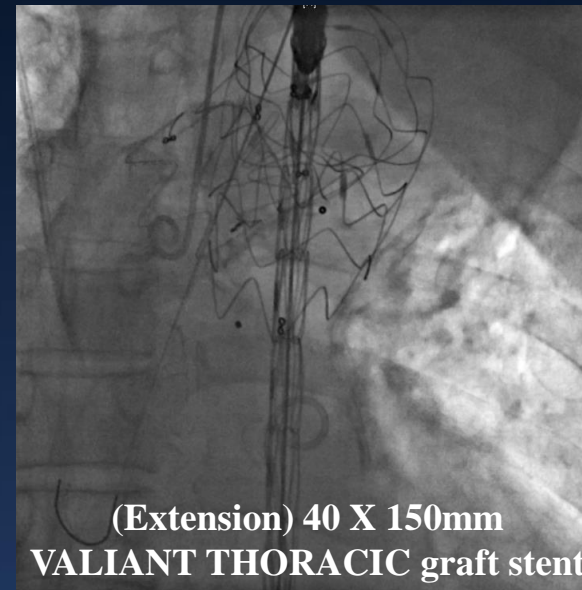
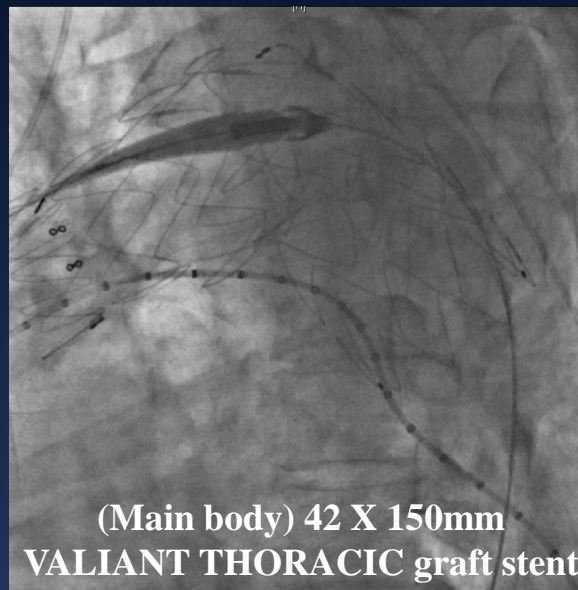
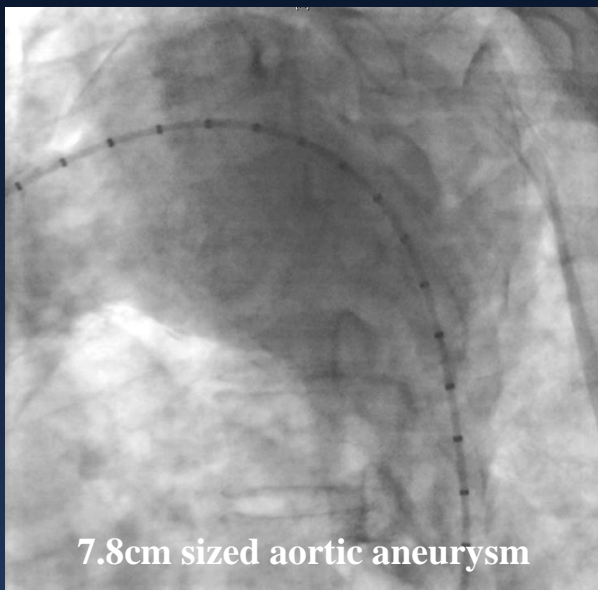
## 2017.08.16 Chest CTA



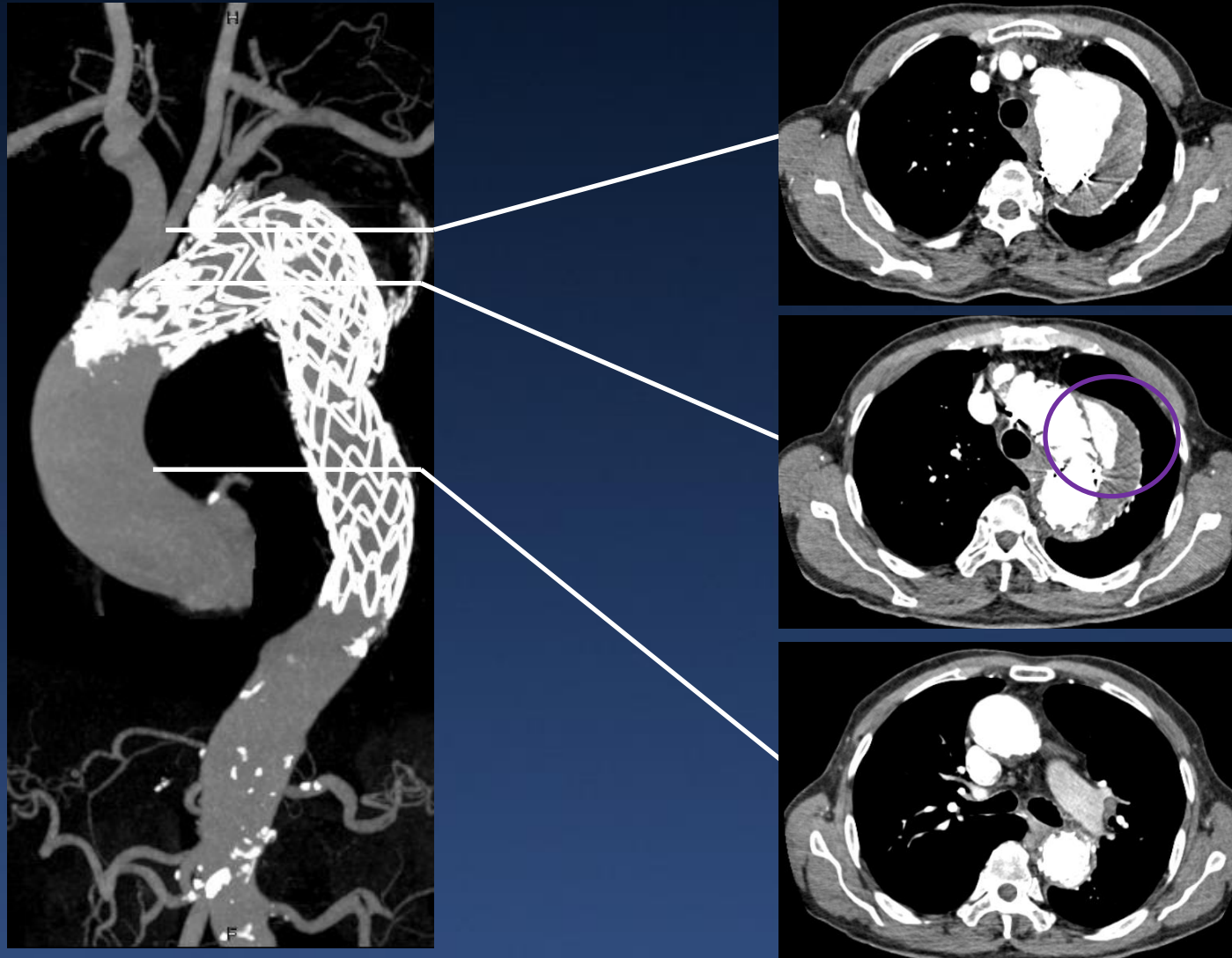
**Markedly increased size of fusiform aneurysm in aortic arch with intramural hematoma**  
Atherosclerotic wall thickening, intimal calcifications and multifocal ulcer-like projections  
**(maximal diameter 7.8cm)**



# 2017.08.21 TEVAR



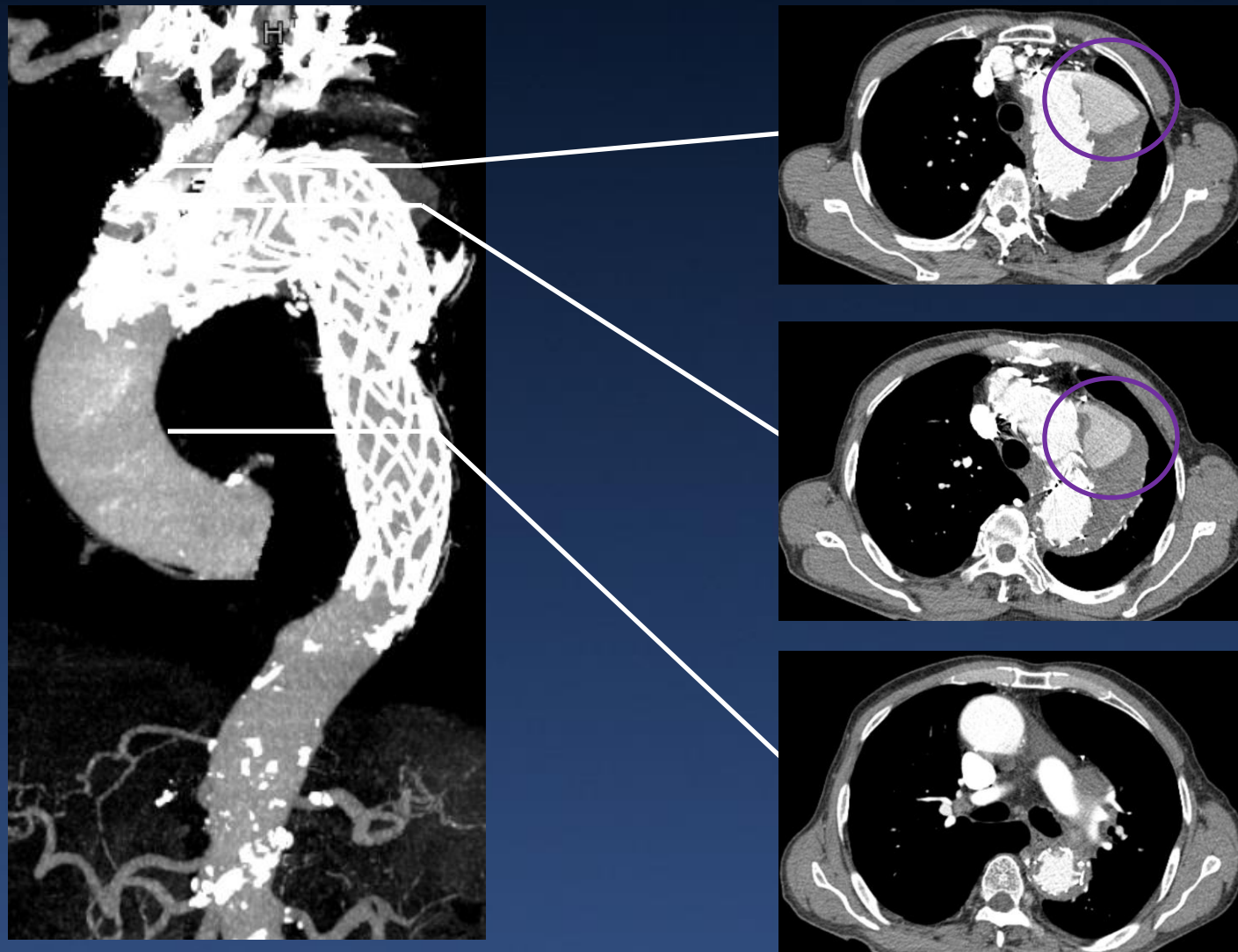
# 2017.09.19 Chest CTA



Evidence of TEVAR from aortic arch to descending thoracic aorta  
without remarkable change of aneurysmal dilatation and intramural hematoma in aortic arch

**Visible endo-leak in aortic arch**

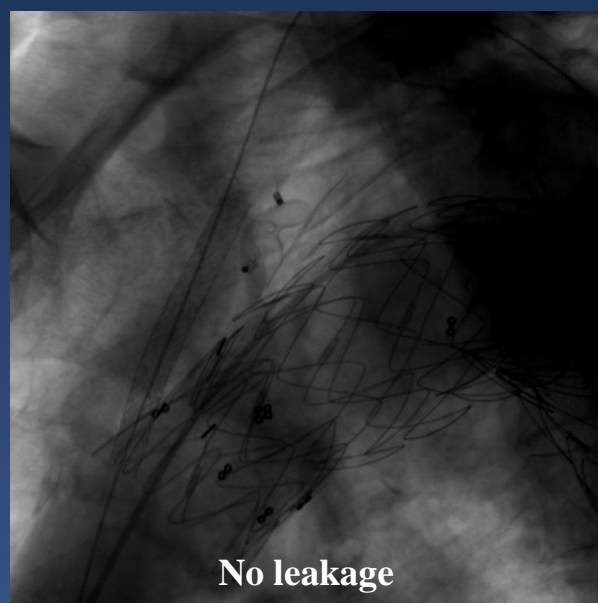
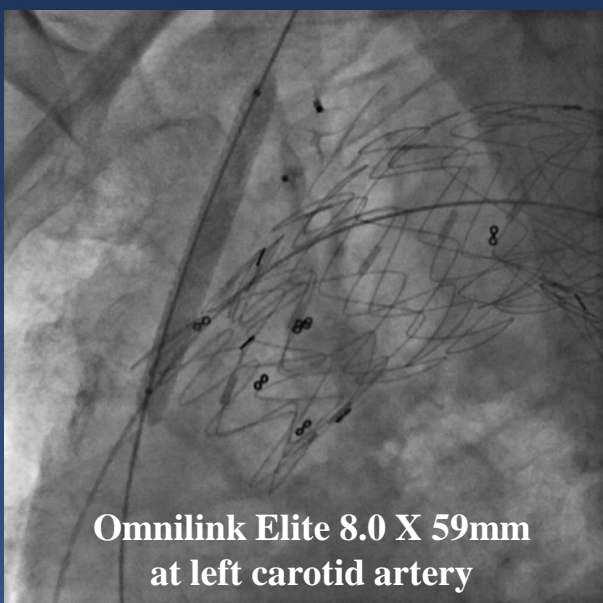
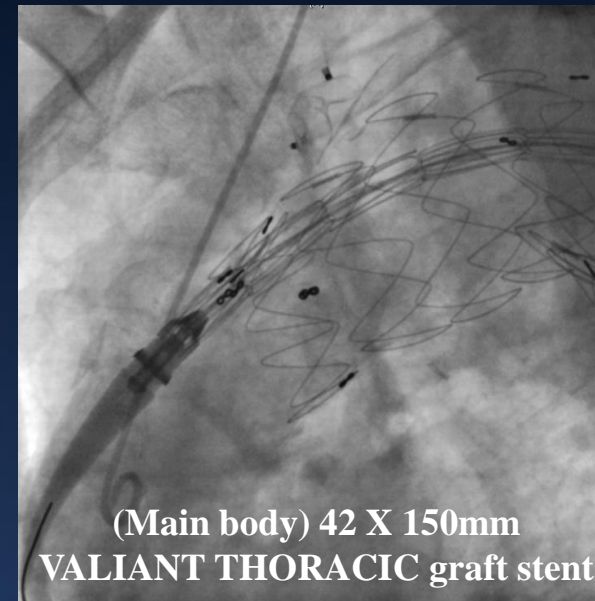
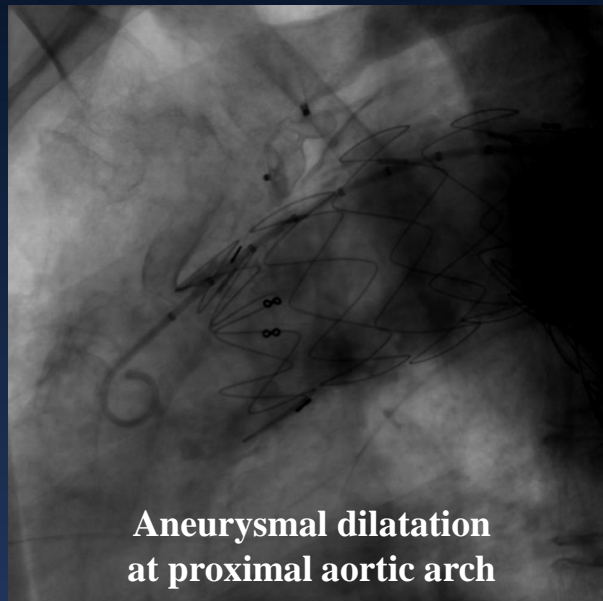
## 2017.12.05 Chest CTA



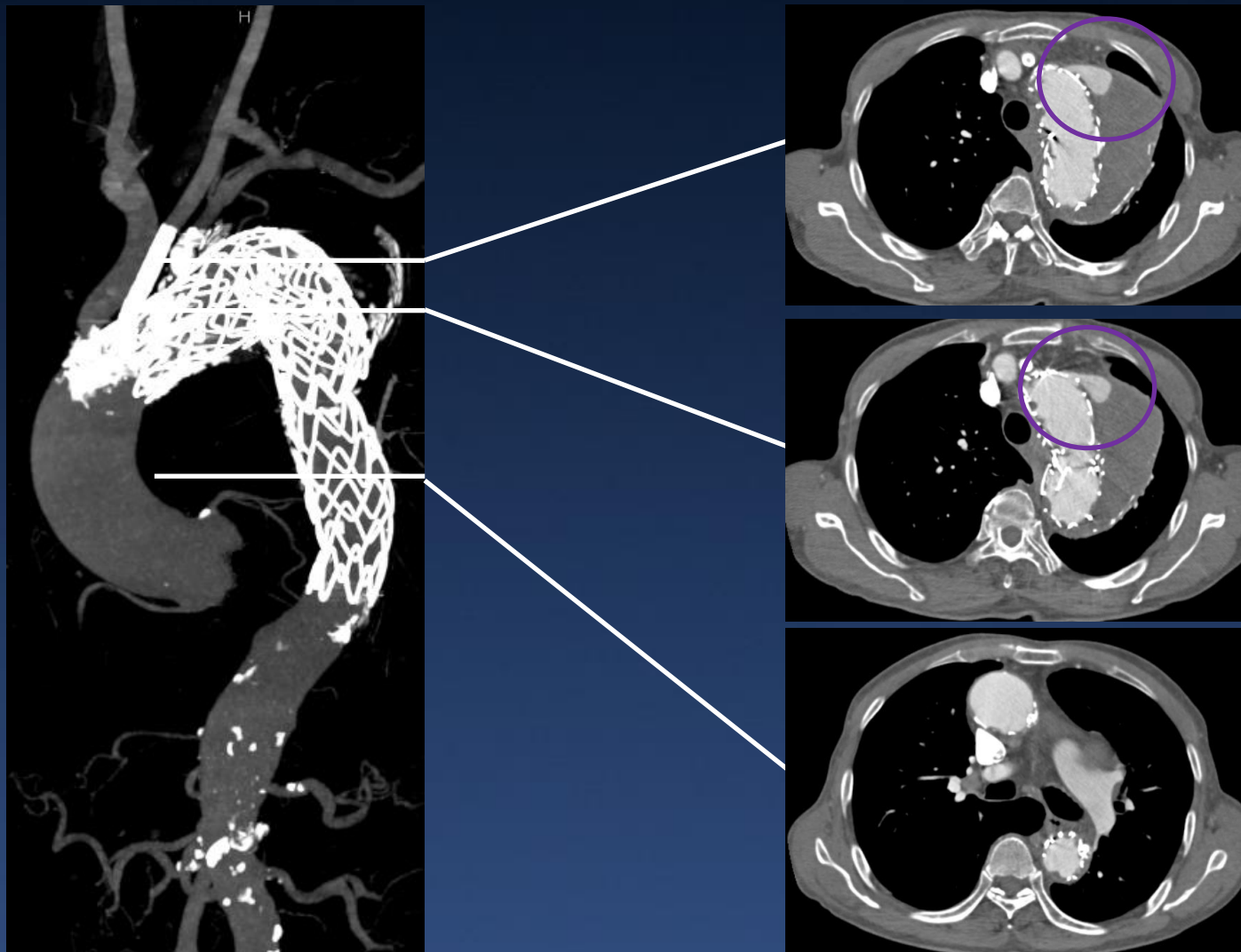
Evidence of TEVAR from aortic arch to descending thoracic aorta  
Increased size of thrombosed aneurysmal dilatation in aortic arch (max. diameter 8 cm-> 8.9cm)

**Aggravation of endo-leak in aortic arch**

# 2017.12.06 TEVAR



## 2018.01.16 Chest CTA

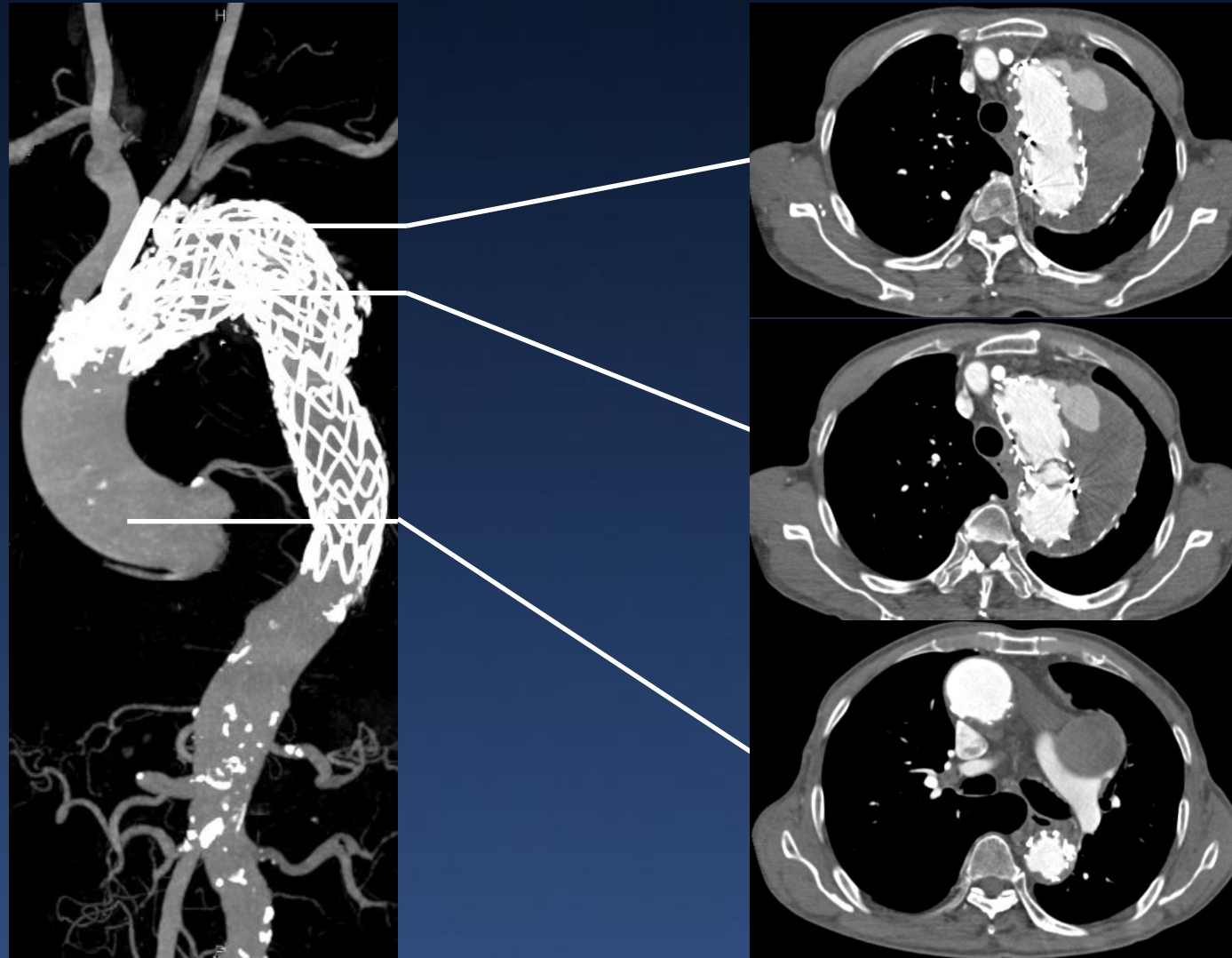


Evidence of TEVAR from aortic arch to descending thoracic aorta

No remarkable change of thrombosed aneurysmal dilatation in aortic arch (max. diameter: 8.9cm)

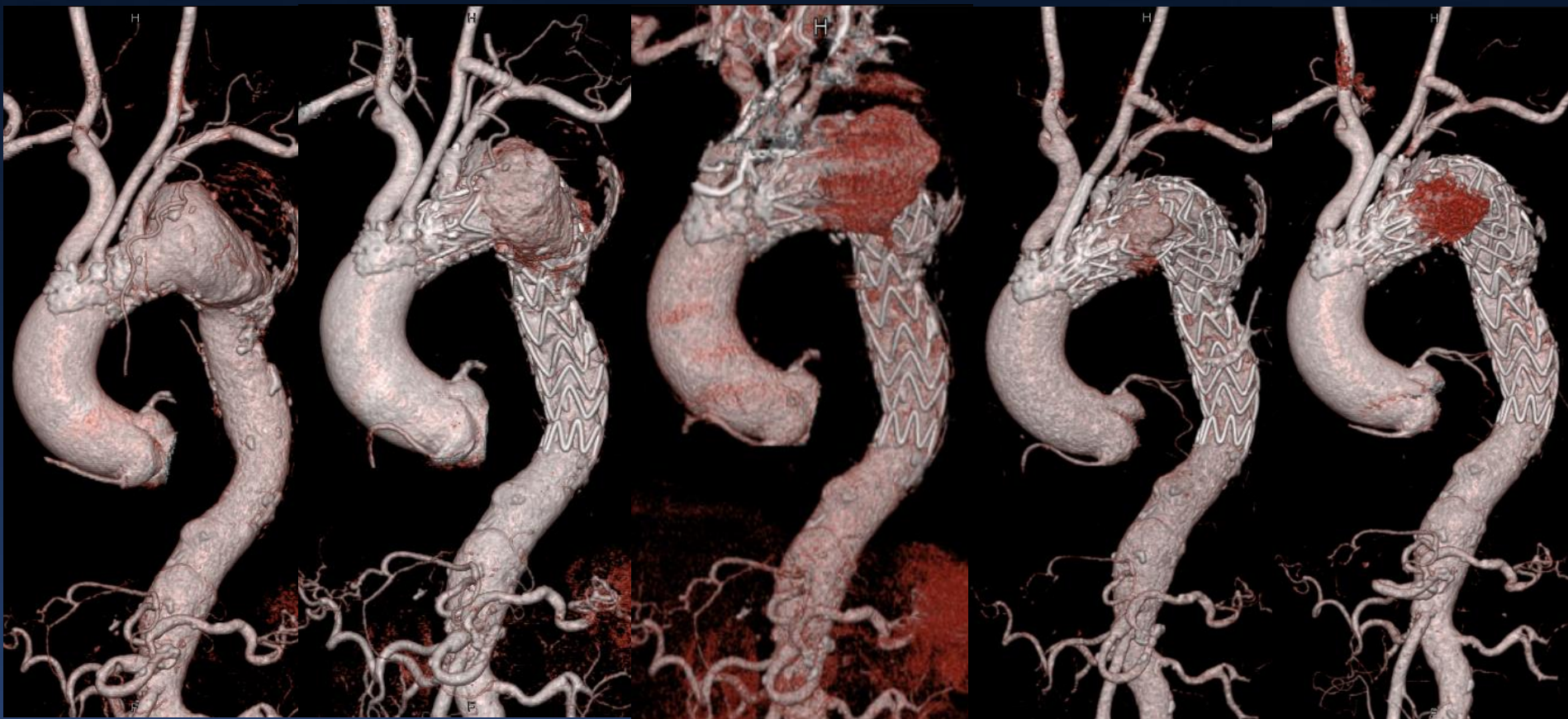
**No remarkable change of endo-leak in aortic arch**

## 2018.06.05 Chest CTA



Evidence of TEVAR from aortic arch to descending thoracic aorta  
Increased in diameter of aortic arch aneurysm (11.6 cm -> 12.8 cm)  
Endo-leak

## Follow up Chest CTA



2017.8.16

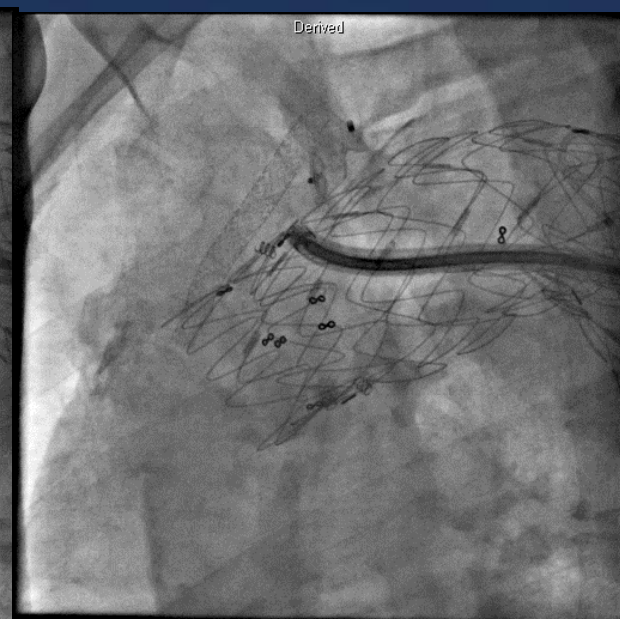
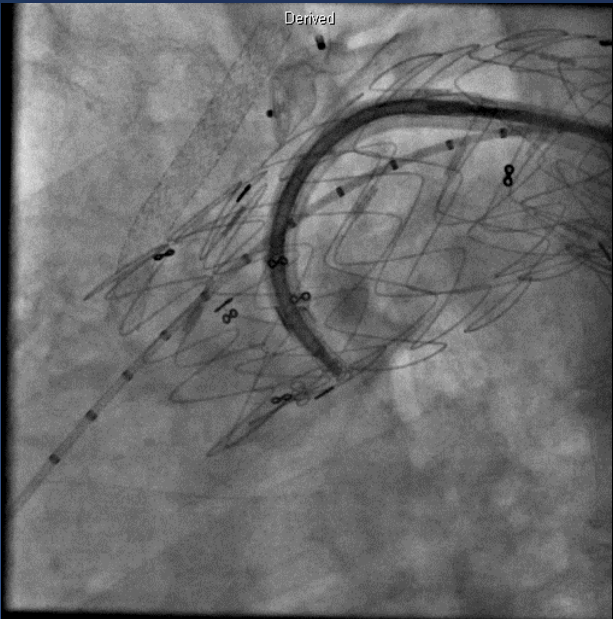
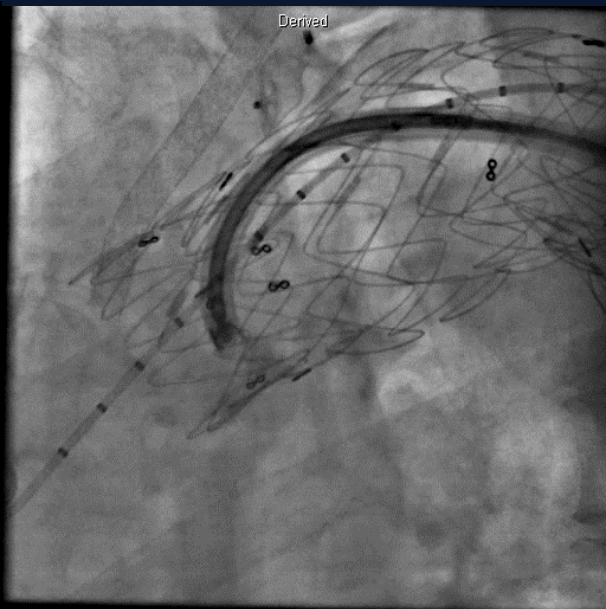
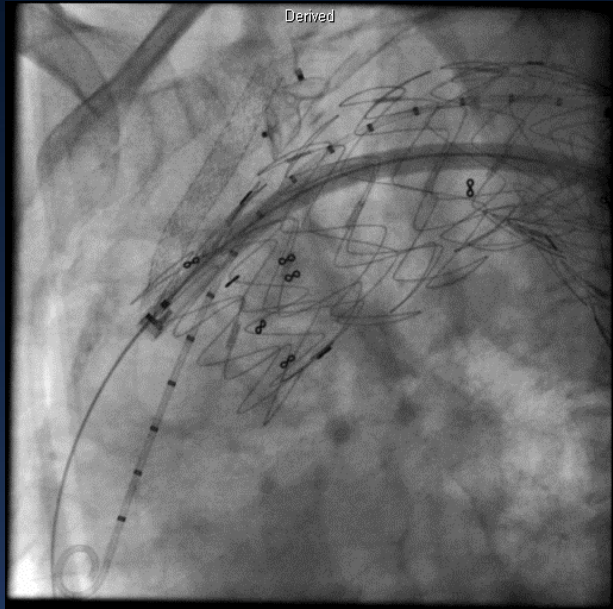
2017.09.19

2017.12.05

2018.01.16

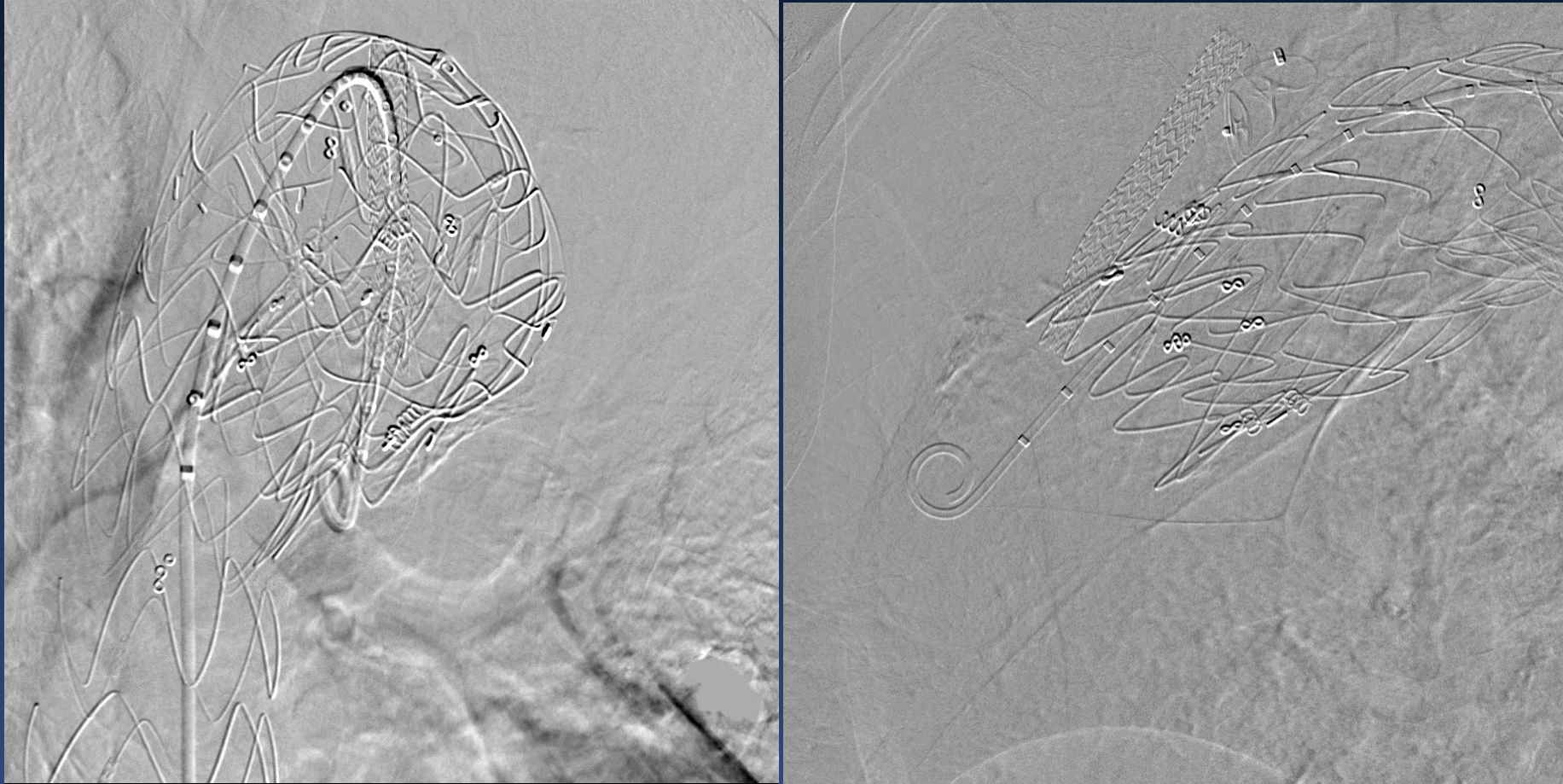
2018.06.05

# 2018.07.30 Heli-FX





**2018.07.30 Heli-FX**

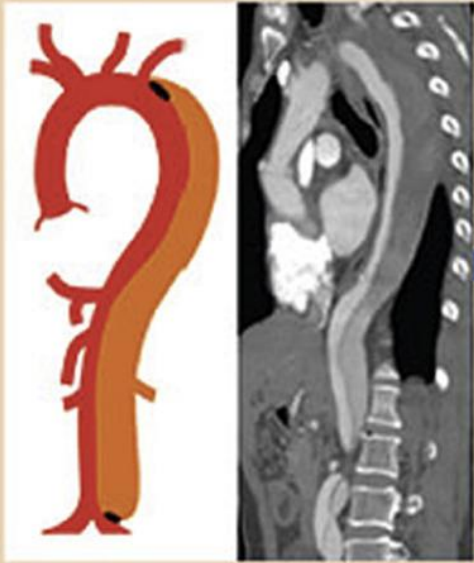


**Screwing for proximal part of TEVAR using Heli-FX guide 42mm and 32mm  
Mild endoleak**

# The Impact of Distal Stent-Graft Induced New Entry on Aortic Remodeling of Chronic Type B Dissection

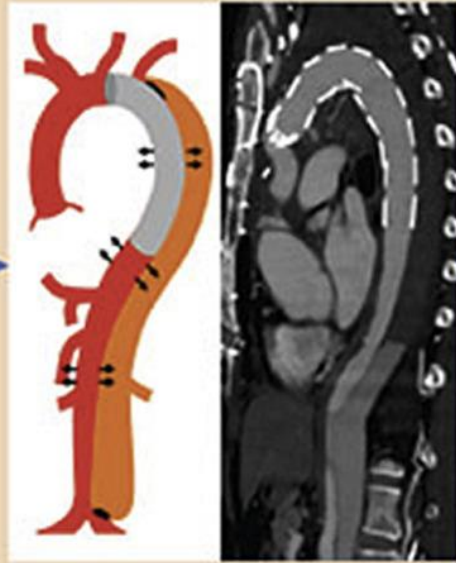
Chun-Yang Huang, Hung-Lung Hsu, Po-Ling Chen, I-Ming Chen, Chiao-Po Hsu, and Chun-Che Shih  
*The Annals of Thoracic Surgery*

Pre-TEVAR

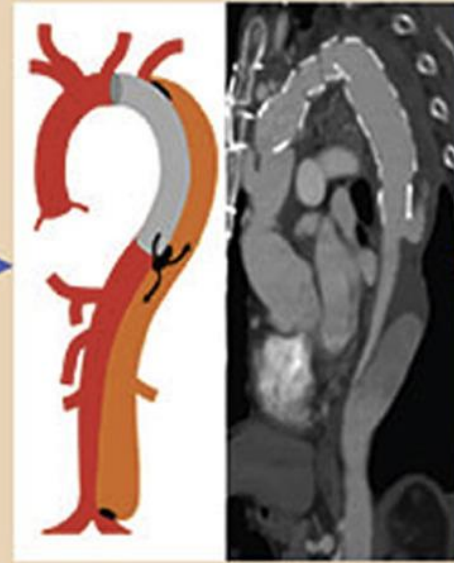


Chronic type B  
aortic dissection

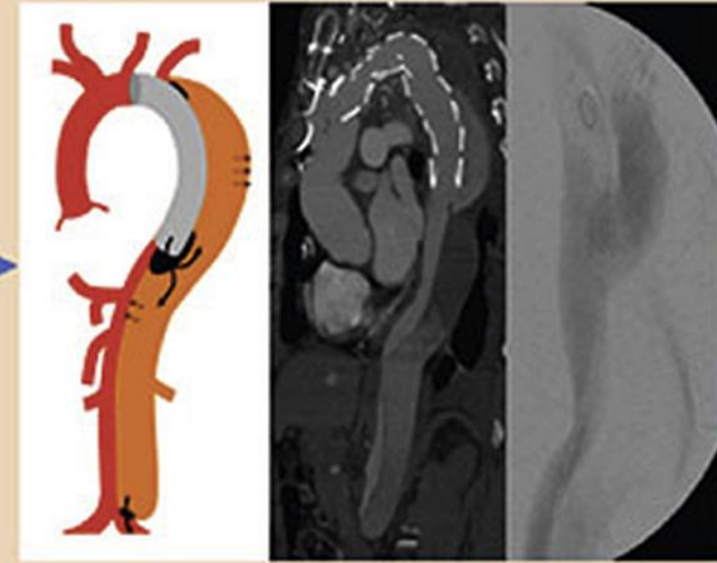
TEVAR



SINE



Delayed progress



False lumen expansion (thoracic)  
True lumen compression (abdominal)

## 75/ Female

C/C Chest pain

P/H HTN

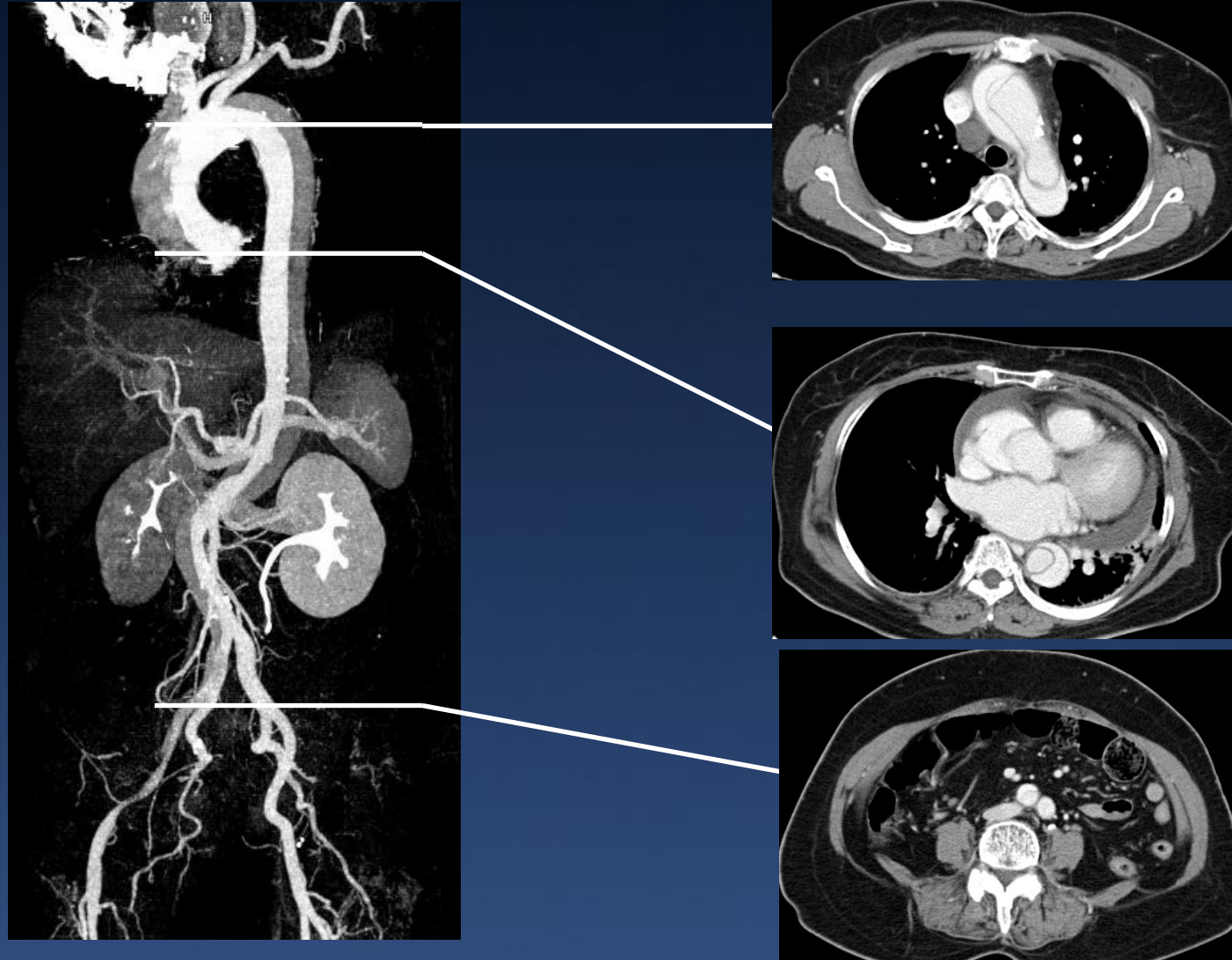
No known Hx of DM, Pul. TBc, Hepatitis,

S/H Smoking : None

Alcohol : None

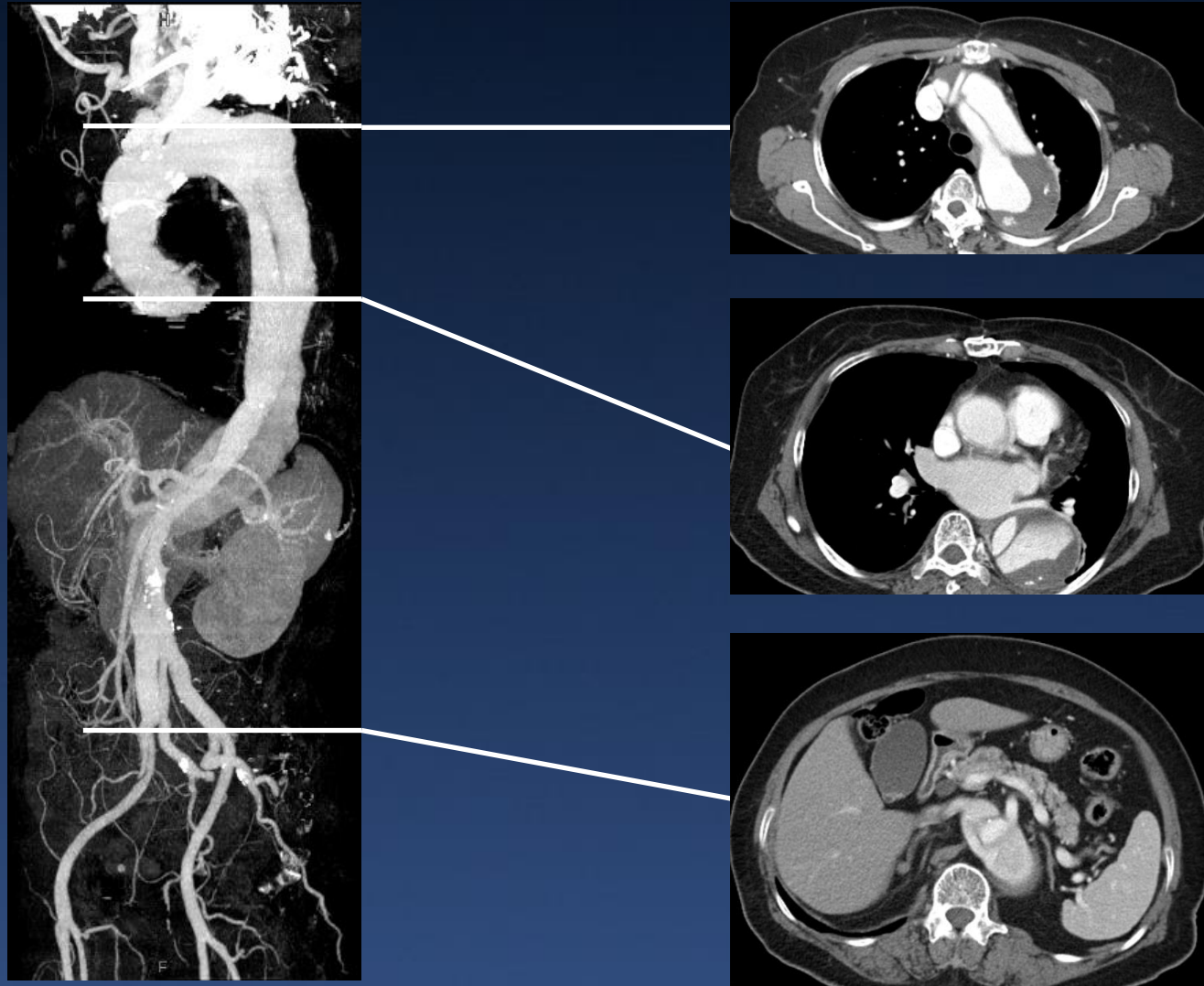
F/H None

## 2008.02.20 Chest/Abdomen CTA



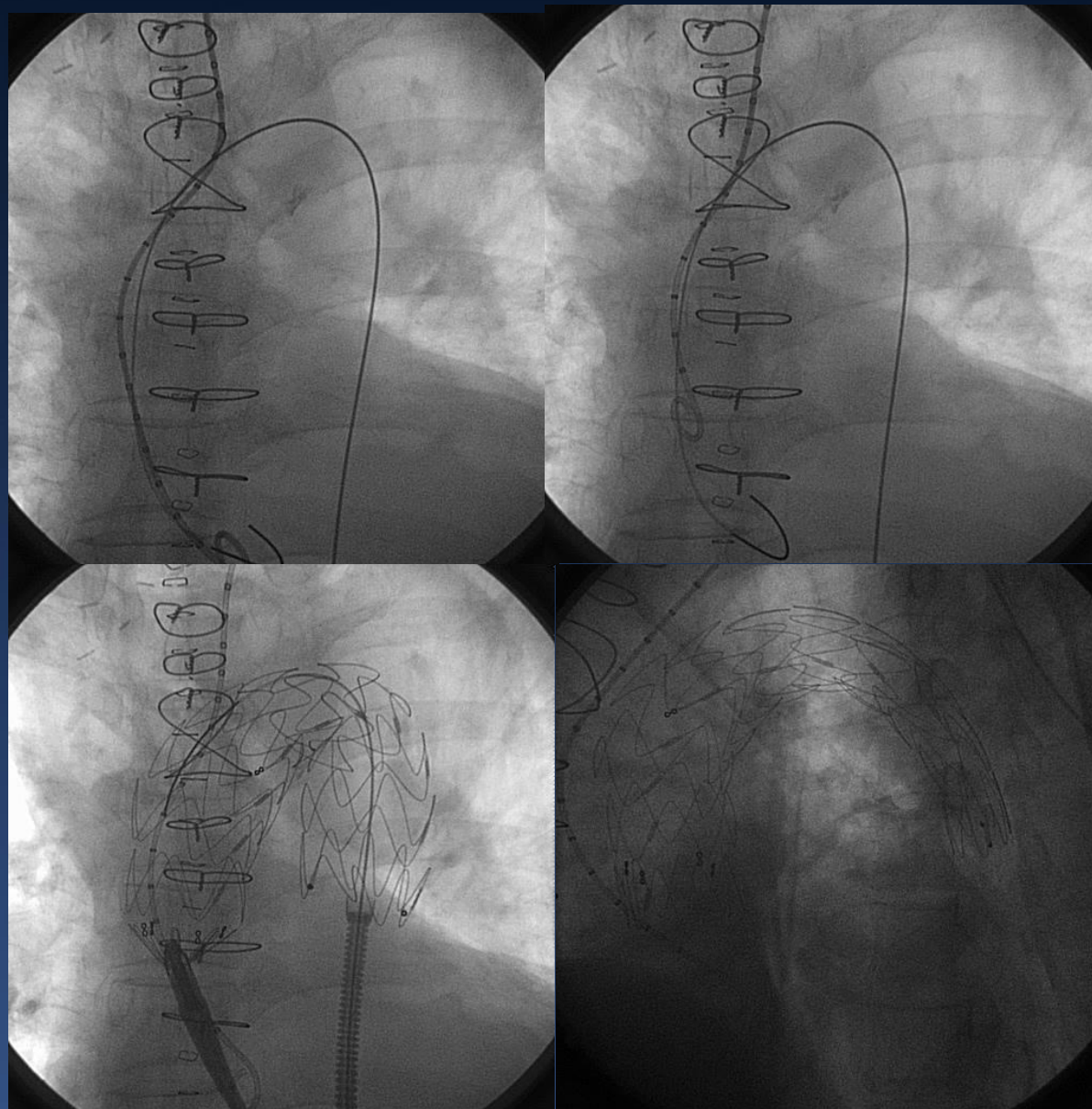
**Aortic dissection (Stanford type A) from aortic arch to right external iliac artery  
-> Graft interposition of ascending aorta (Vascutec 66mm) (2008.02.21 CS operation)**

## 2012.03.05 Chest/Abdomen CTA

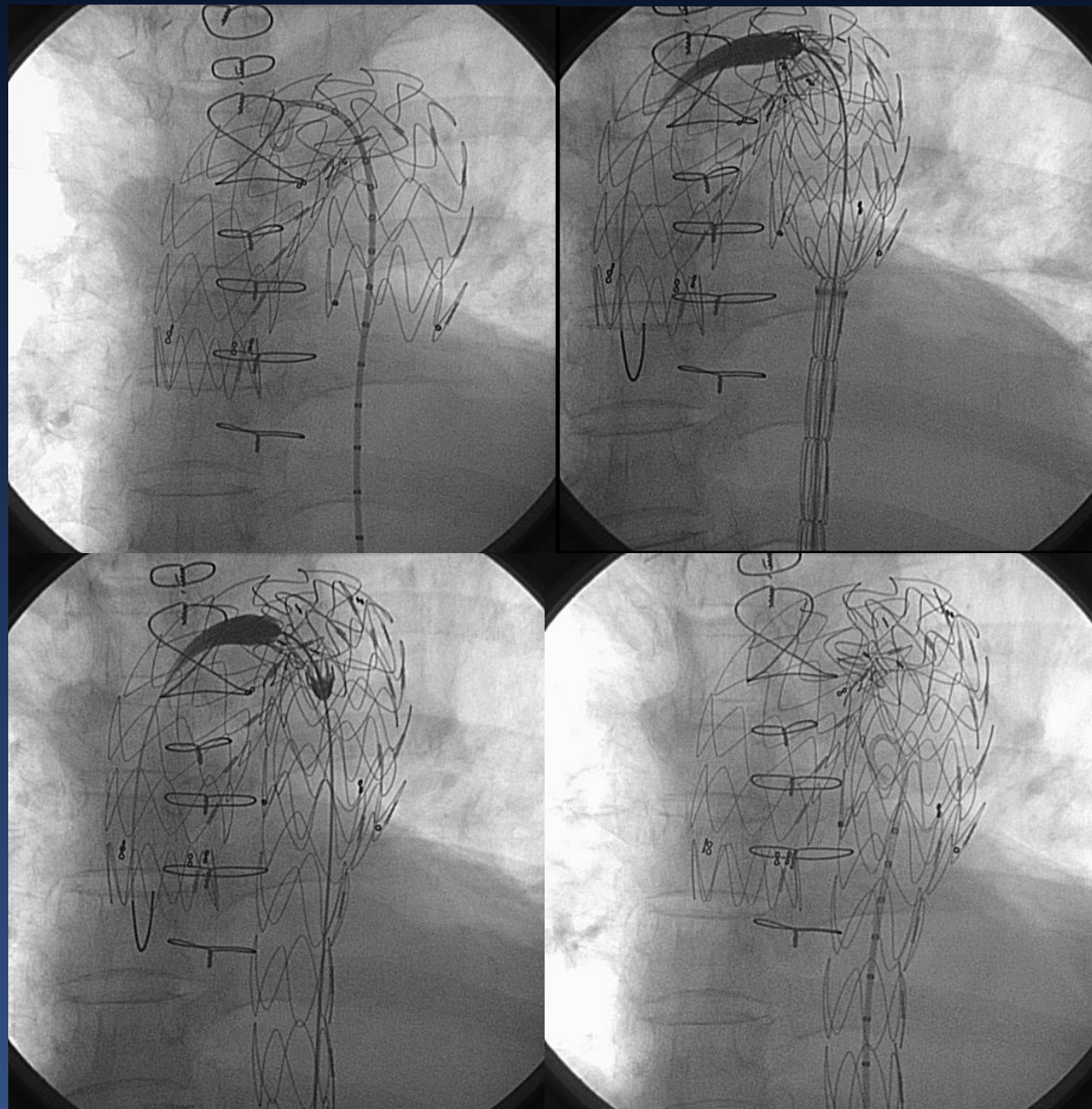


**Somewhat increased size of chronic aortic dissection involving descending thoracic aorta with internal dystrophic calcifications in false lumen thrombus**

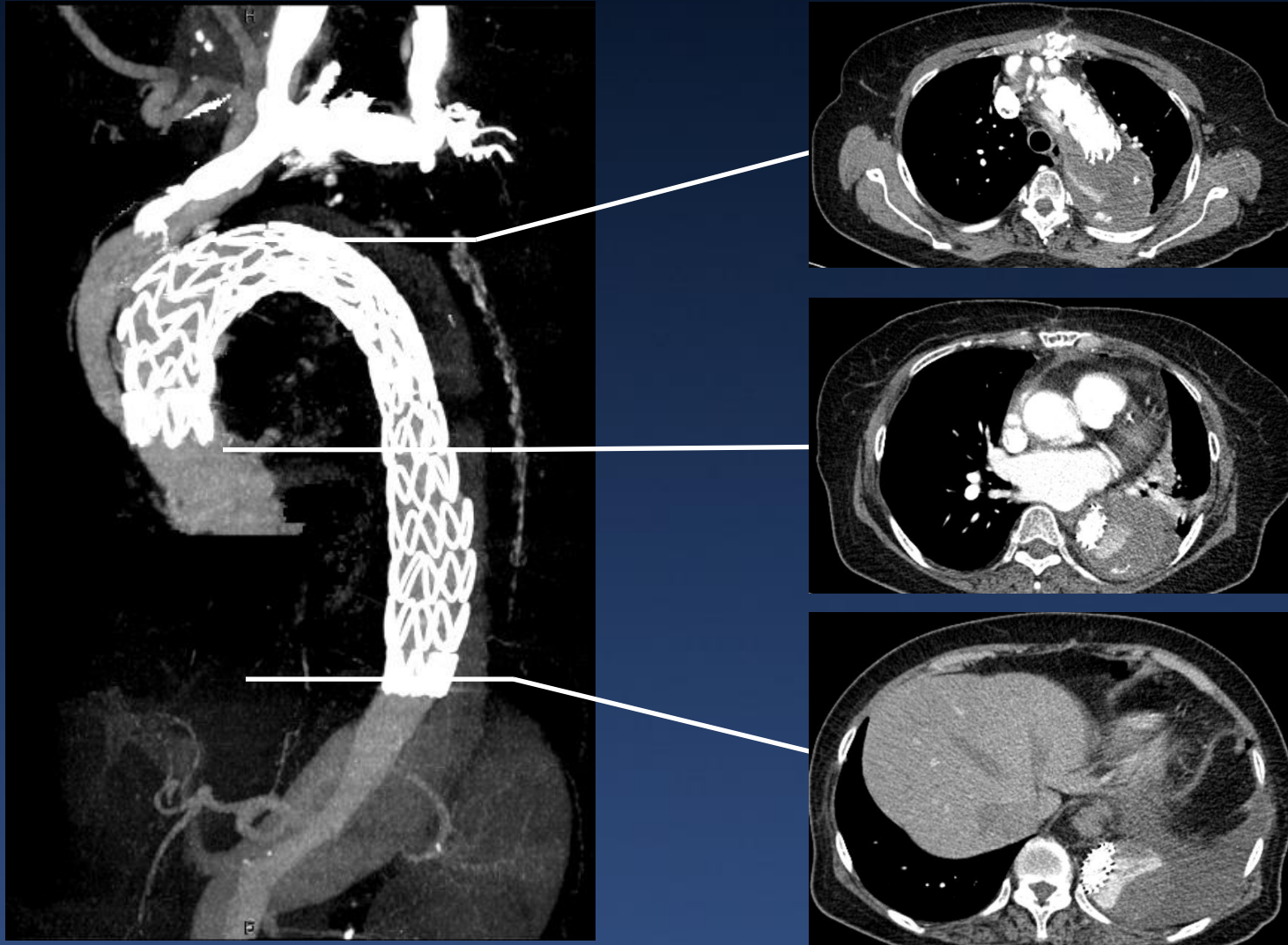
2012.04.30 TEVAR



2012.05.09 TEVAR



## 2012.05.16 Chest CTA



S/P Metallic stent insertion in ascending to distal descending thoracic aorta  
With more thrombosed chronic aortic dissection



## 2015.05.06 Chest CTA

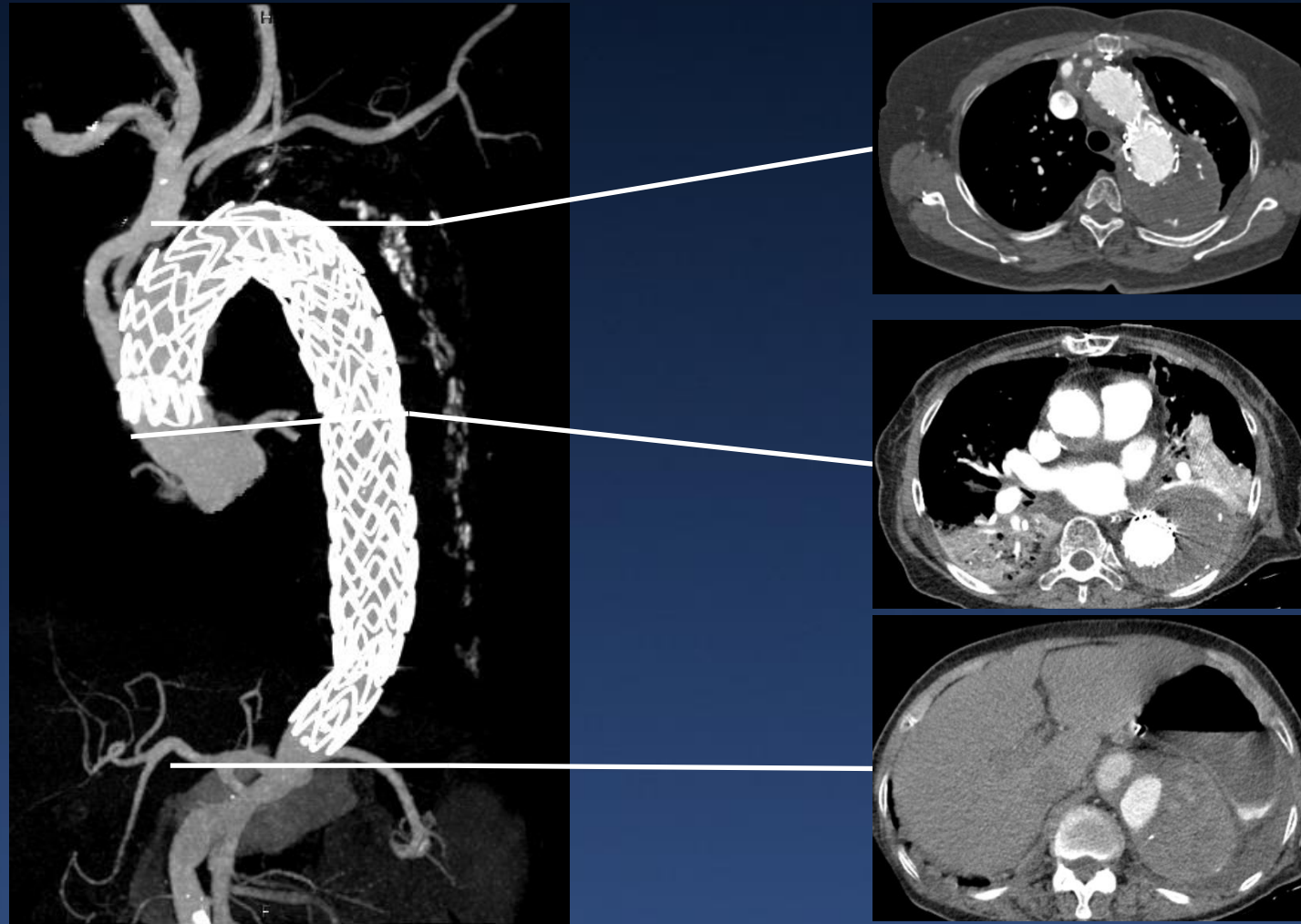


Increased size of aneurysmal dilatation with dissection in descending aorta with partially thrombosed false lumen

# 2015.10.07 TEVAR

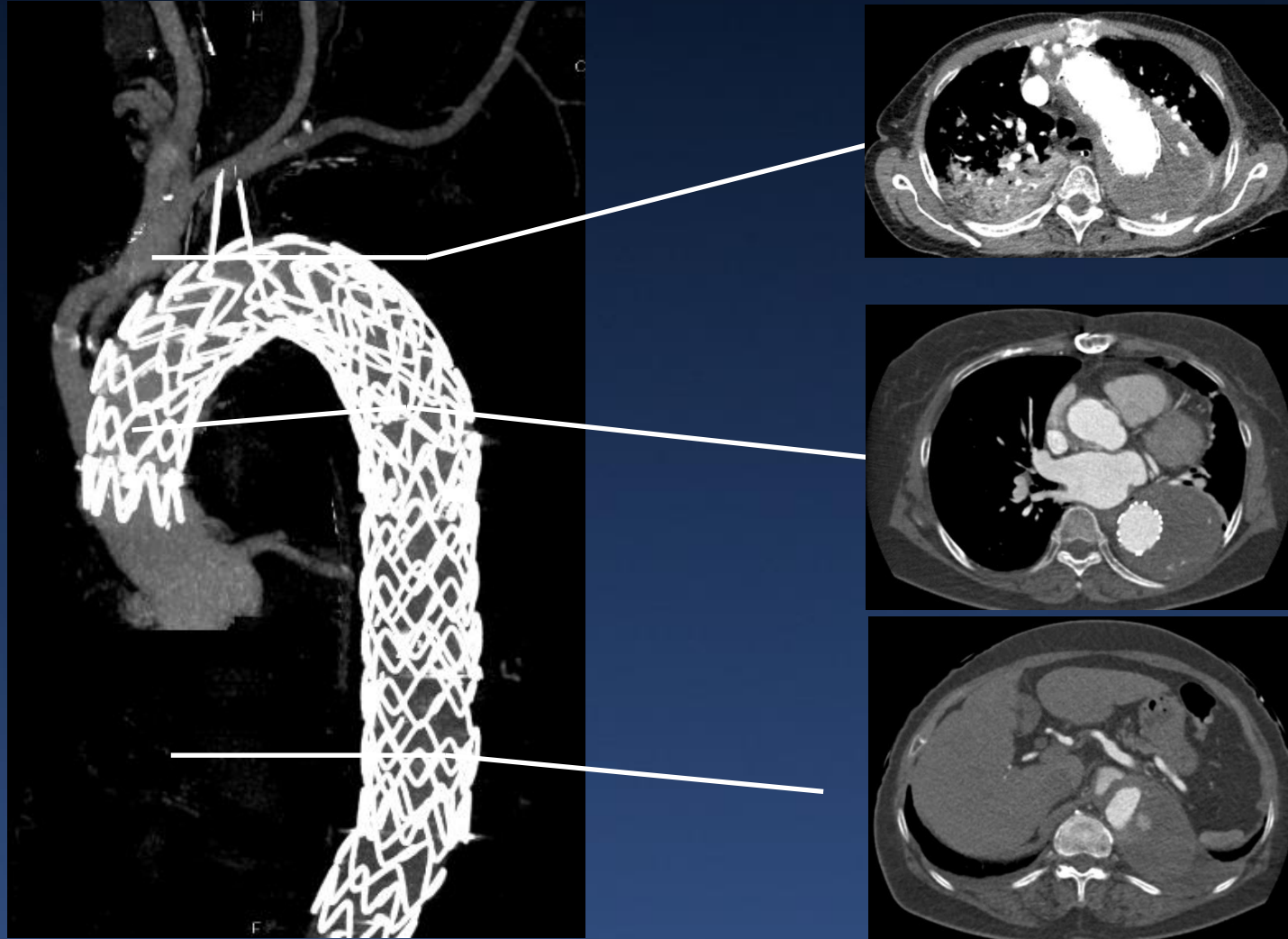


## 2015.10.12 Chest CTA



No significant change of aneurysmal dilatation with dissection in descending thoracic aorta with partially thrombosed false lumen.

## 2018.06.03 Chest CTA



No detectable significant endoleak  
No remarkable change of maximal diameter of aorta : 9.5 -> 9.2 cm.

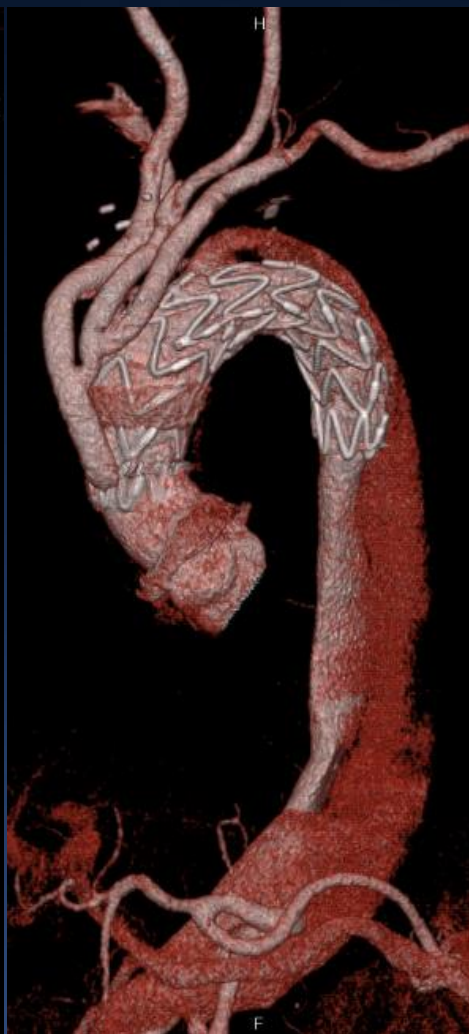
## Follow up Chest/Abdomen CTA



2008.02.02



2012.03.05



2012.05.04



2012.05.16

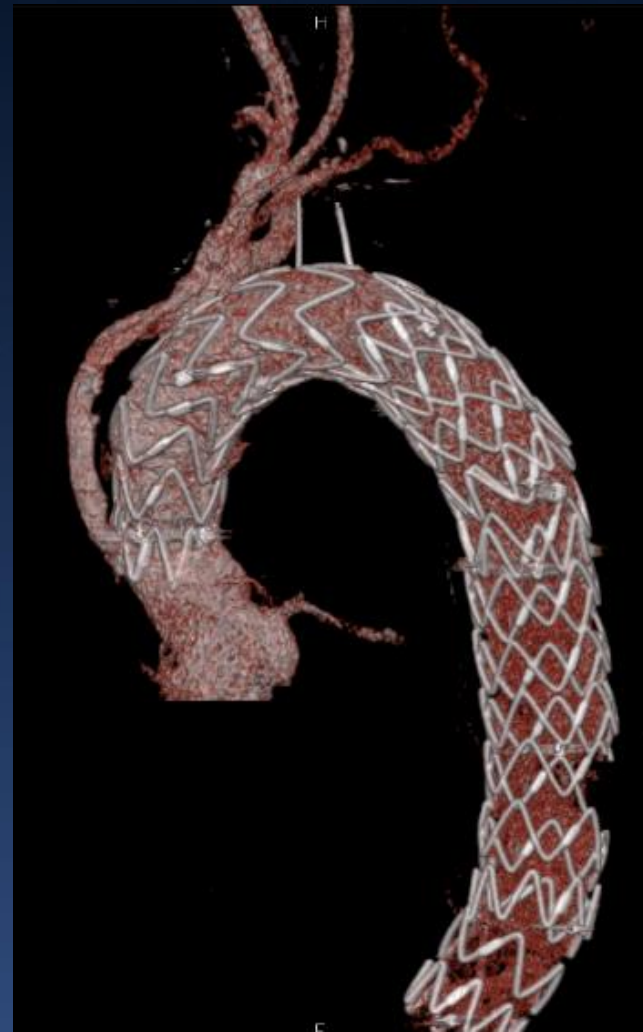
## Follow up Chest/Abdomen CTA



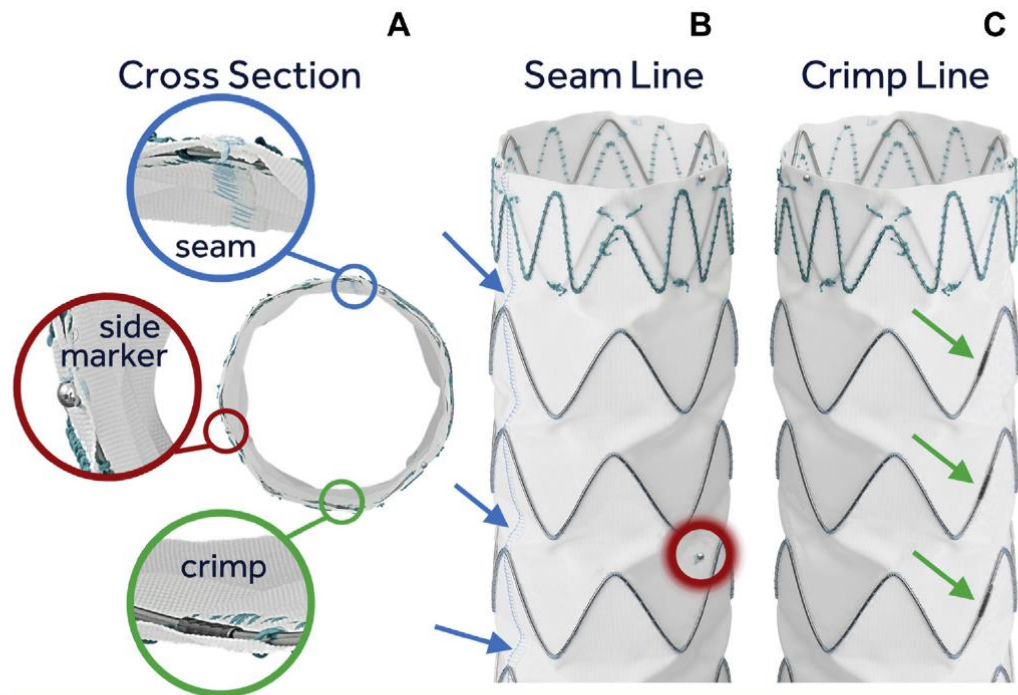
2015.05.06



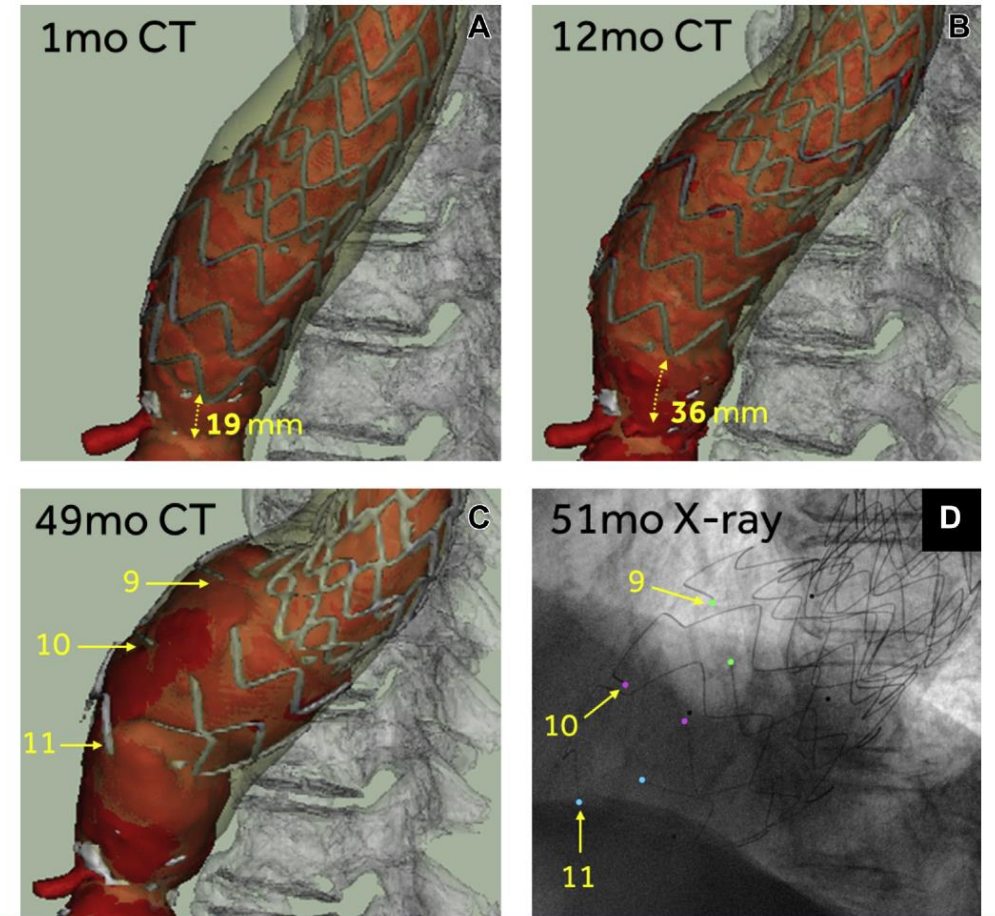
2015.10.07



2018.06.03



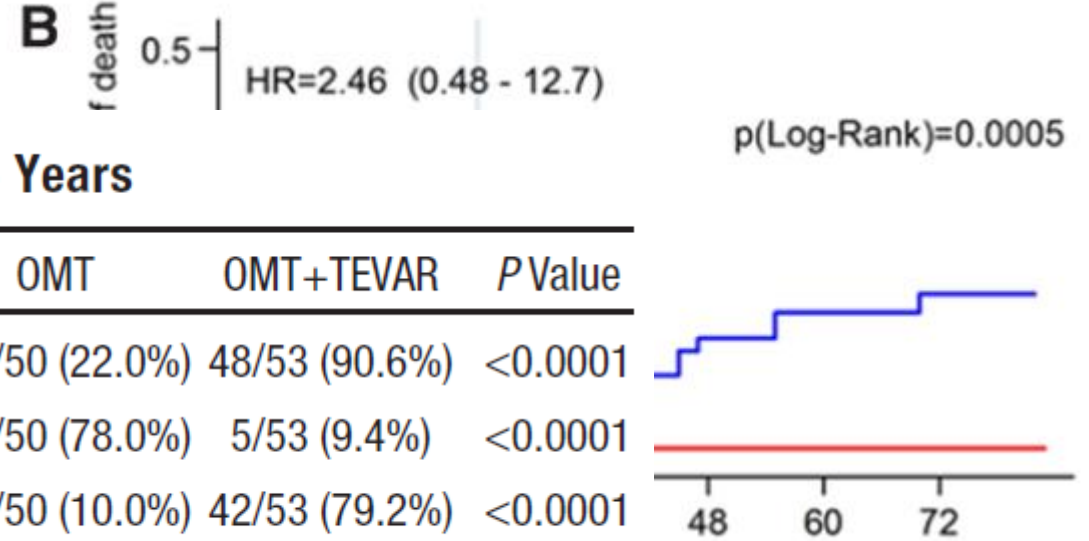
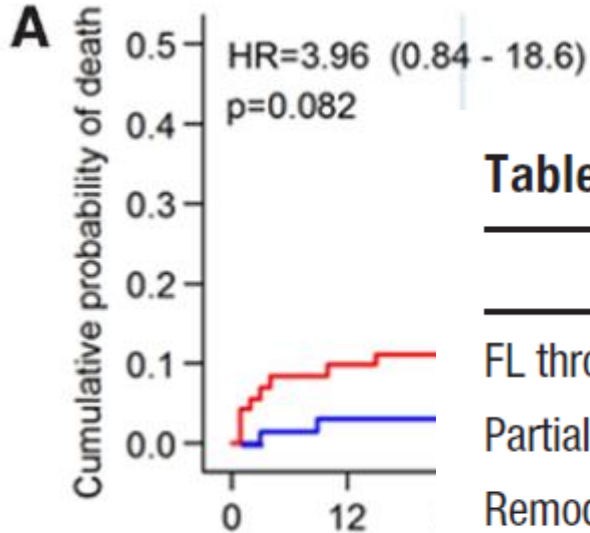
**Fig 1.** **A**, Construction of the Valiant Navion stent graft with the cross-section view showing the stent rings sewn with the crimps located  $\sim 180^\circ$  from the graft seam. Also, a radiopaque side marker is nearly equidistant between the seam and crimps (red circle). **B**, View of a graft with the seam running down the length of the graft (blue arrows). **C**, View showing a line of crimps on the other side of the graft (green arrows).



**Fig 4.** Patient 4. **A,B**, Three-dimensional computed tomography angiography (CTA) reconstruction showing the distance between the distal edge of the graft and distal edge of the celiac artery had increased by 17 mm by the 12-month imaging follow-up. The bottom three stent rings had fractured by the 49-month CTA study (**C**), and the fractured stents were also clear on the 51-month chest radiography (**D**).

# Long Term Outcomes of TEVAR in TBAD

## 5 yrs Data from the INSTEAD-XL Trial



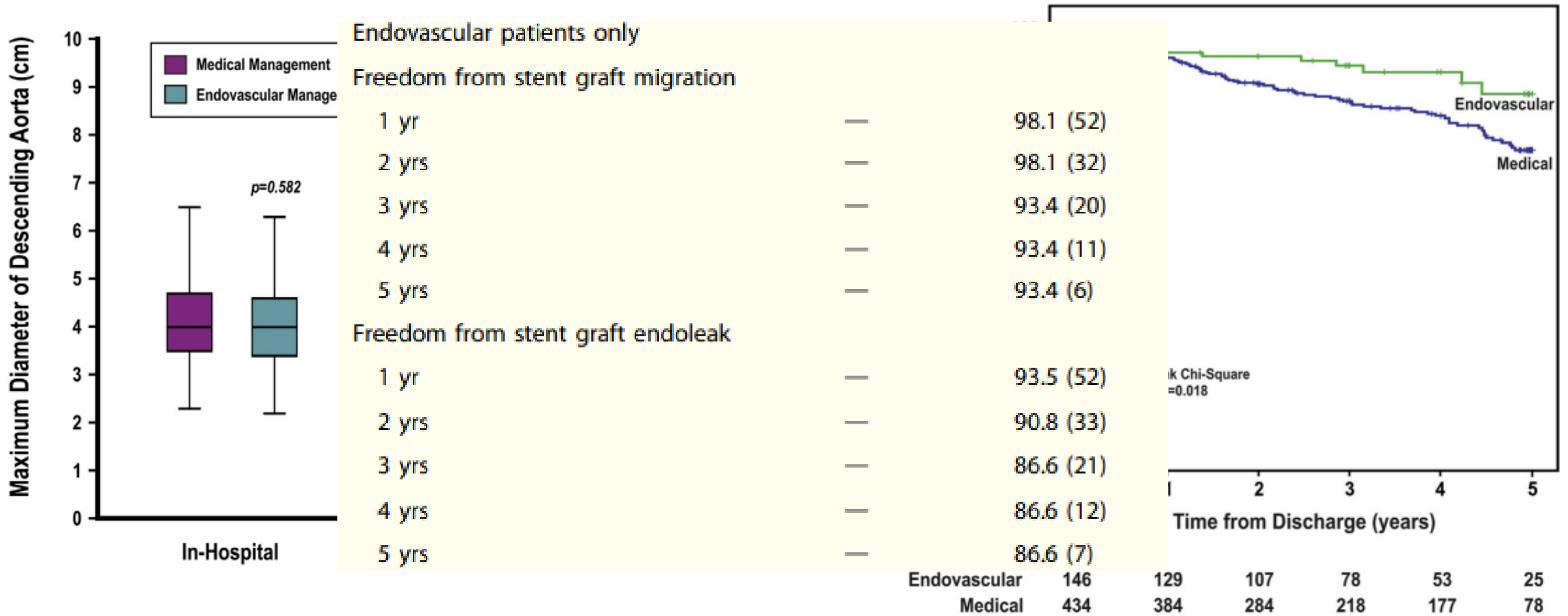
**Table 5. Aortic Morphology at 5 Years**

	OMT	OMT+TEVAR	P Value
FL thrombosis	11/50 (22.0%)	48/53 (90.6%)	<0.0001
Partial FL/no FL thrombosis	39/50 (78.0%)	5/53 (9.4%)	<0.0001
Remodeling of thoracic aorta*	5/50 (10.0%)	42/53 (79.2%)	<0.0001
Critical expansion of thoracic aorta†	33/50 (66.0%)	11/53 (20.8%)	<0.0001



# Long Term Outcomes of TEVAR in TBAD

5 yrs Data from the IRAD (International Registry of Acute Aortic Dissection)



# Case

**70/F**

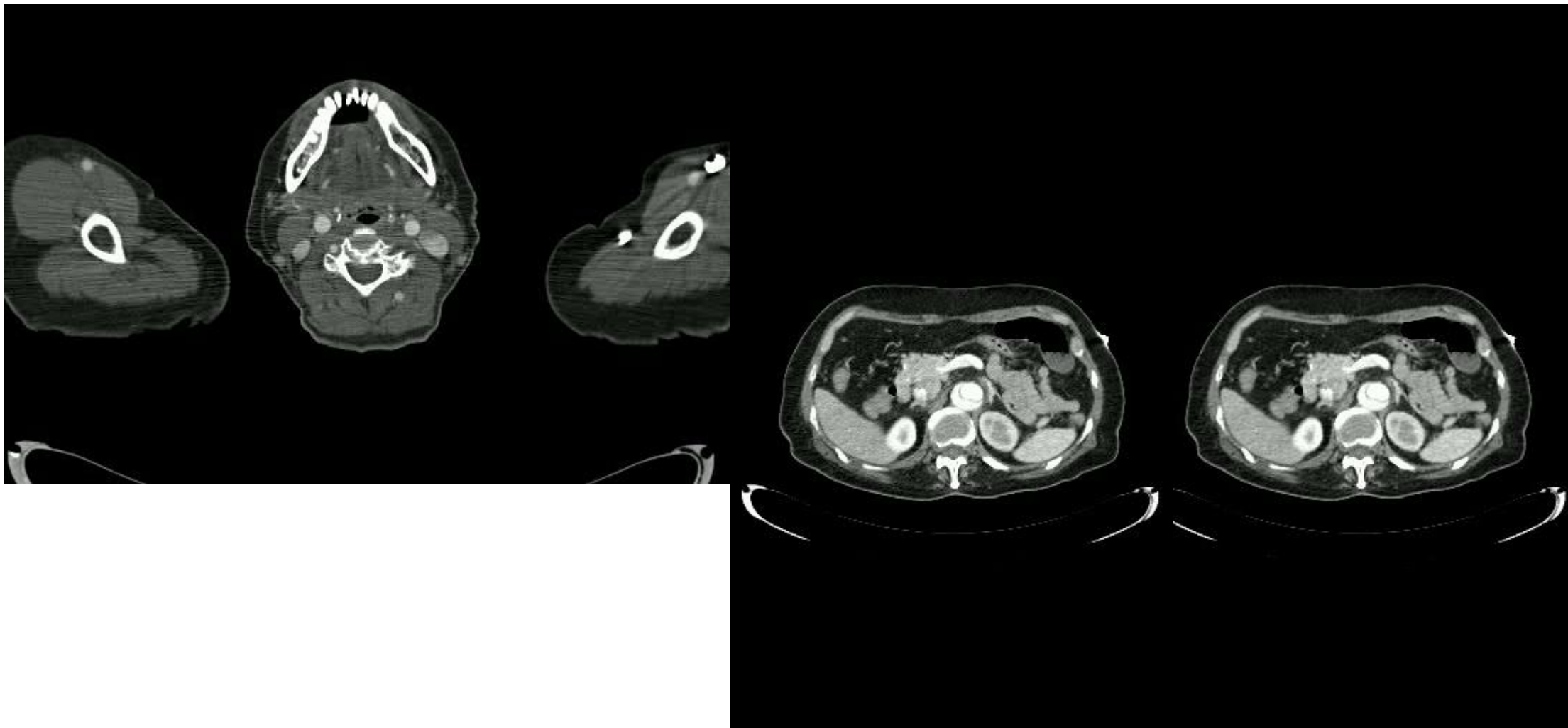
**C/C Chest pain/Back pain (2 hrs ago)**

**P/H HTN/DM/Hepatitis/TB (+/-/-/-)**

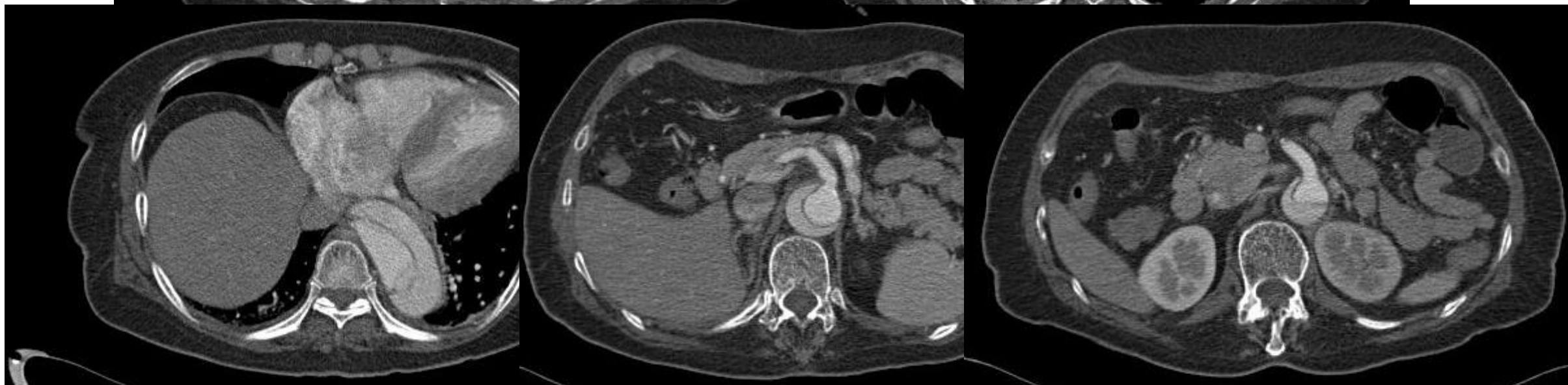
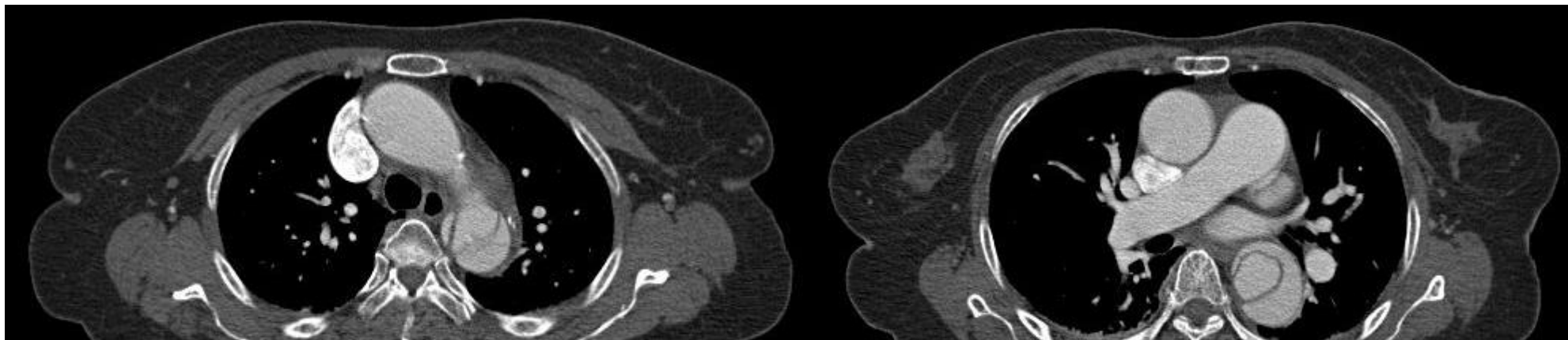
**F/H N-S**

**S/H N-S**

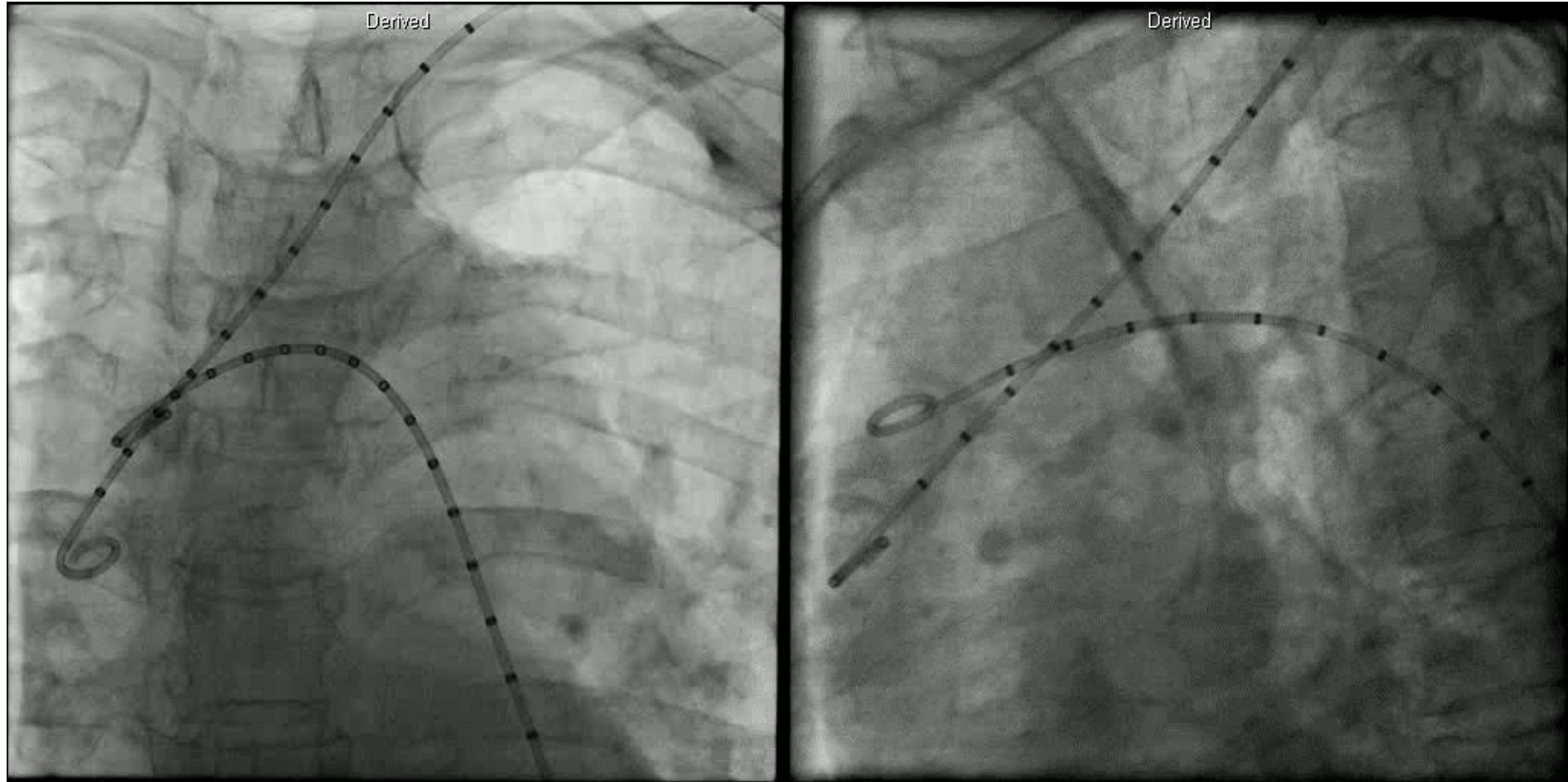
# Case (Initial CTA)



# Case (Initial CTA)

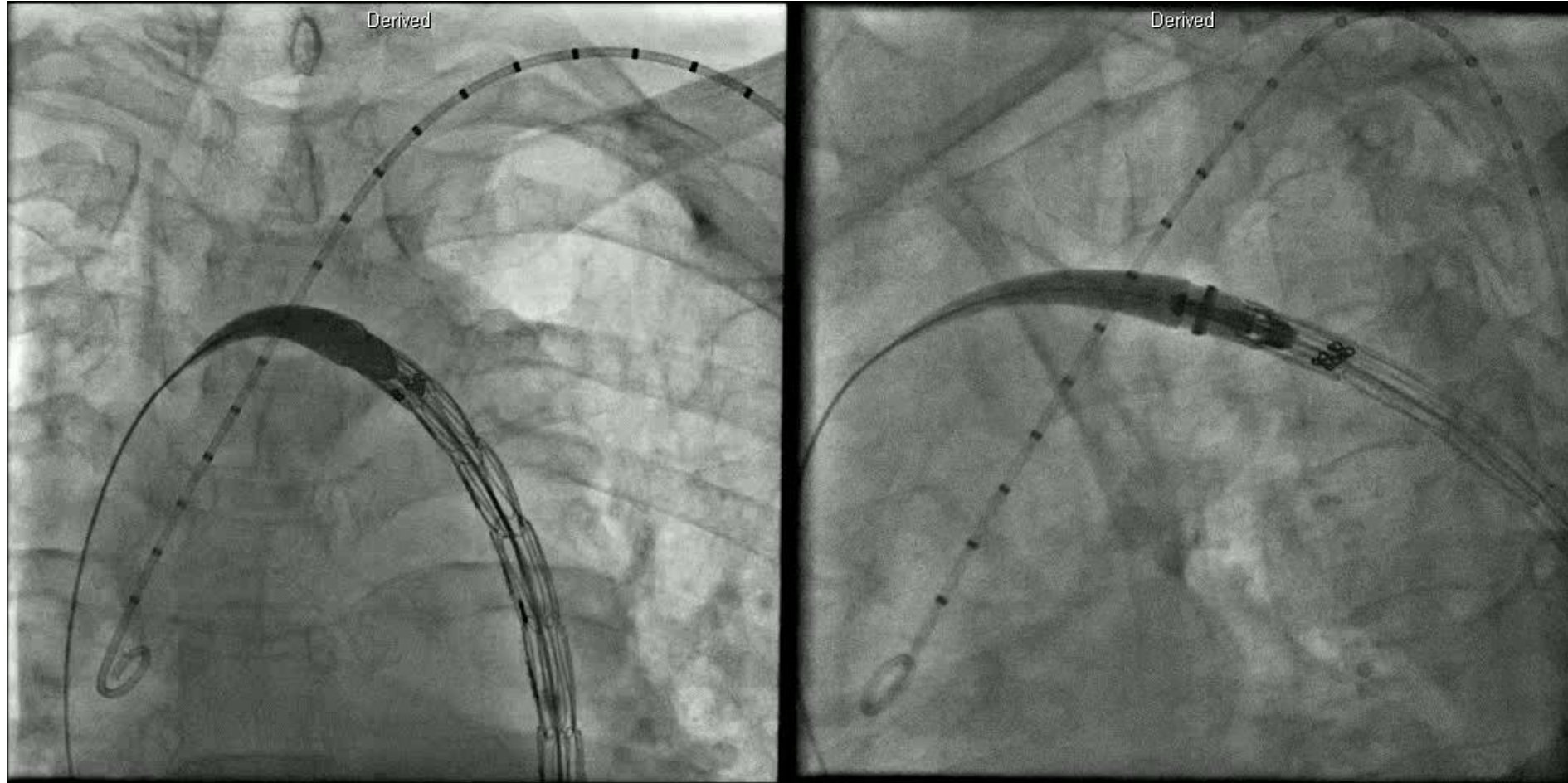


# Case (TEVAR)



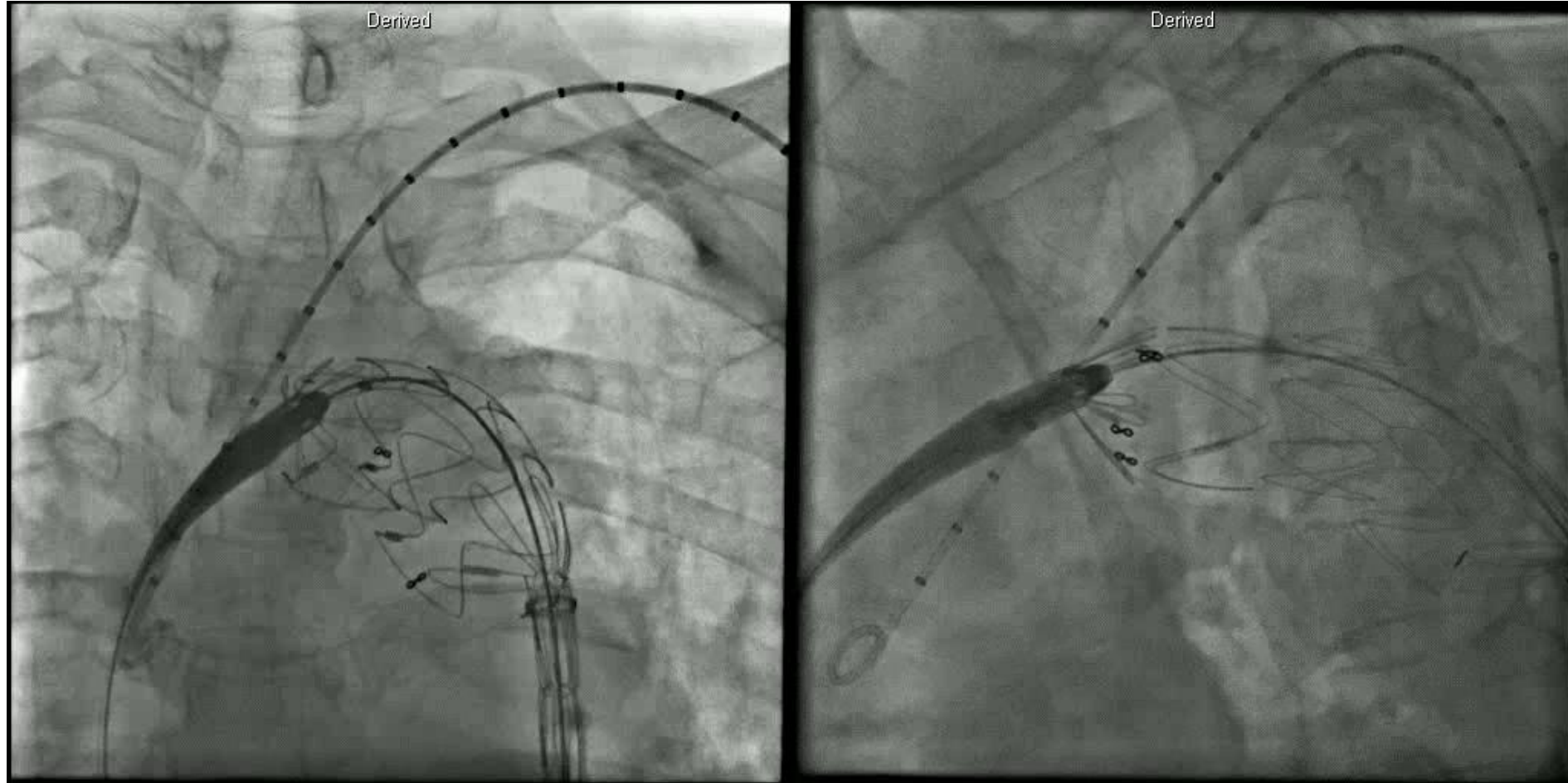
TBAD, High risk

# Case (TEVAR)



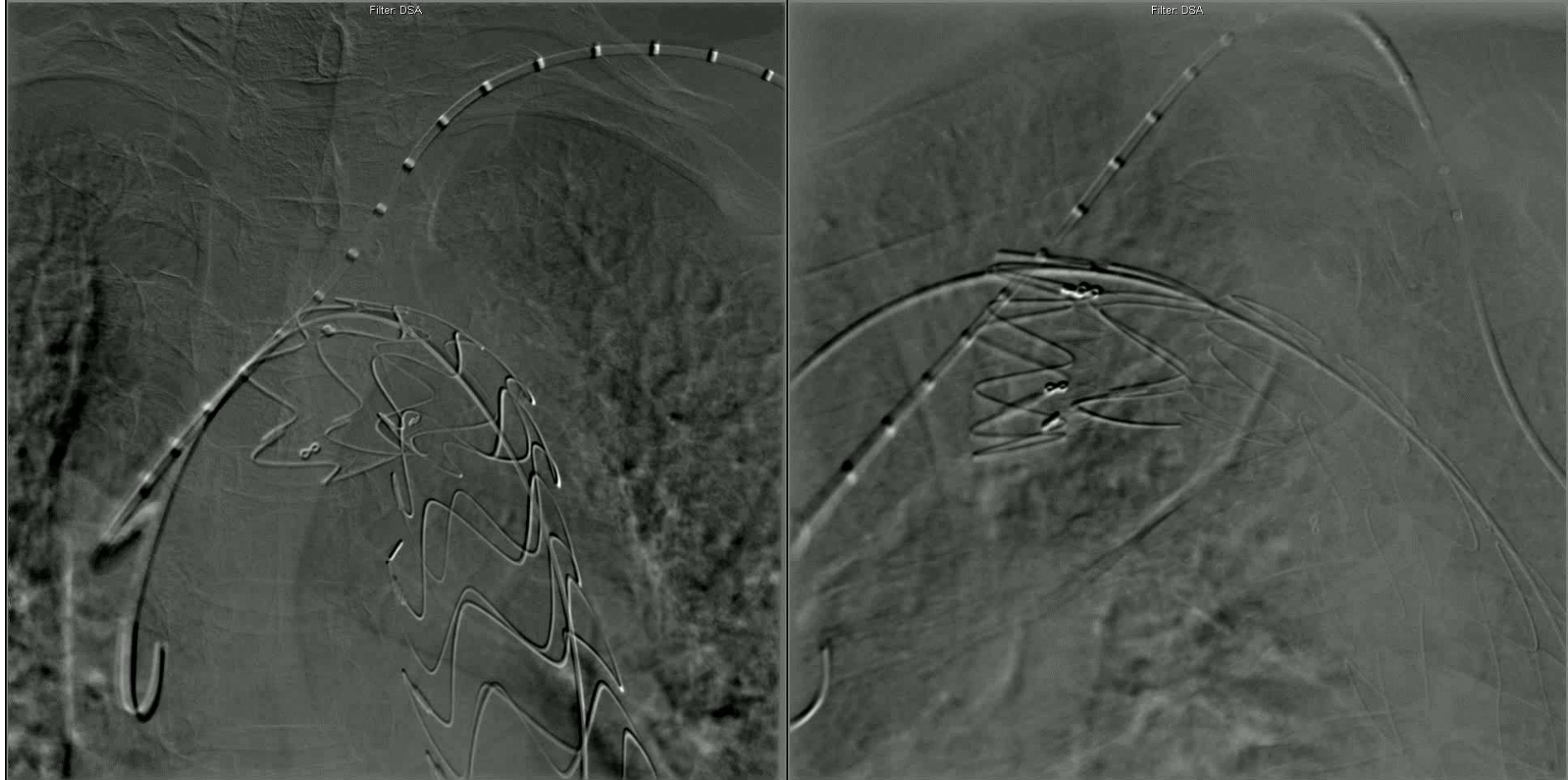
**Valiant Thoracic 36x32x200mm (Zone 3)**

# Case (TEVAR)



**Valiant Thoracic 36x32x200mm (Zone 3)**

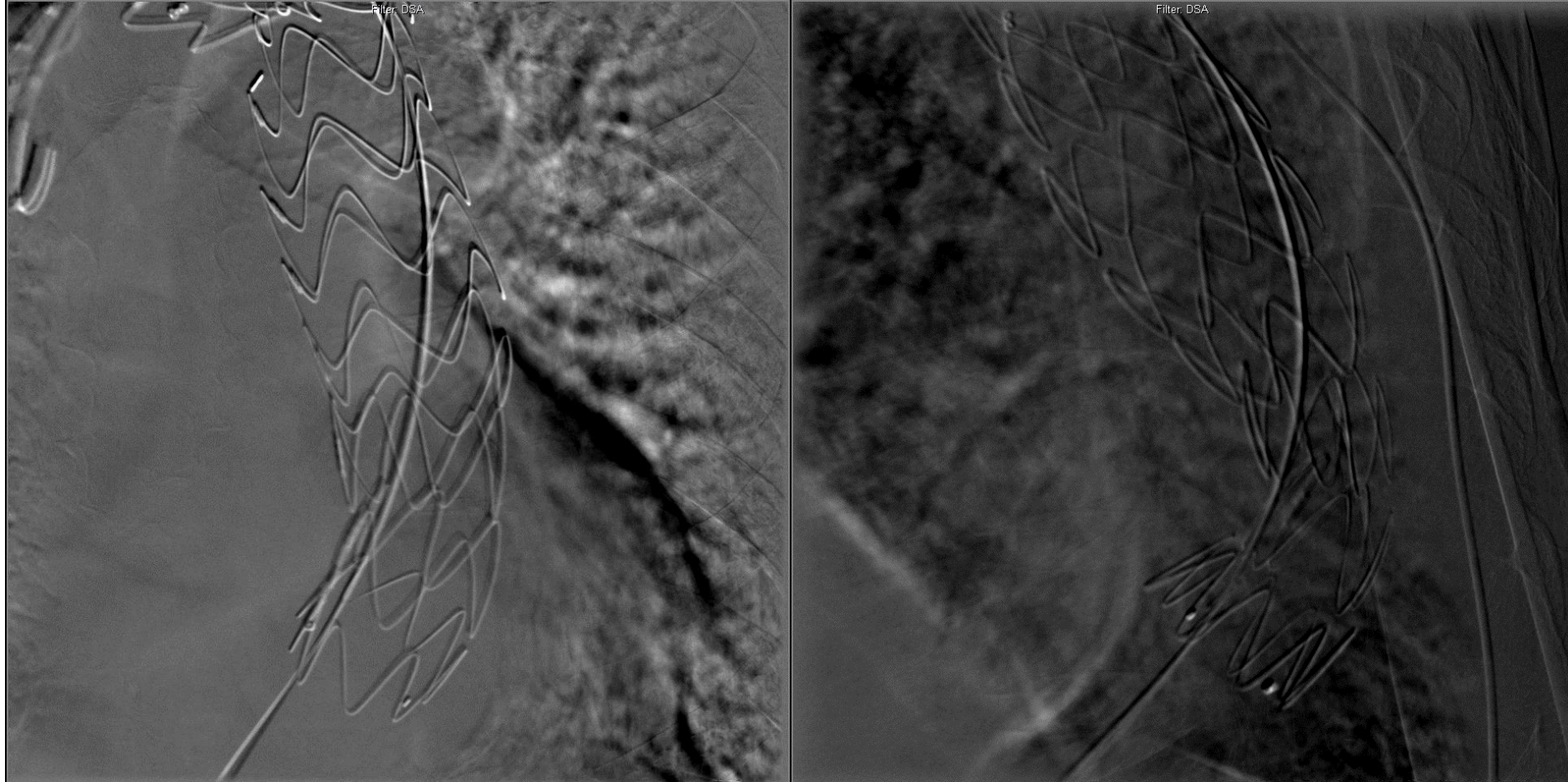
# Case (TEVAR)



**Successful TEVAR with VALIANT THORACIC Stent Graft**

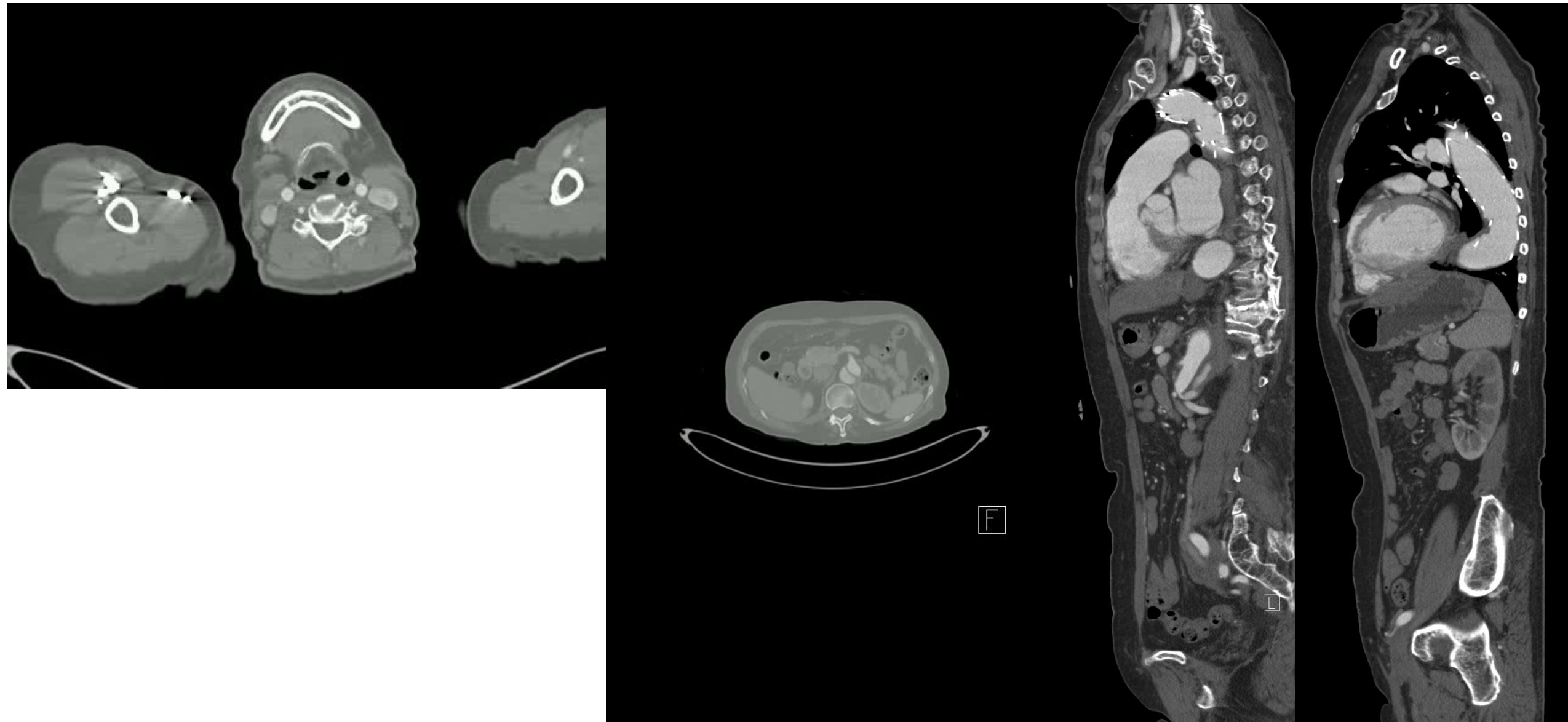


# Case (TEVAR)

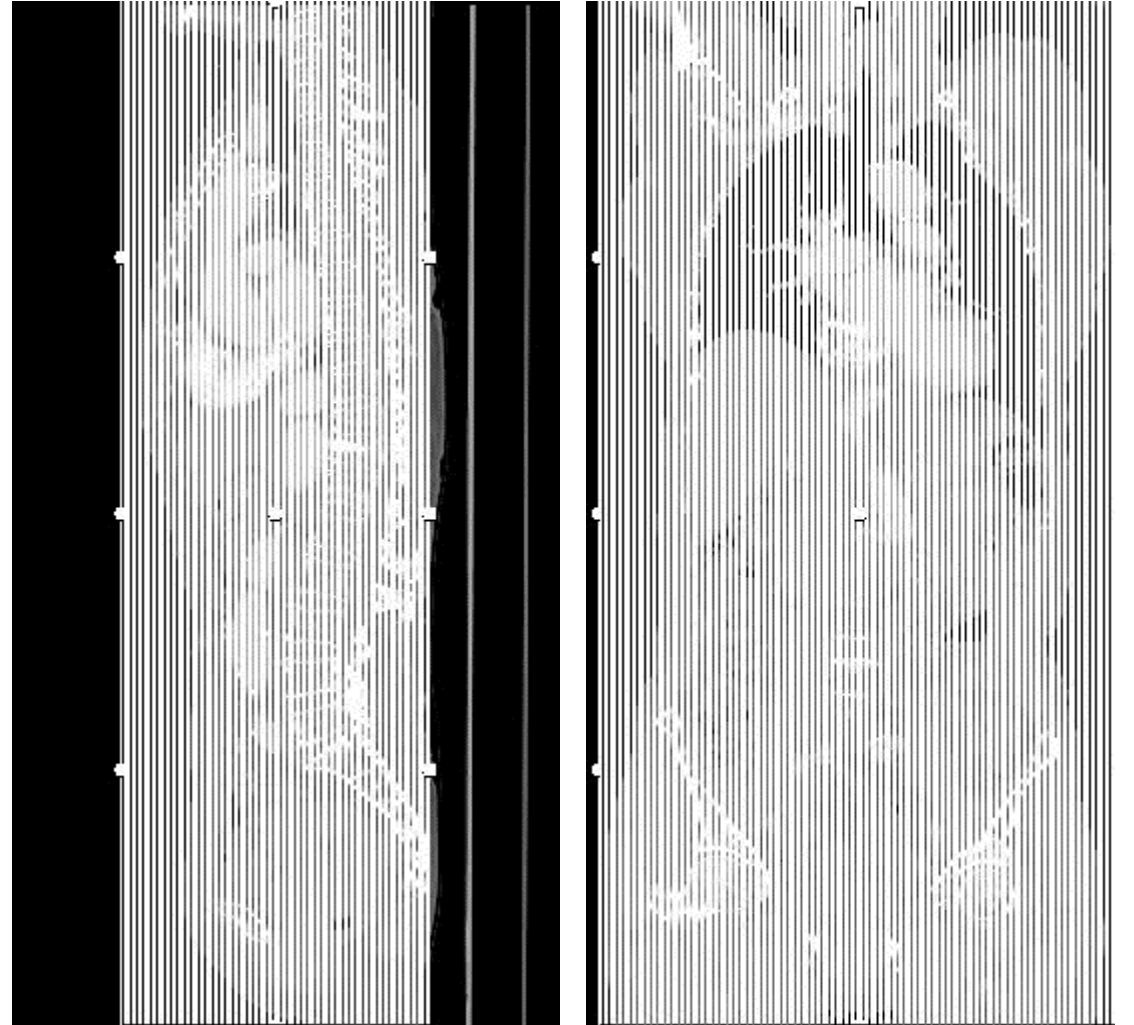
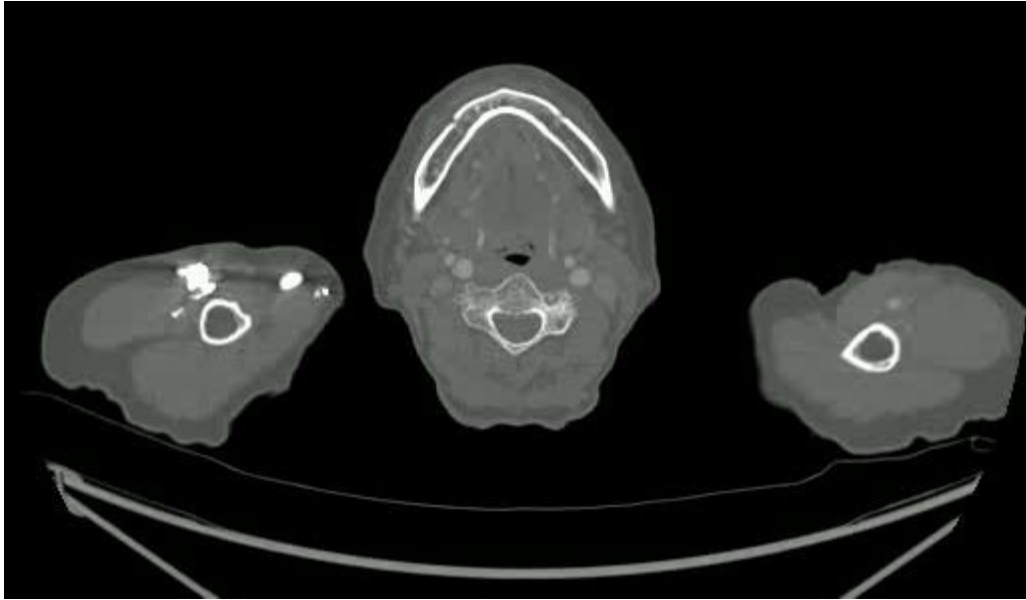


**Successful TEVAR with VALIANT THORACIC Stent Graft**

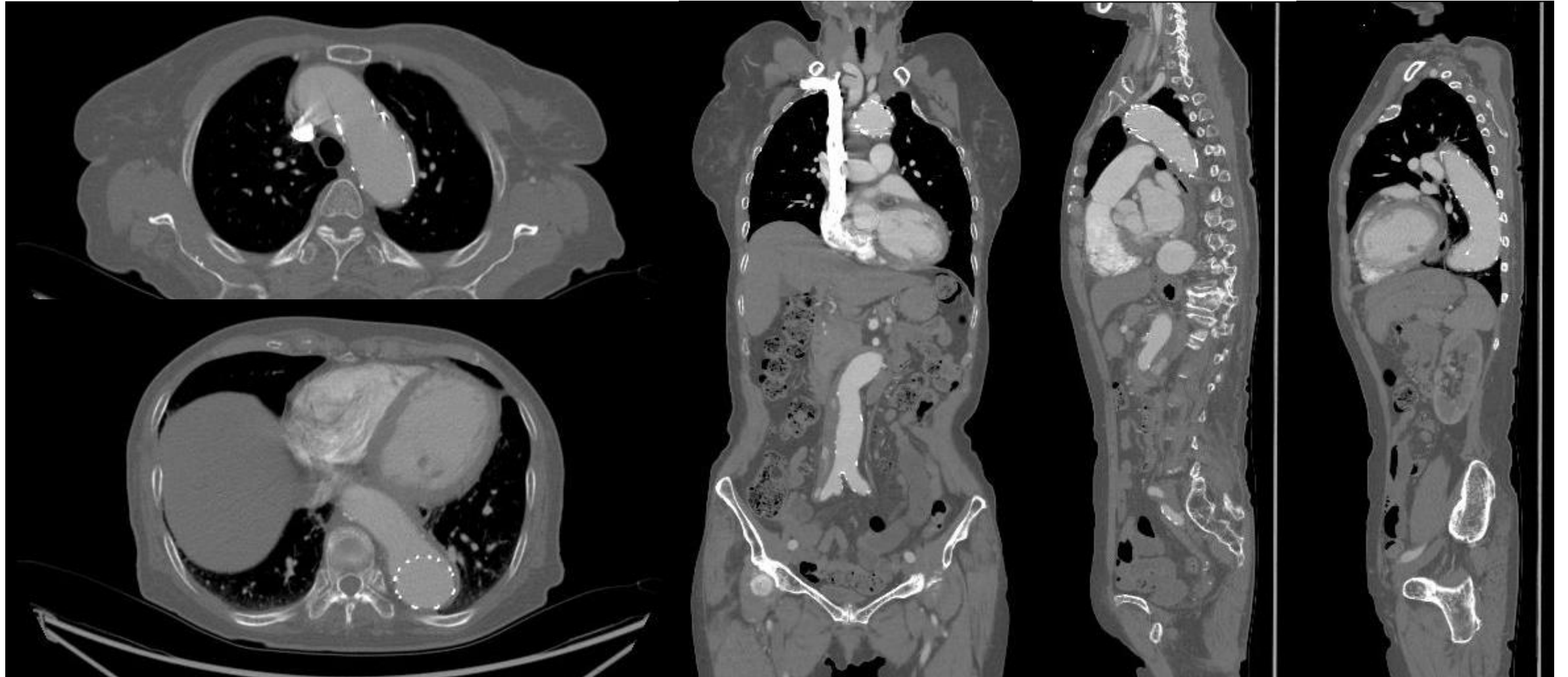
# Case (1Y FU CTA)



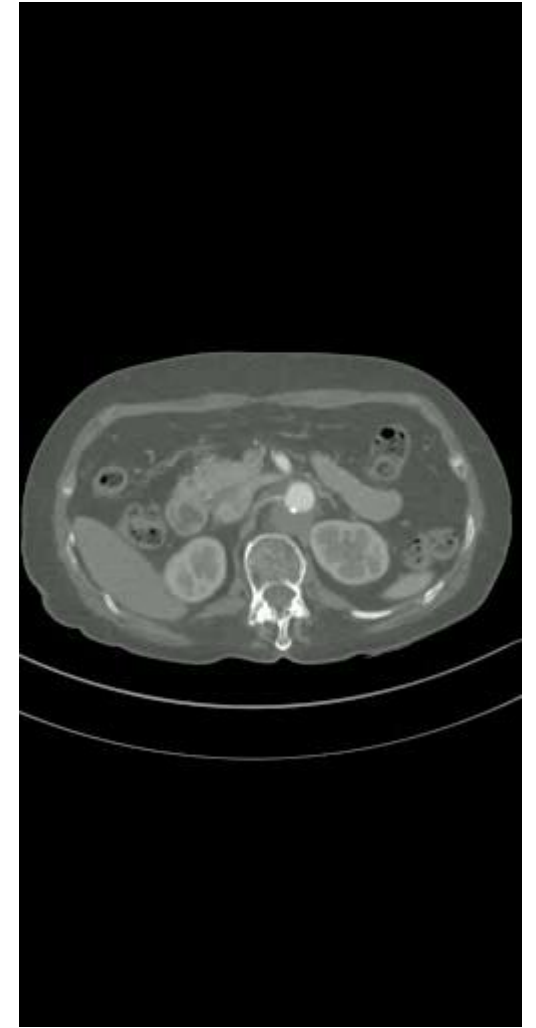
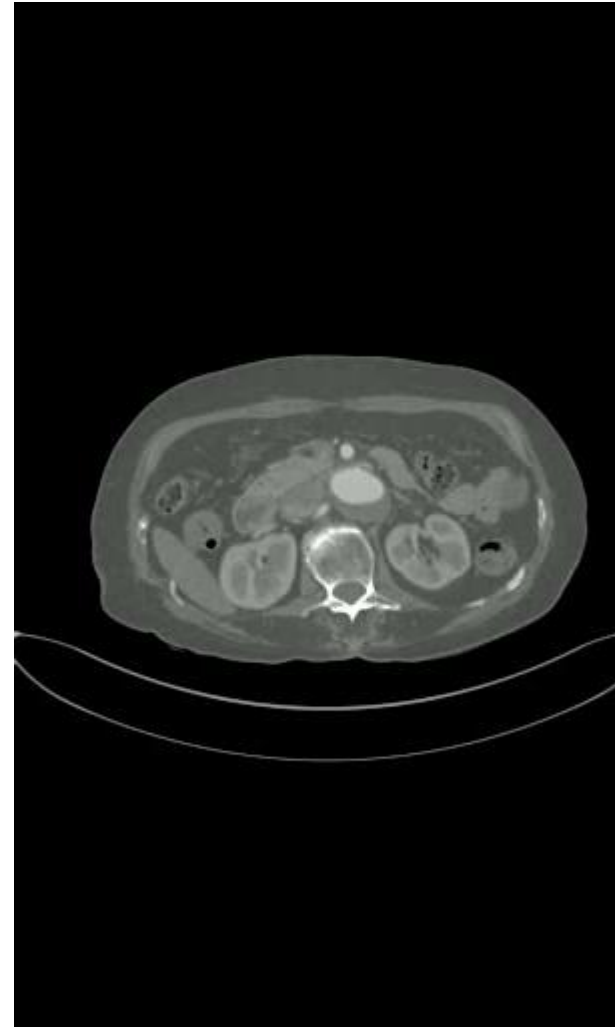
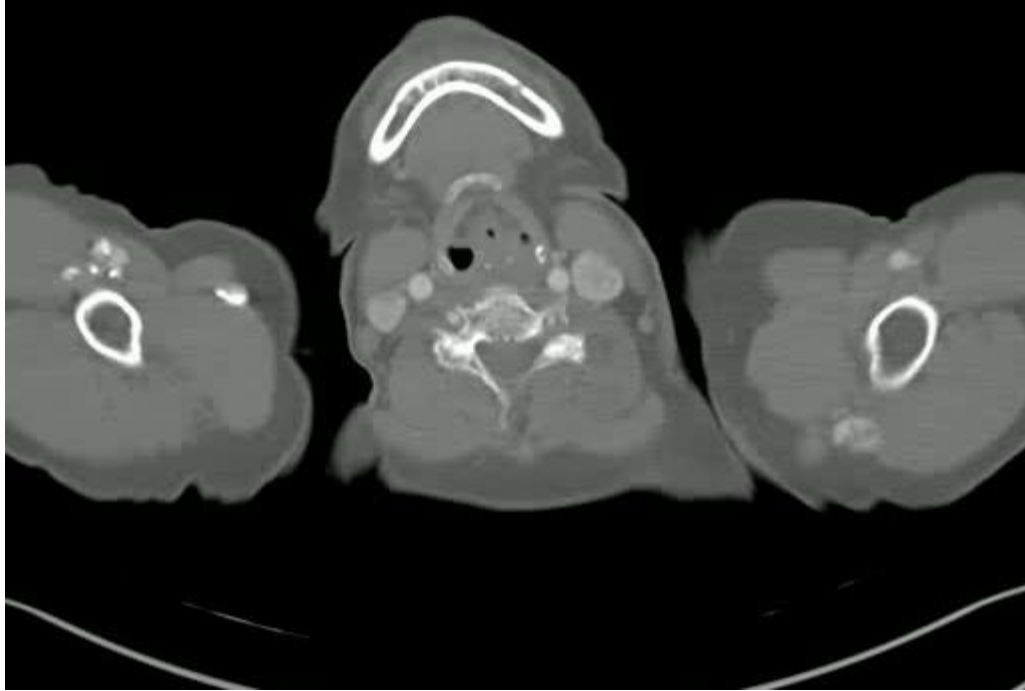
# Case 1 (5Y FU CTA)



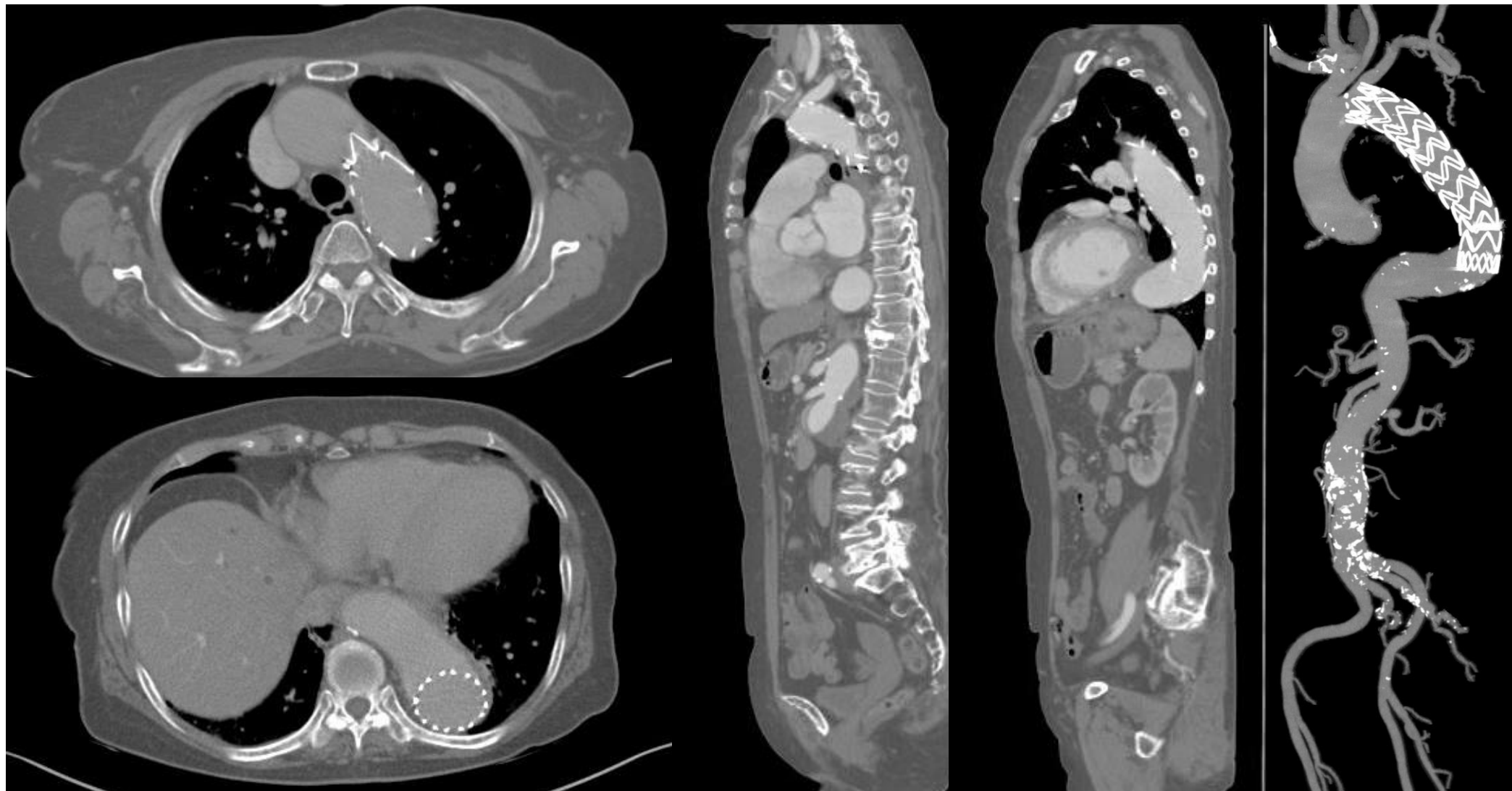
# Case (5Y FU CTA)



# Case (8.5Y FU CTA)

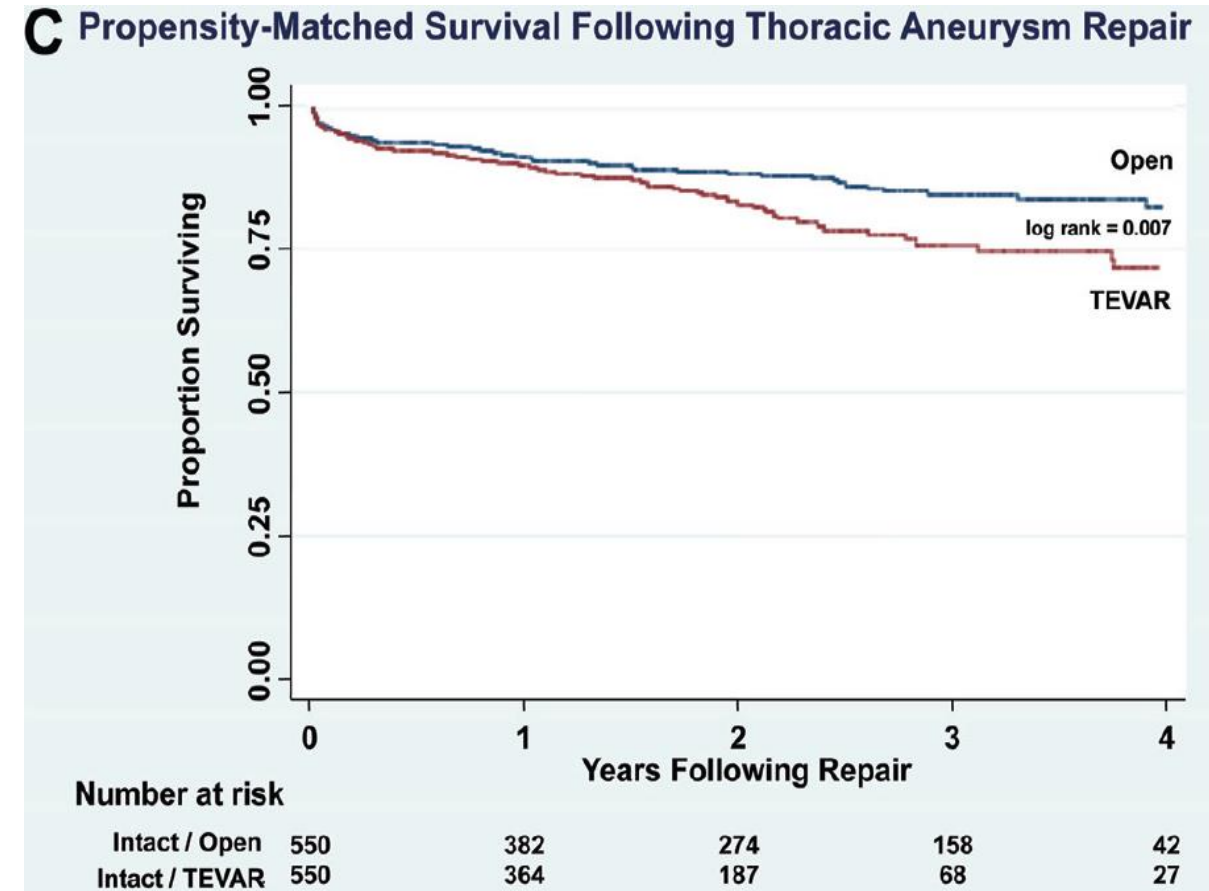
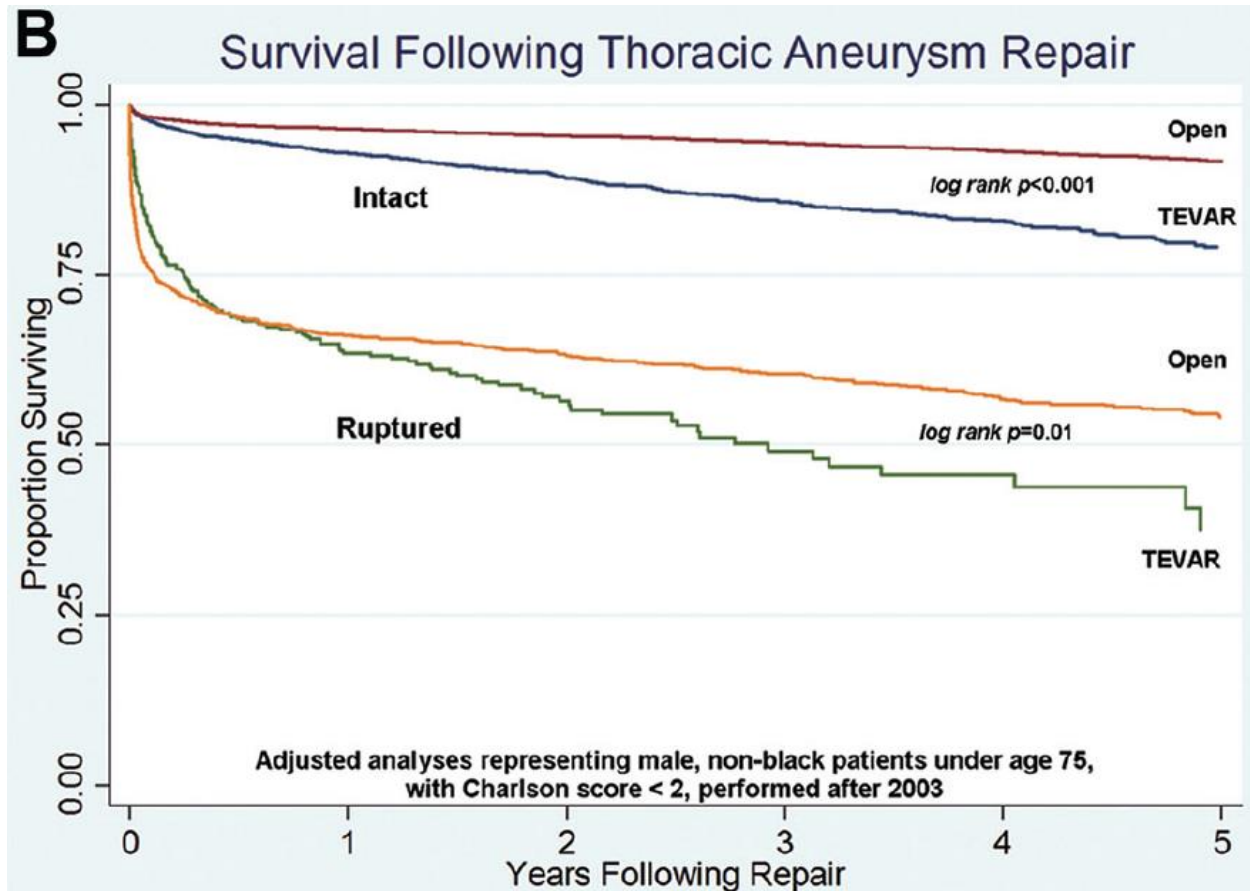


# Case (8.5Y FU CTA)



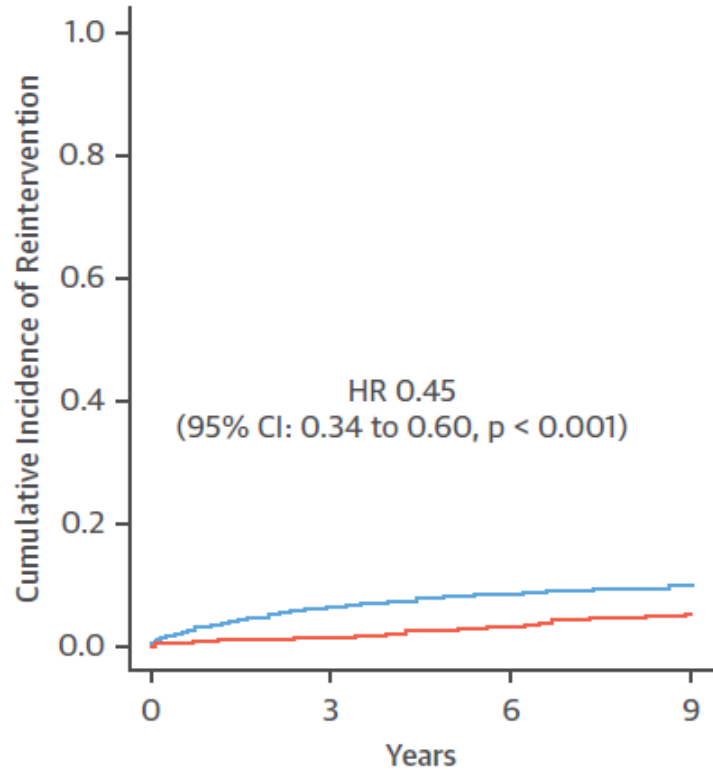
# Long-Term Outcomes of TEVAR in TAA

## Open repair vs. TEVAR

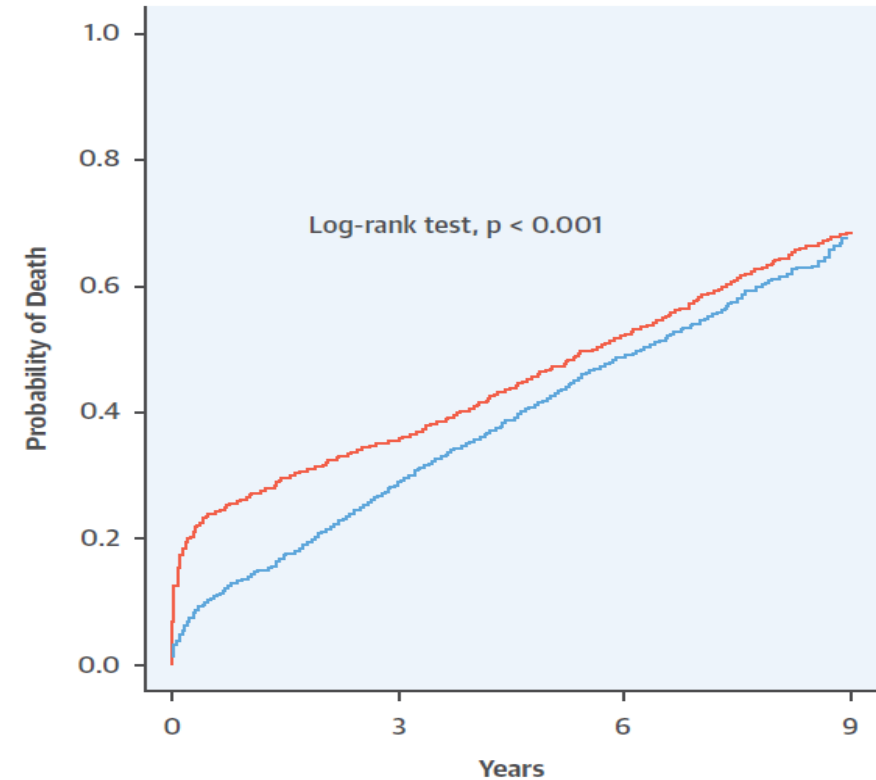


# Long-Term Outcomes of TEVAR in TAA

## Open repair vs. TEVAR



Reintervention: TEVAR	2,470	2,307.8	668	477.8
Reintervention: OSR	1,235	1,216.8	568	722



2,470	1,761	725	31
1,235	795	590	389

— Thoracic Endovascular Aortic Repair  
— Open Surgical Repair



# Conclusion

- **TEVAR has become the preferred approach for patients with thoracic aortic pathology and anatomy amenable to endograft placement.**
- **Adequate seal zones, careful preoperative planning, and proper device sizing are critical to obtain a good result and limit complications.**