AORTIC LIVE 2017
October 23–24, 2017
Hamburg, Germany

CHRONIC AORTIC DISSECTION: HOW TO DEAL WITH THE FALSE LUMEN IN OPEN AND ENDOVASCULAR SURGERY

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Disclosure

Speaker name:

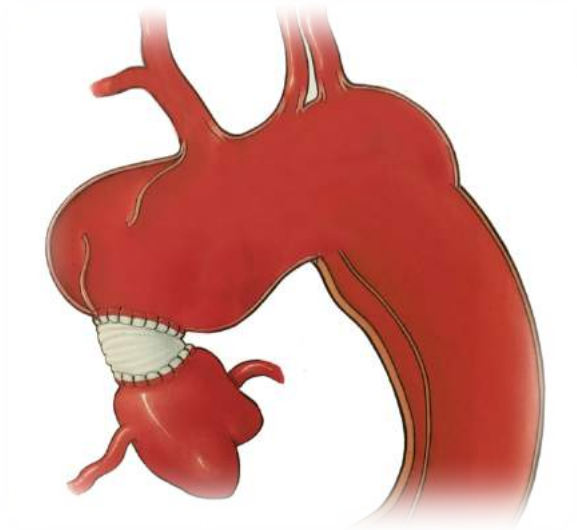
Luca Bertoglio

I have the following potential conflicts of interest to report:

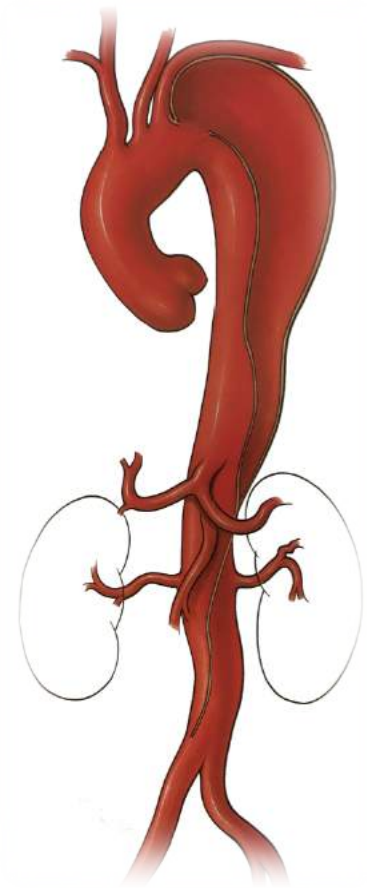
- [X] Consulting: Cook Medical Inc.
- [ ] Employment in industry
- [ ] Stockholder of a healthcare company
- [ ] Owner of a healthcare company
- [ ] Other(s)

- [ ] I do not have any potential conflict of interest

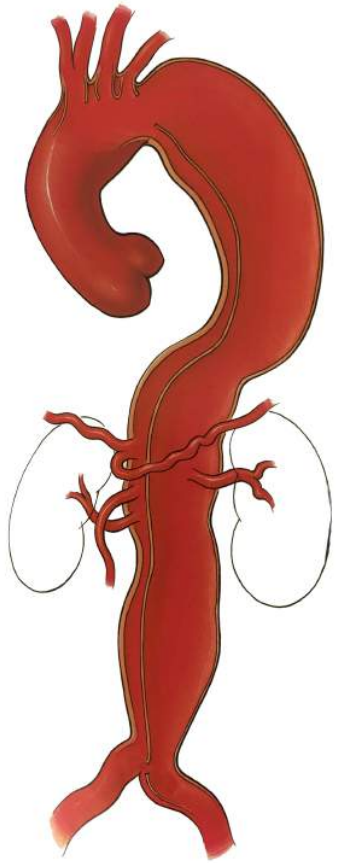
Chronic dissection aortic scenarios



Residual TAD

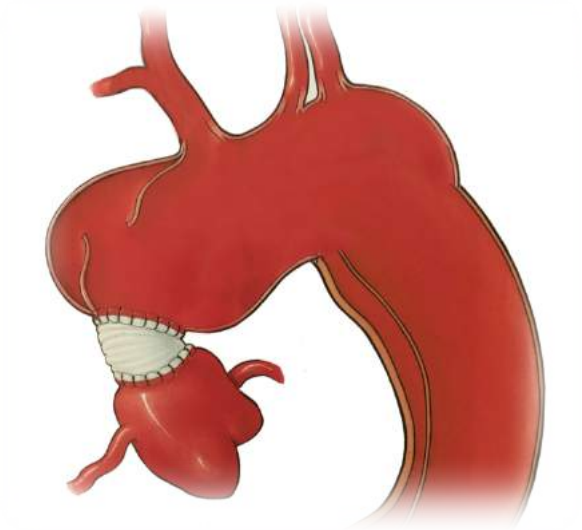


DTA FL evolution



TAAA FL evolution

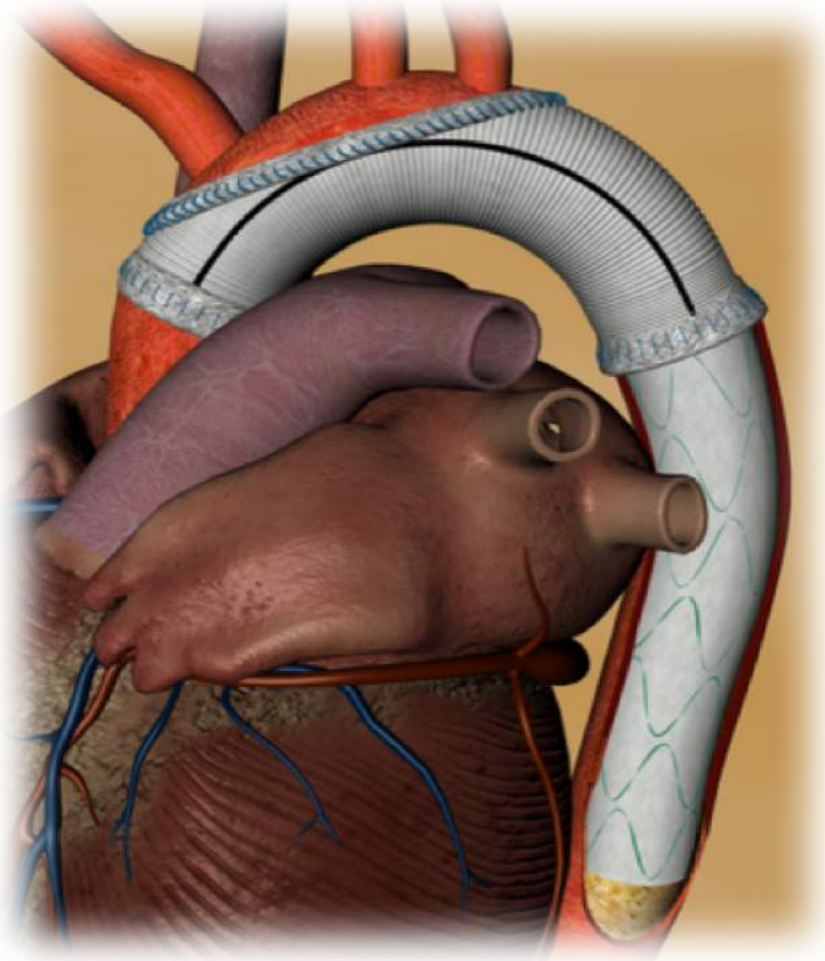
Residual Type A dissection



- Fix permanently the arch FL
- Allow further OPEN or ENDO repairs

OPEN: frozen elephant trunk (FET)

30 out of 43 (69.7%) OSR FET have a residual cTAD



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+ Monday, October 23, 2017: Aortic Valve - Root - Ascending Aorta

− Monday, October 23, 2017: Aortic Arch

14.00 – 18.30 **SESSION 2: AORTIC ARCH**
Chairmen: *P. Cao, R. Di Bartolomeo*
Panel: *C. Detter, A. Estrera, M. Farber, J. Schmidli*

PRESENTATIONS

- The natural history of aortic arch aneurysms: when to intervene – *S. Cheng*
- How to manage the left subclavian and left vertebral artery during TEVAR – *J. Schmidli*
- The evolution of FET-technique – *H. Jakob*
- TBAD and FET: Is there an indication for open surgery? – *M. Grabenwöger*
- New branched and fenestrated devices for the aortic arch – *M. Farber*

VIDEOS

- Single sidebranch zone 2 TEVAR – *G. Oderich / B. Mendes*
- Debranching techniques: Osaka style – *K. Shimamura*
- Tips and tricks for branched arch endografting – *M. Czerny*
- Tips and tricks for open surgical arch repair – *M. Shrestha*

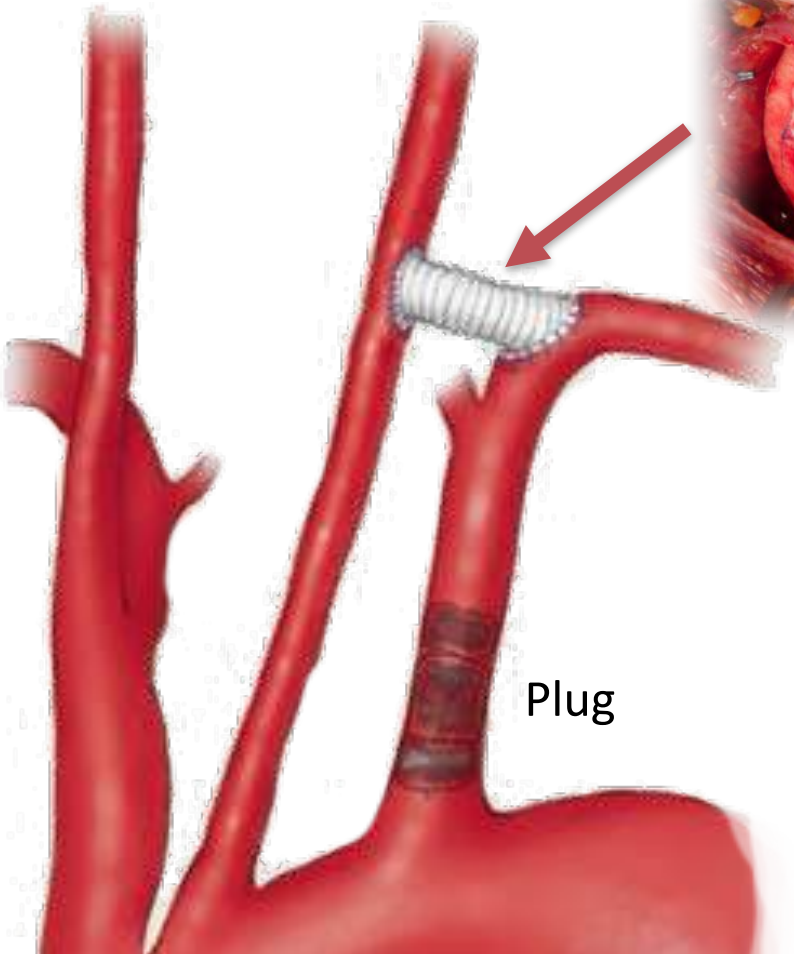
16.00 – 16.30 **COFFEE BREAK**

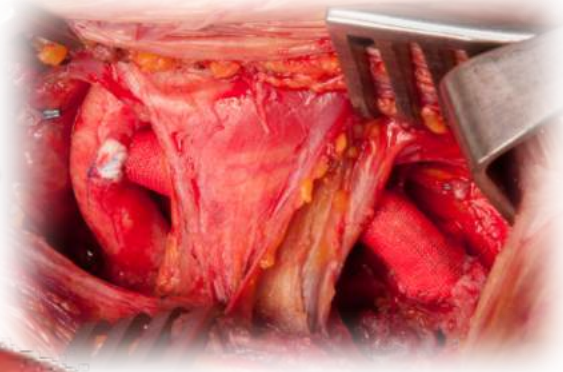
LIVE CASE TRANSMISSIONS

- Frozen Elephant Trunk with Jotec E-vita OPEN NEO [Essen] – *K. Tsagakis*
- Frozen Elephant Trunk with Vascutek Thoraflex hybrid [Hamburg] – *C. Detter*
- Branched TEVAR with Cook Zenith Branched Graft [Hamburg] – *S. Haulon*
- Fenestrated TEVAR with Cook Zenith Fenestrated Graft [Hamburg] – *N. Tsilimparis*
- TEVAR Zone 2 with Jotec E-vita Thoracic [Berlin] – *S. Buz*
- TEVAR in hostile arch with Gore cTAG (Active Control System) [Regensburg] – *K. Pfister/K. Oikonomou*

Frozen elephant trunk: 1st Step

Carotid to subclavian bypass for bi-hemispheric cerebral perfusion through axillary arteries





CSB

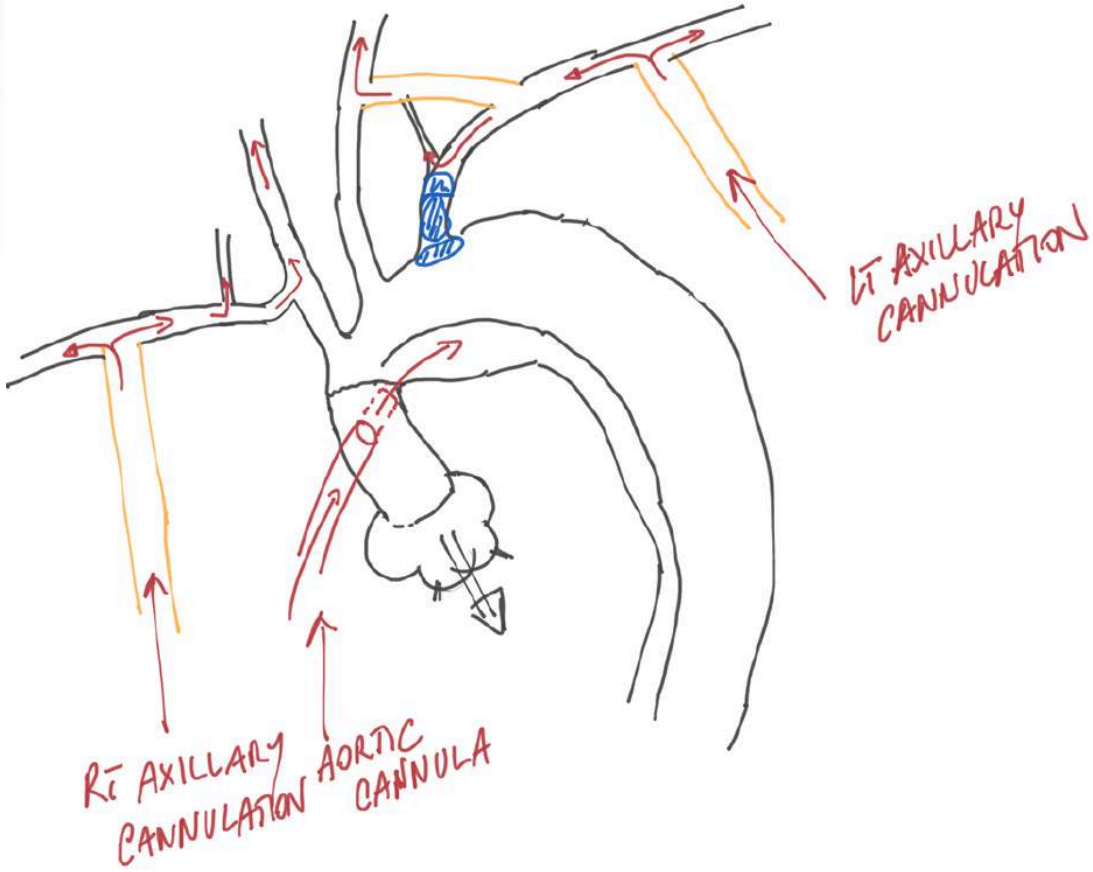
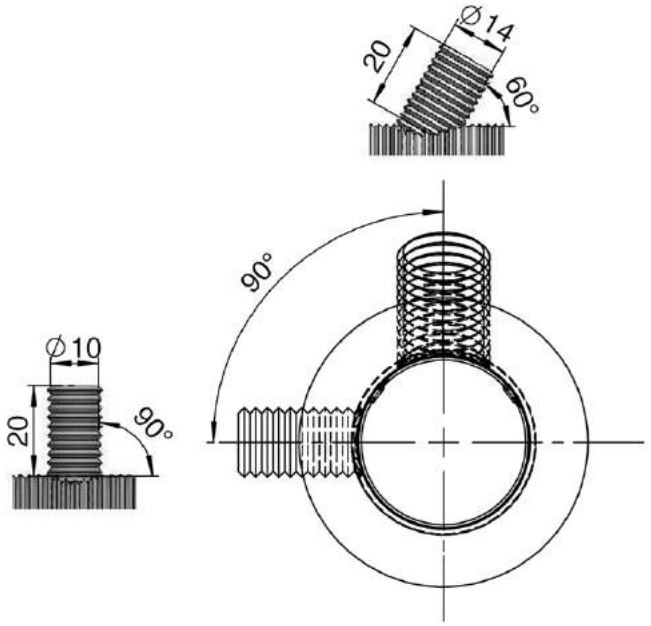


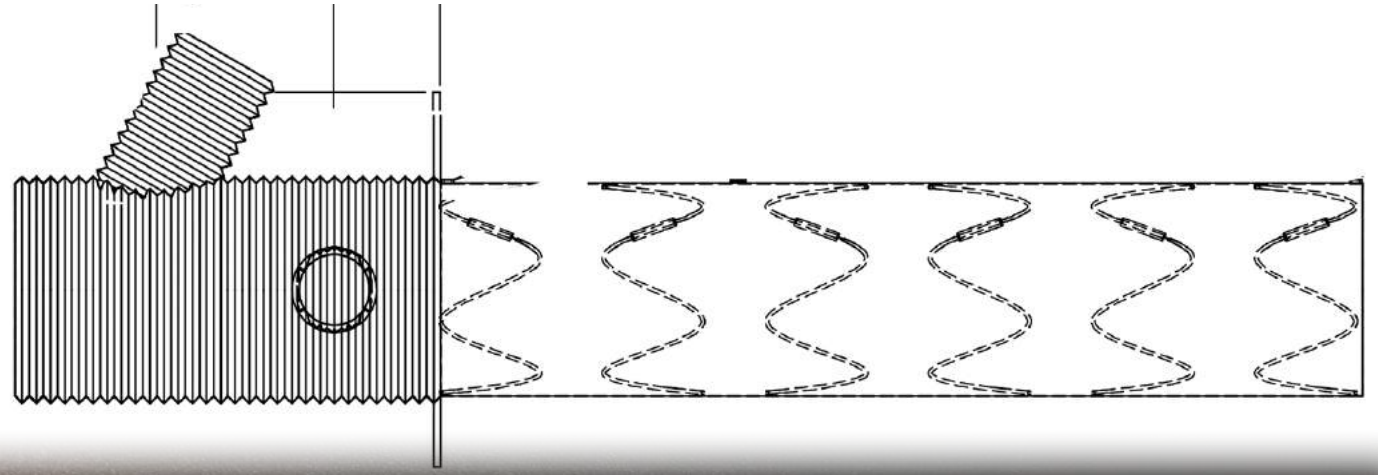
Illustration by David Factor (Mayo Clinic) in Oderich GS edition. Springer 2017

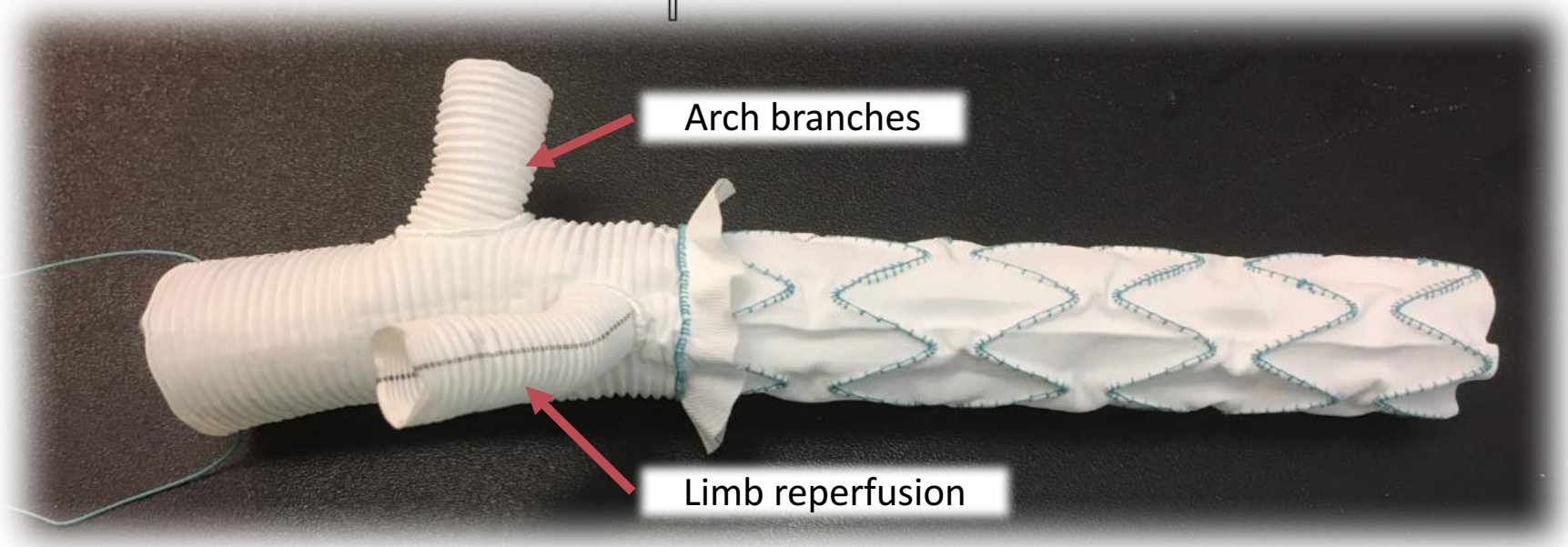
Bertoglio L et al. Ann Thoracic Surg 2017 [In press]

Frozen elephant trunk: 2nd Step with a CMD E-Vita

Arch branches first and early limb reperfusion



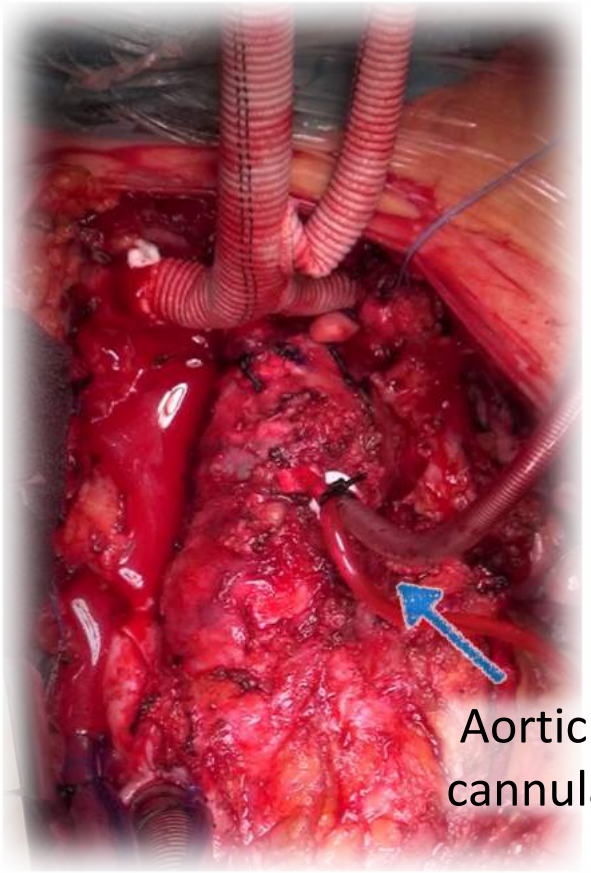




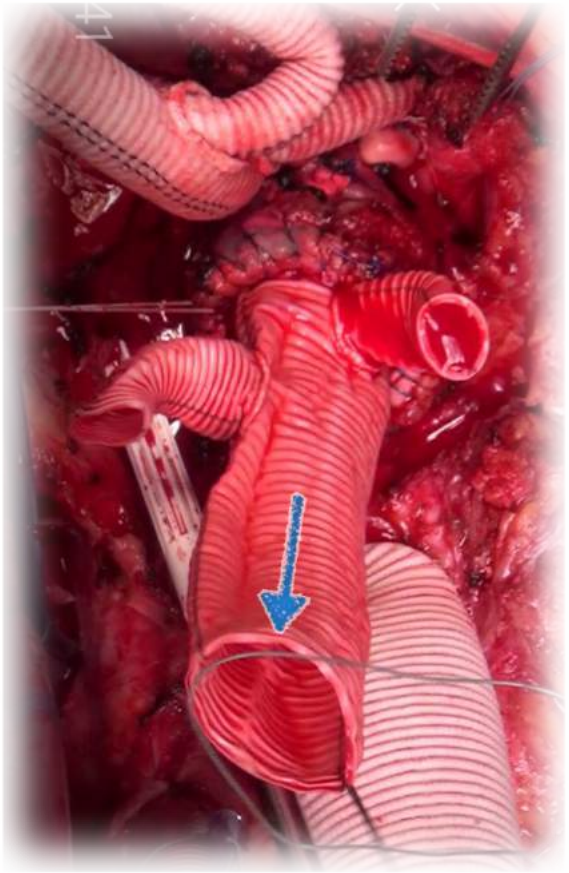
Bertoglio L et al. Ann Thoracic Surg 2017 [In press]

Frozen elephant trunk: 2nd Step

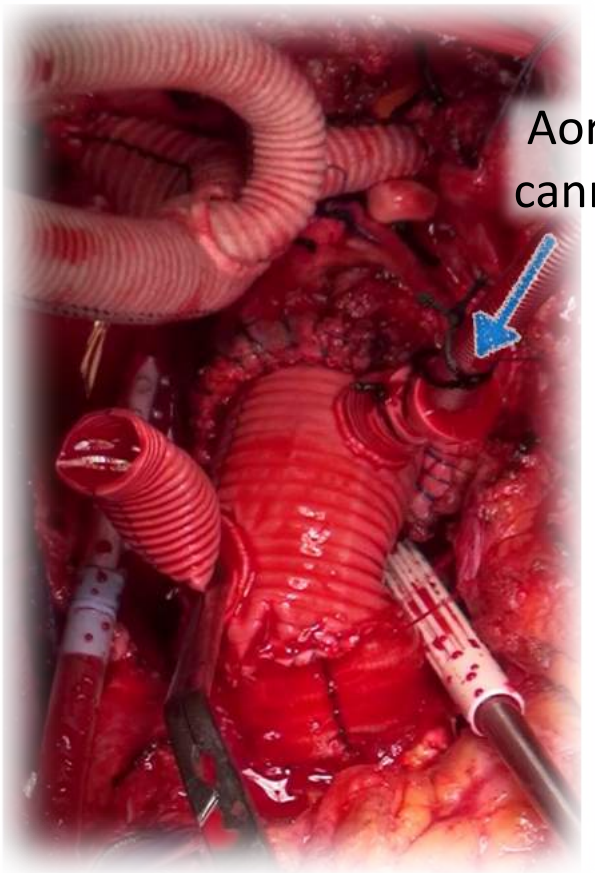
Arch branches first and early limb reperfusion with continuous bi-emispheric perfusion



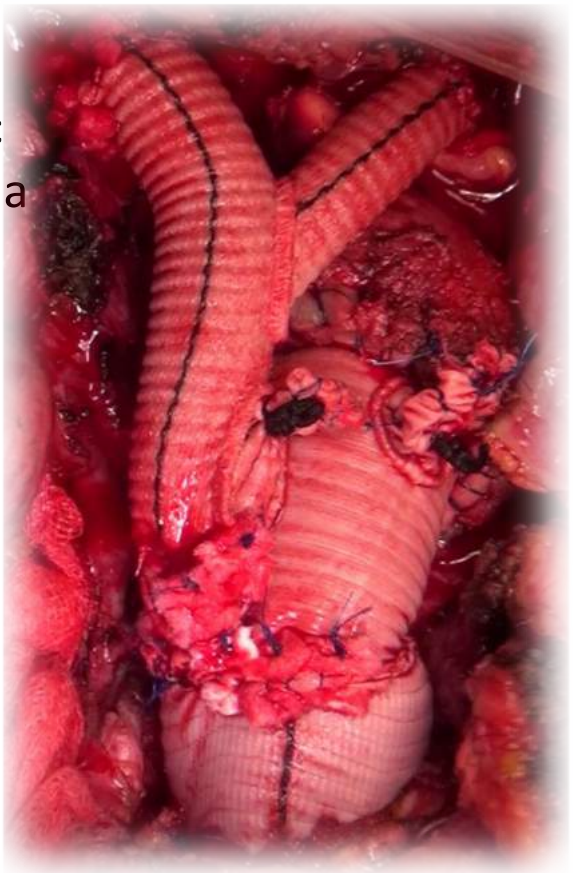
Debranching
(32°C)



FET retrival
(28°C)



Limb reperfusion
(32°C)



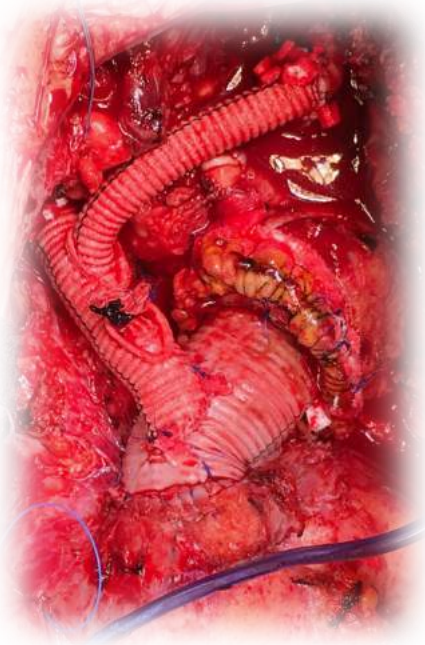
SAT anastomosis
(34°C)

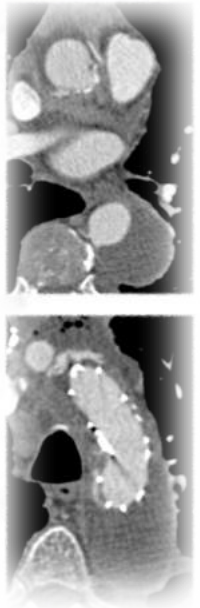
Brain (axillary)	+	+	+	-
Distal (aorta)	+	-	+	-

OSR FET results

15 out of 43 (25%) already performed an OPEN or ENDO 2nd stage

	30-day results
Mortality	4 (9.3%)
Major cerebrovascular events	2 (4.6%)
Spinal cord ischemia	3 (6.9%)
Renal injury / failure (AKI 2-4)	6 (13.9%)
Respiratory failure	4 (9.3%)
Bleeding (re-exploration)	3 (6.9%)





15 / 43 cases (25%)
2nd distal aortic procedure

Open TAAA	10 (67%)
BEVAR	1 (7%)
TEVAR alone	2 (13%)
TEVAR + Candy plug	2 (13%)

Performed with our OSR CT surgeons: Castiglioni A

ENDO: Inner branch arch repair

1st case 2013 – worldwide: < 20 cases published

Endovascular Repair of a Chronic Arch Dissecting Aneurysm With a Branched Endograft

Rotaïlle Spear, MD, Adrien Kaladji, MD, Blayne Bardet, PhD, and Stephan Haulon, MD, PhD

Department of Vascular Surgery, Hôpital Cardiologique, Centre Hospitalier Régional Universitaire de Lille, Lille, France; Department of Cardiothoracic and Vascular Surgery, Centre Hospitalier Régional Universitaire de Rennes, Rennes, France; Cook Medical, Bloomington, Indiana; and INSERM U1008, Université Lille Nord de France, Lille, France

Acute type A dissection requires emergent surgery that often includes ascending aorta replacement. Regular follow-up with computed tomography (CT) can identify aneurysmal dilation of the false lumen distal to the open repair. Because redo operations can be high risk, we performed an endovascular repair on a patient deemed unfit for open operation using an aortic arch branched device with 2 internal branches for the innominate trunk and the left common carotid artery. This endovascular approach is a possible alternative in open surgical procedures in selected cases.

(Ann Thorac Surg 2013;96:e39–41)
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Acute type A dissection occurs in 3 in 100,000 persons per year [1]. This pathologic process requires emergent open surgical treatment. The most frequently performed surgical option is an ascending aortic replacement with a tubular graft. Regular follow-up with computed tomography (CT), which is recommended by current guidelines, can identify dilatation of the dissected aorta distal to the graft repair in almost 60% of patients [2]. Open redo surgical procedures for these patients can be high risk. We describe an endovascular alternative for aortic arch repair using a branched endograft in a patient previously treated with an open operation for an acute type A dissection and who was deemed unfit for another open surgical procedure.

A 70-year-old woman treated in 2008 for an acute type A dissection with a 26-mm-diameter tubular prosthesis using the Yacoub technique presented with a 65-mm aneurysmal dilatation of the aortic arch and the thoracic aorta (Fig 1). The patient had a medical history that included high blood pressure, chronic renal insufficiency (1.7 mL/min estimated glomerular filtration rate), severe malnutrition (body mass index, 16 kg/m^2), and breast cancer. The proximal entry tear was located just distal to the graft, and the dissection involved the entire aorta. The supraaortic vessels were not dissected and emerged from the true lumen. The patient was deemed unfit for a redo open operation, and therefore an endovascular approach was proposed for the aortic arch repair.

A branched arch endograft manufactured by Cook Medical (Bloomington, IN) with 2 internal side branches (innominate artery and left common carotid artery) was designed according to the patient's anatomy. A transposition of the left subclavian artery into the left carotid artery was performed as a first procedure 10 days before the endovascular repair [3]. Implantation of the different components required access from the left femoral artery, the left axillary artery, and the right common carotid artery. Before the endograft introduction, a Lunderquist (Cook Medical, Bloomington, IN) stiff wire guide was inserted from the left femoral access through the aortic valve with the tip coiled in the left ventricle. Angiography was performed to confirm that the fusion with the preoperative computed tomographic scan 3-dimensional volume rendering reconstruction was accurate (Fig 2). The endograft was then deployed under rapid pacing with its proximal sealing stent positioned in the ascending aorta graft and the branch origins proximal to their respective target vessel ostia. A modified limb extension was inserted through the right common carotid artery to bridge the gap between the proximal innominate artery and the innominate artery. The distal branch was bridged to the left common carotid artery using a self-expandable covered stent (Fluency, 9 mm × 60 mm; CR Bard, Murray Hill, New Jersey). A distal thoracic endograft was implanted with a 3-stent overlap between both components. The final angiogram showed patency of the coronary arteries and all supraaortic vessels and exclusion of the aneurysmal false lumen. These observations were confirmed by postoperative CT (Fig 3). The postoperative period was uneventful, and the patient was discharged on postoperative day 11.

Comment

Aneurysmal evolution of the false lumen is responsible for 45% of redo operations after acute type A open repair [4]. Redo operations of the aorta distal to the surgical graft are associated with up to a 13% rate of in-hospital mortality. The associated morbidity is also high and includes early secondary procedures to correct hemorrhage, postoperative renal failure, and stroke [5]. Indeed, temporary neurologic dysfunction is seen in 32.7% of patients [6].

Different endovascular techniques have been described previously for the repair of the aortic arch, including custom-made fenestrated endografts, in situ endograft fenestrations, and chimney grafts. These techniques have not gained wide acceptance and are generally

Dr Haulon discloses financial relationships with Cook Medical and GE Healthcare; and Dr Roeder with Cook Medical.

0003-4975/$36.00

Spear R et al. Ann Thorac Surg 2013

Spear R et al. Eur J Vasc Endovasc Surg 2016

Inner branch suitability in residual TAD

Suitable cases: 52/73 cases (71.2%)

	Reasons for unsuitability
Ascending graft (proximal landing)	21/73 (28.8%)
Graft too short (< 40 mm)	71.4%
Major kink (> 90°)	23.8%
Graft diameter too large (>38 mm)	4.8%
Innominate artery	18/72 (25.0%)
Dissection	77.8%
IA diameter >20 mm	16.7%
Conical shape	5.6%
Left common carotid	4/4 (5.6%)
Dissection	100%

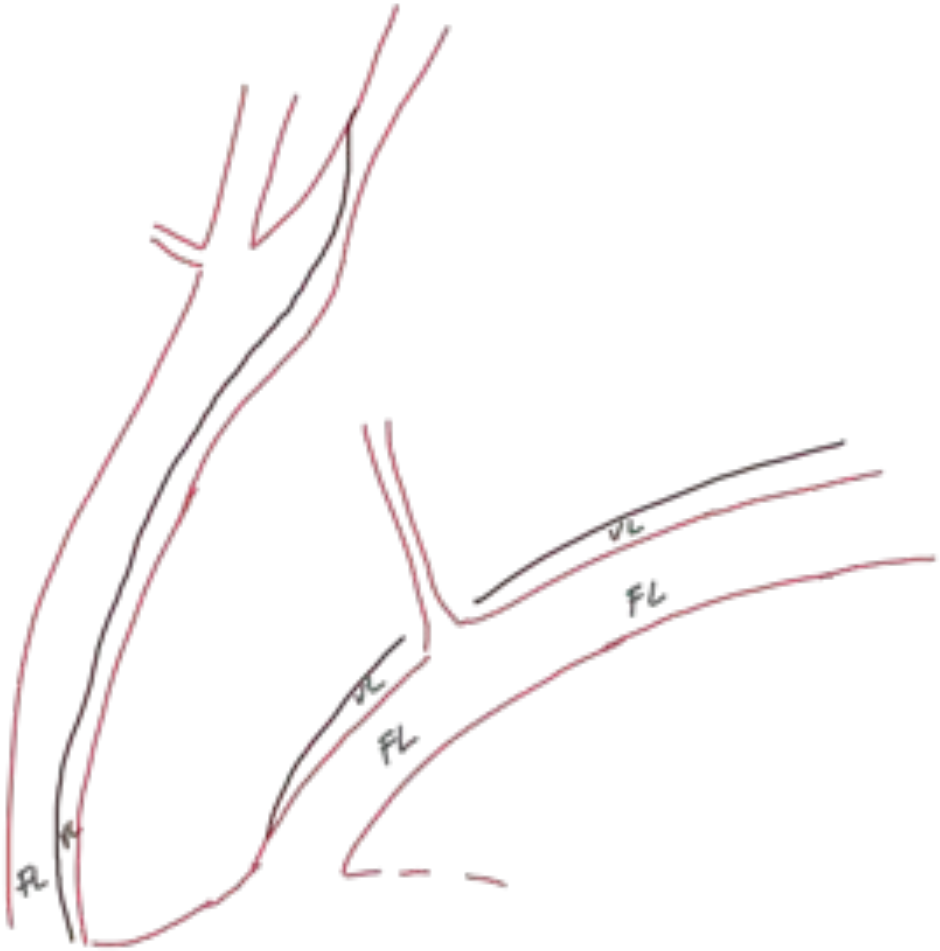
Graft kink

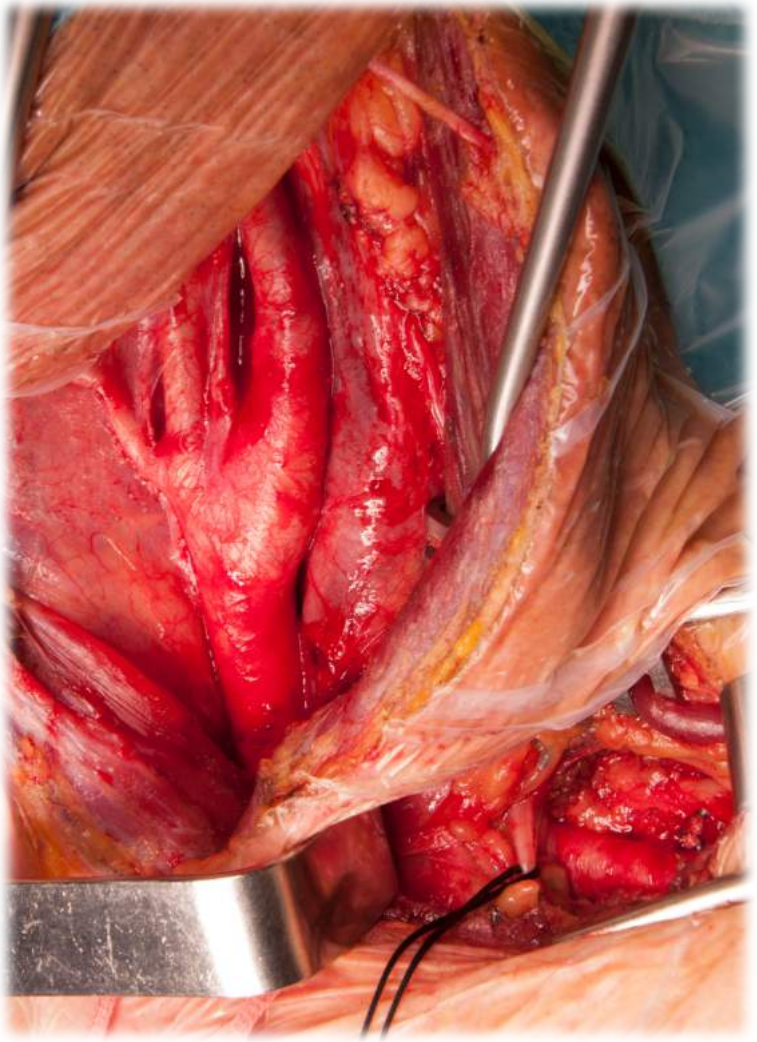
Extensive SAT dissection

Milne et al. Ann Thorac Surg 2016

Supraortic vessels dissection

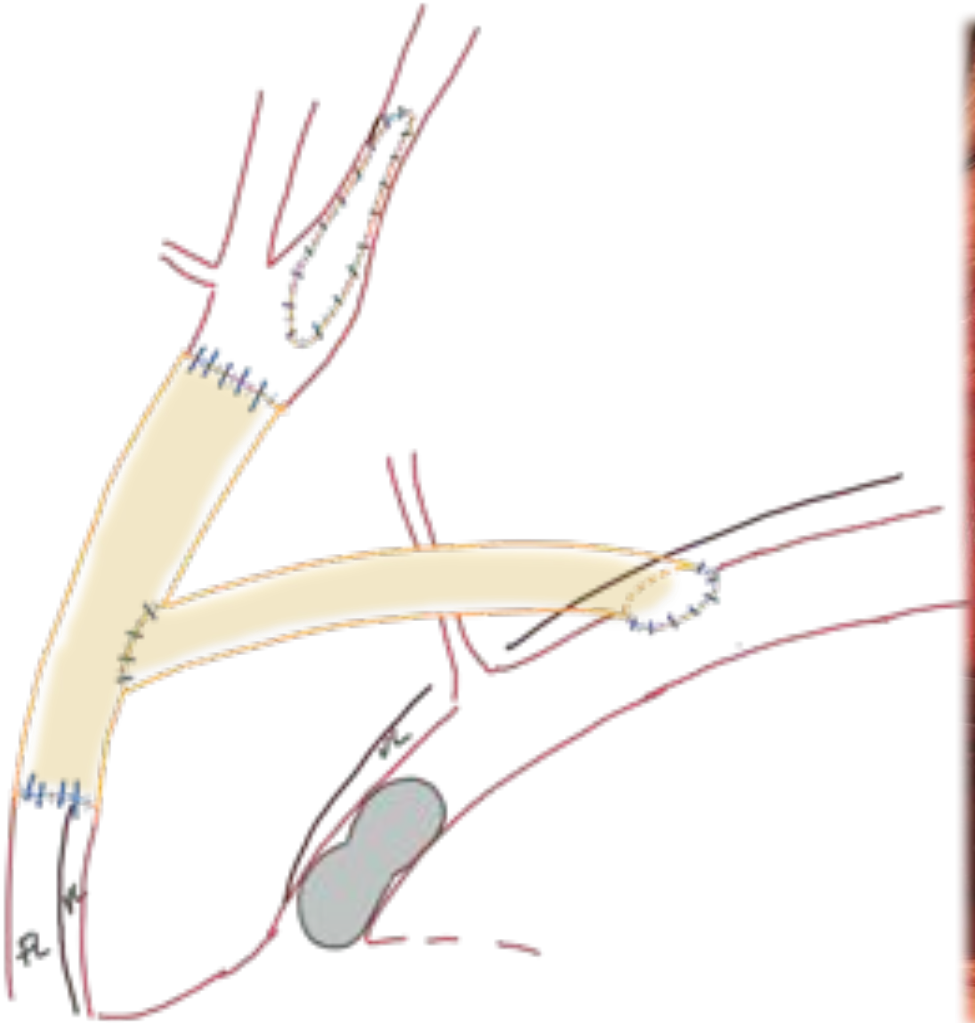
Increased complexity for both OPEN and ENDO repair

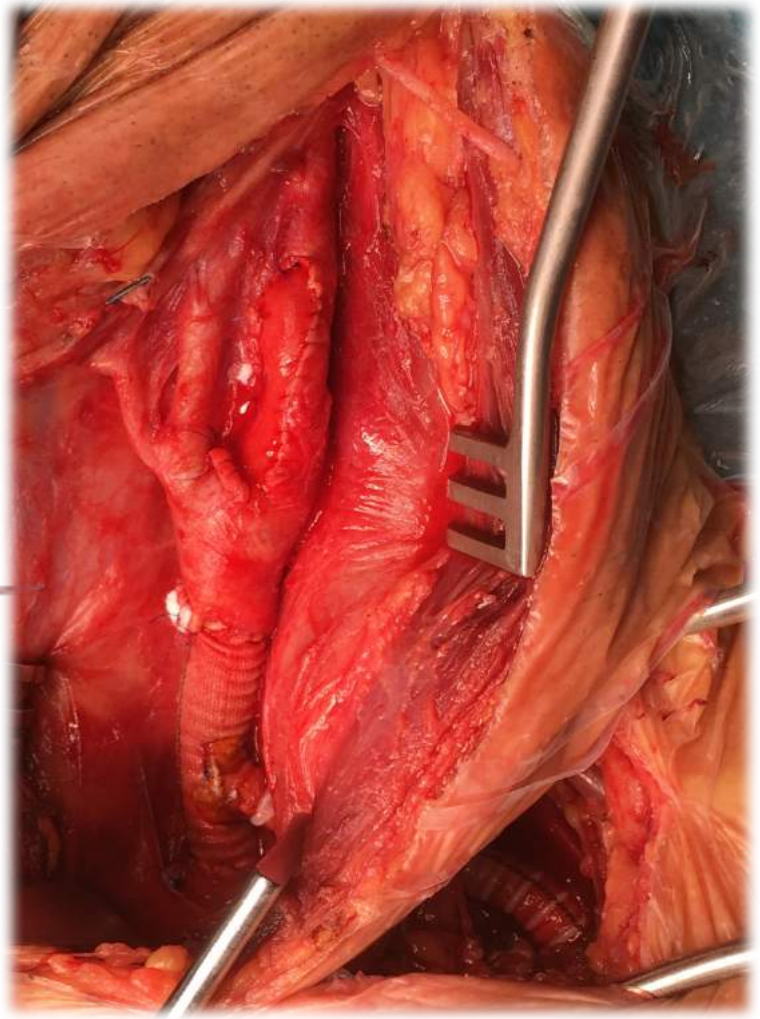




Supraortic vessels dissection

Hybrid techniques

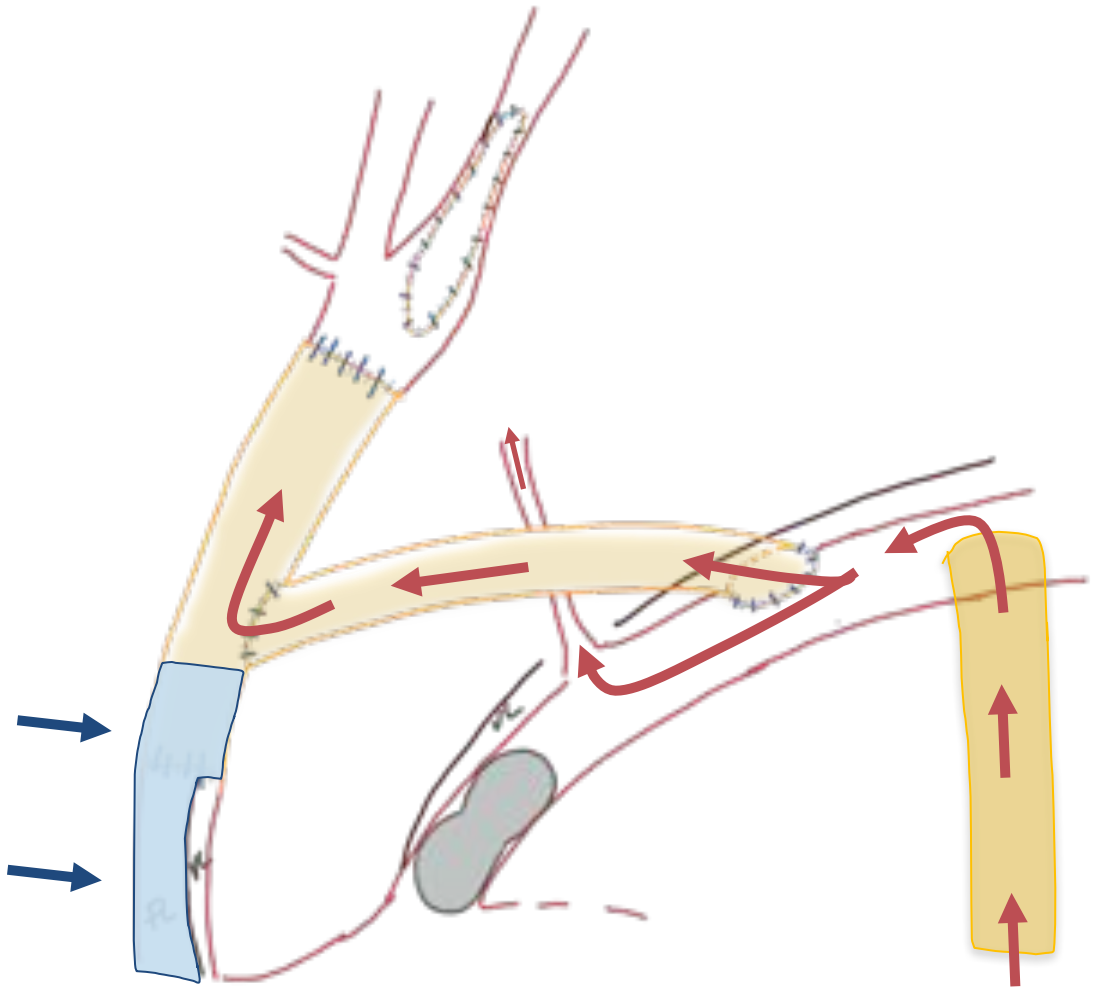




Supraortic vessels dissection

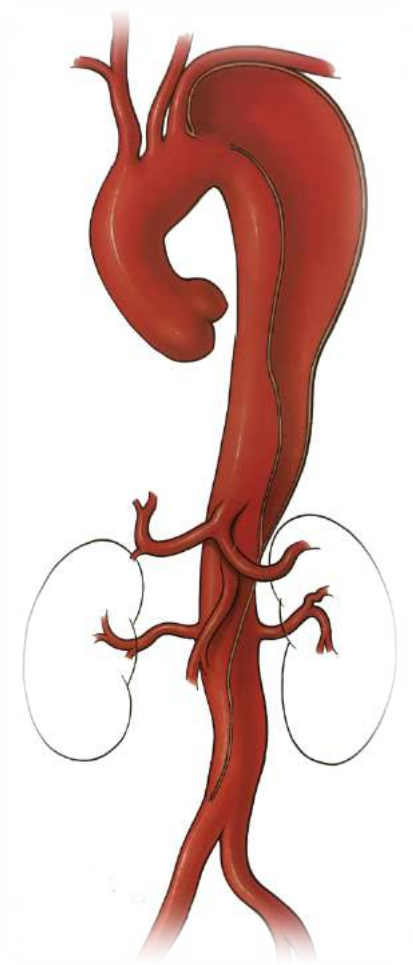
Suitable landing zone or cerebral perfusion

ENDO
Carotid landing zone



OPEN
Axillary perfusion

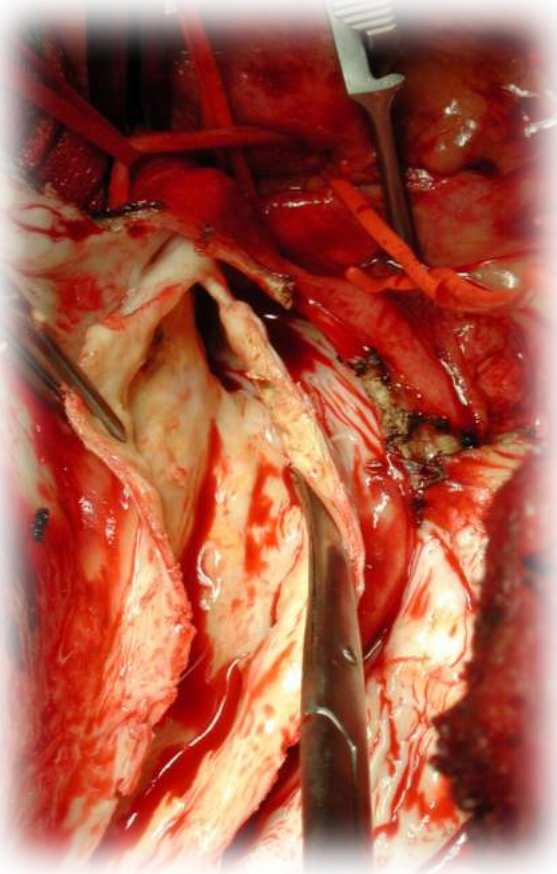
Limited thoracic FL evolution

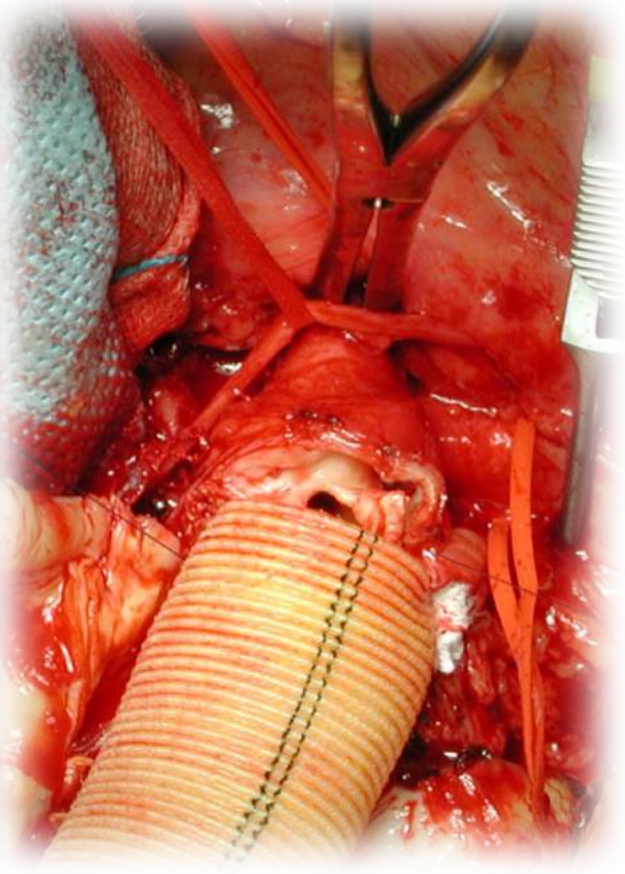


- Prevent FL thoracic rupture
- Allow distal OPEN or ENDO repairs

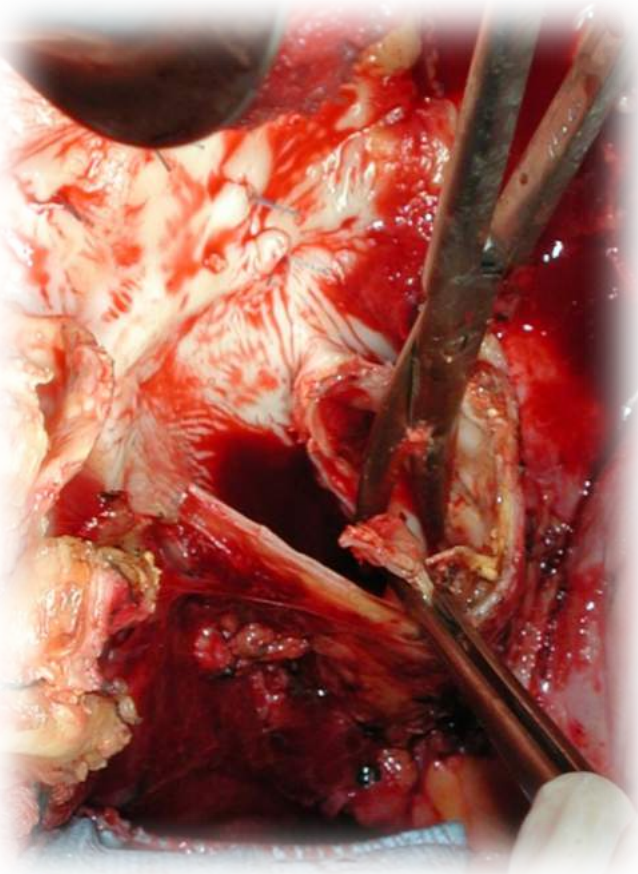
OPEN: chronic type B thoracic repair

Proximal and distal anastomosis





Proximal anastomosis

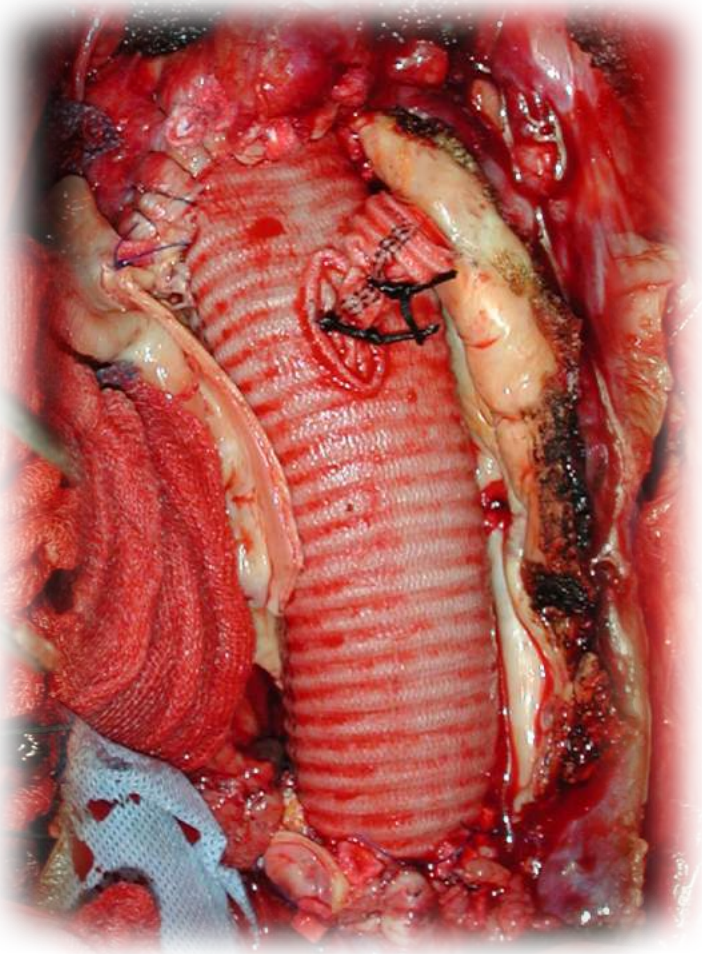


Distal anastomosis

OSR thoracic repair results

67 cases (1993 - 2016)

	30-day results
Mortality	2 (3.0%)
Major cerebrovascular events	1 (1.5%)
Spinal cord ischemia	3 (4.5%)
Renal injury / failure (AKI 2-4)	4 (6.0%)
Respiratory failure	11 (16.4%)



Chiesa et al. [Unpublished series]

OPEN: isolated thoracic repair drawbacks

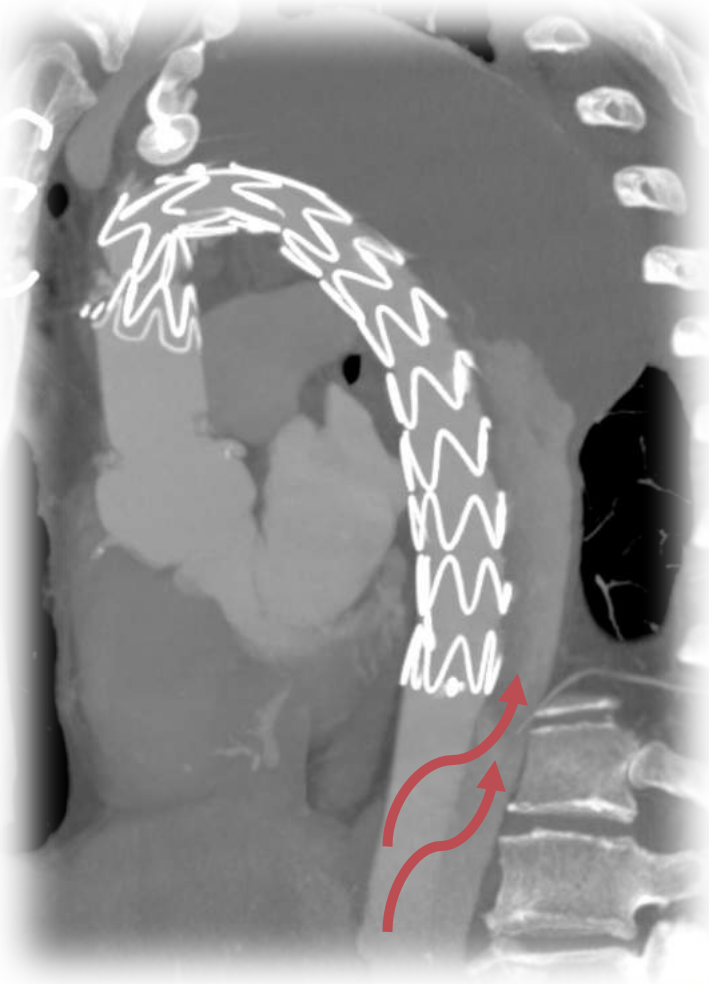
If distal FL evolusion occurs:

- Possible frozen chest (redo open?!)
- Double barrel lumen perfusion (endo?)

Bertoglio et al. J Cardiovasc Surg (Torino) 2015

ENDO: TEVAR alone drawbacks

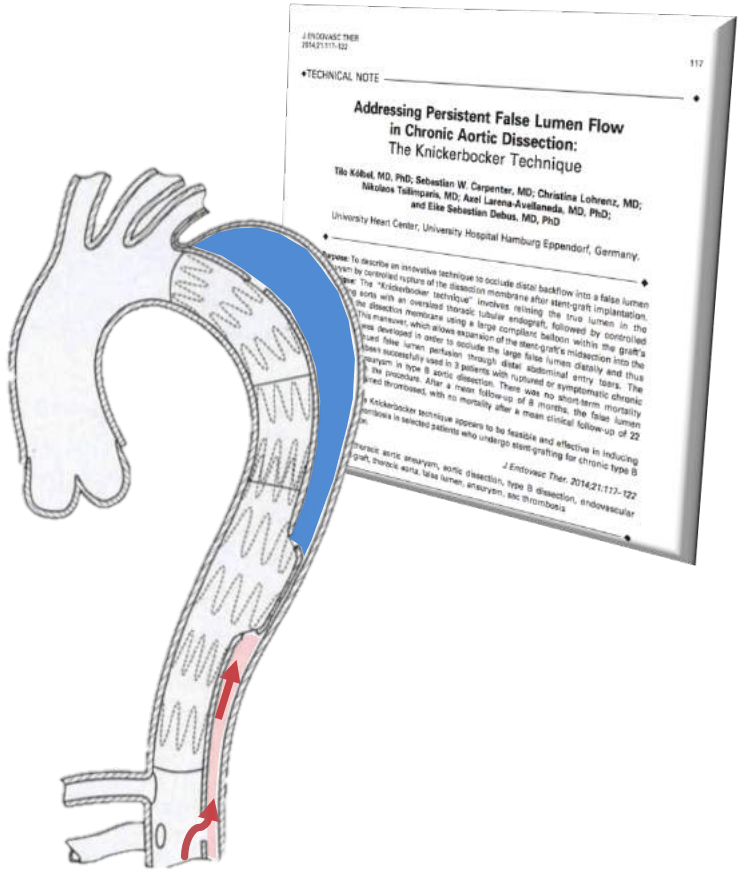
35% of FL expansion at a median follow-up of 16 (r. 1-74) months



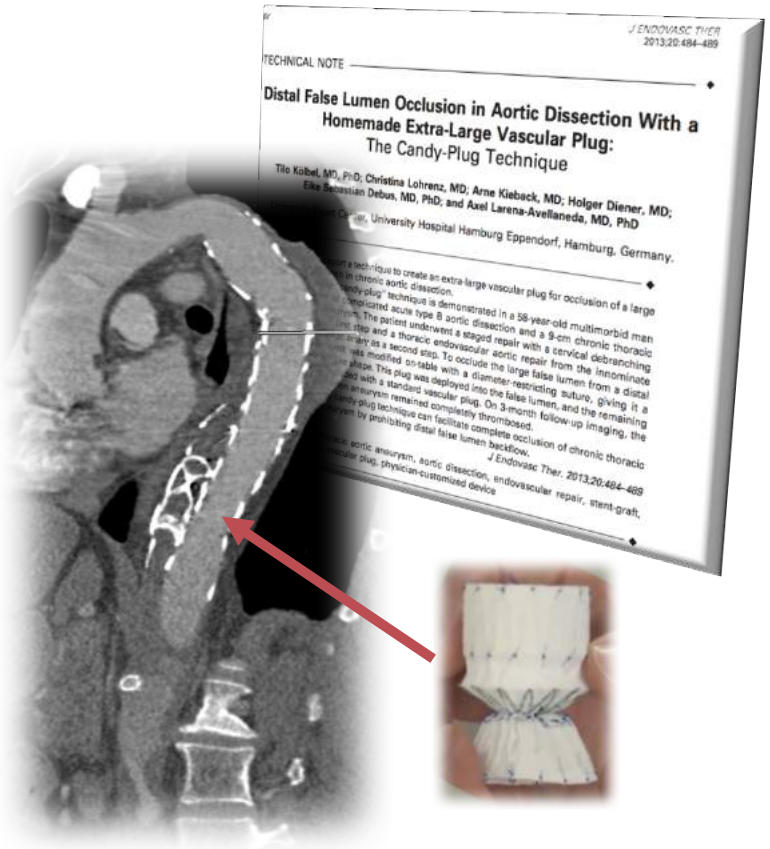
Scali et al. J Vasc Surg 2013

ENDO: TEVAR+ FL occlusion techniques

Two different solutions



The Knickerbocker



The Candy-Plug

Kolbel et al. J Endovasc Ther 2013
Kolbel et al. J Endovasc Ther 2014

ENDO: Candy-plug

Case Example

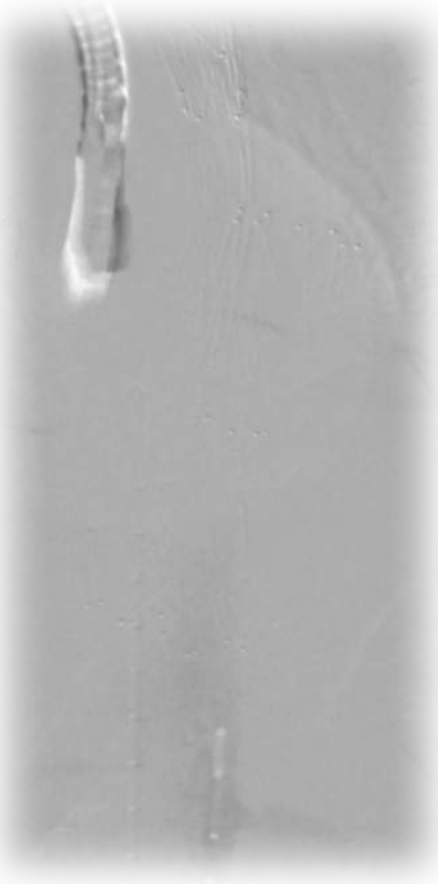
FL candy deployment

Occluder deployment

Candy-plug

FL occlusion

TL injection

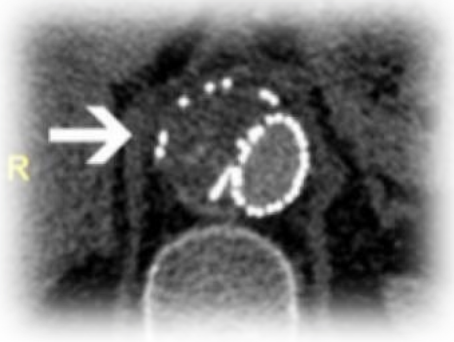


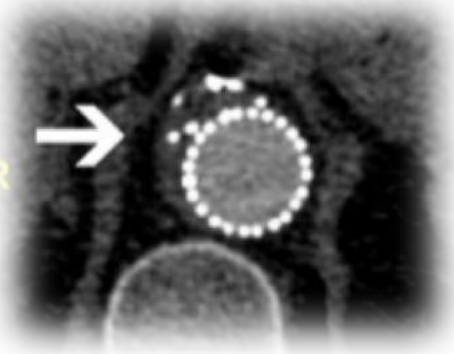
FL injection

Hamburg candy plug experience

18 cases (2013-2016): Clinical success 94%

- Mean follow-up: 9 months (r. 0-26)
- 1 FL rupture in an endoleak case
- Follow-up > 6 months in 10 cases:
  7 cases showed aortic remodelling





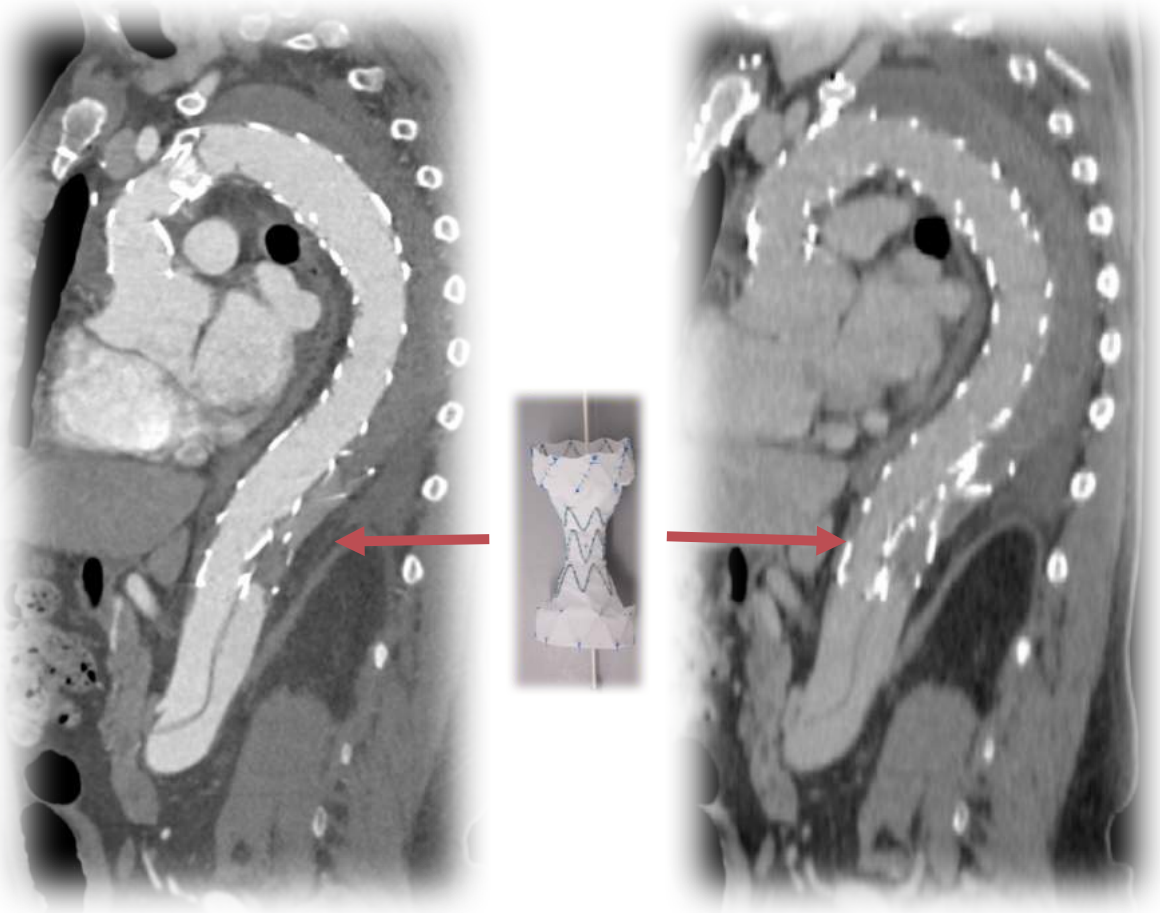
The Candy-Plug Technique: Technical Aspects and Early Results of a New Endovascular Method for False Lumen Occlusion in Chronic Aortic Dissection

Fiona Rohlffs, MD[1], Nikolaos Tsilimparis, MD[1], Beatrice Fiorucci, MD[1,2], Franziska Heidemann, MD[1], Elke Sebastian Debus, MD, PhD[1], and Tilo Kölbel, MD, PhD[1]

Rohlffs et al. J Endovasc Ther 2017

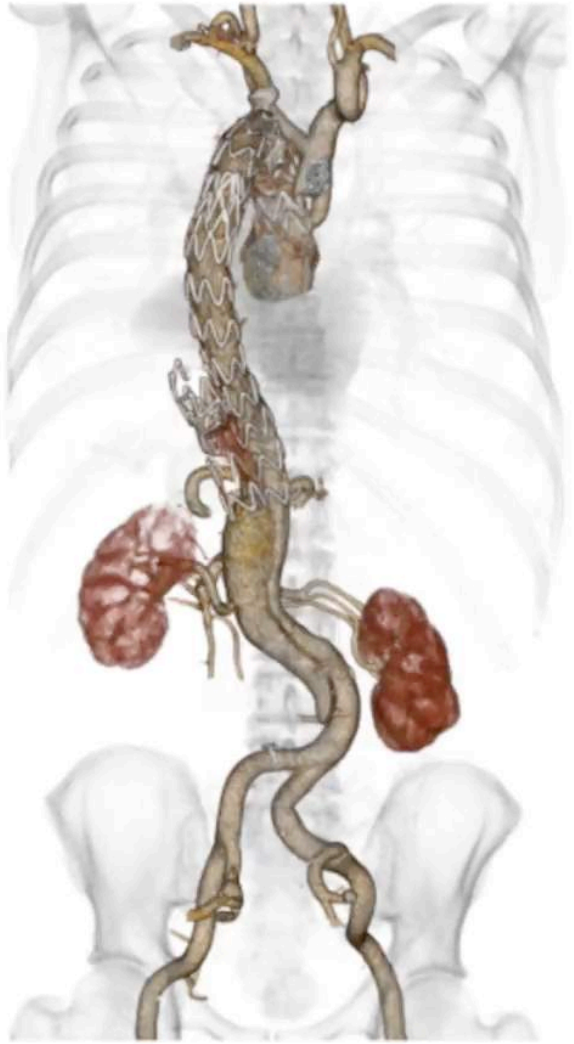
OSR candy plug experience

7 cases (2015-2017): 6/7 technical success and no FL growth at 6 month



Arterial

Venous



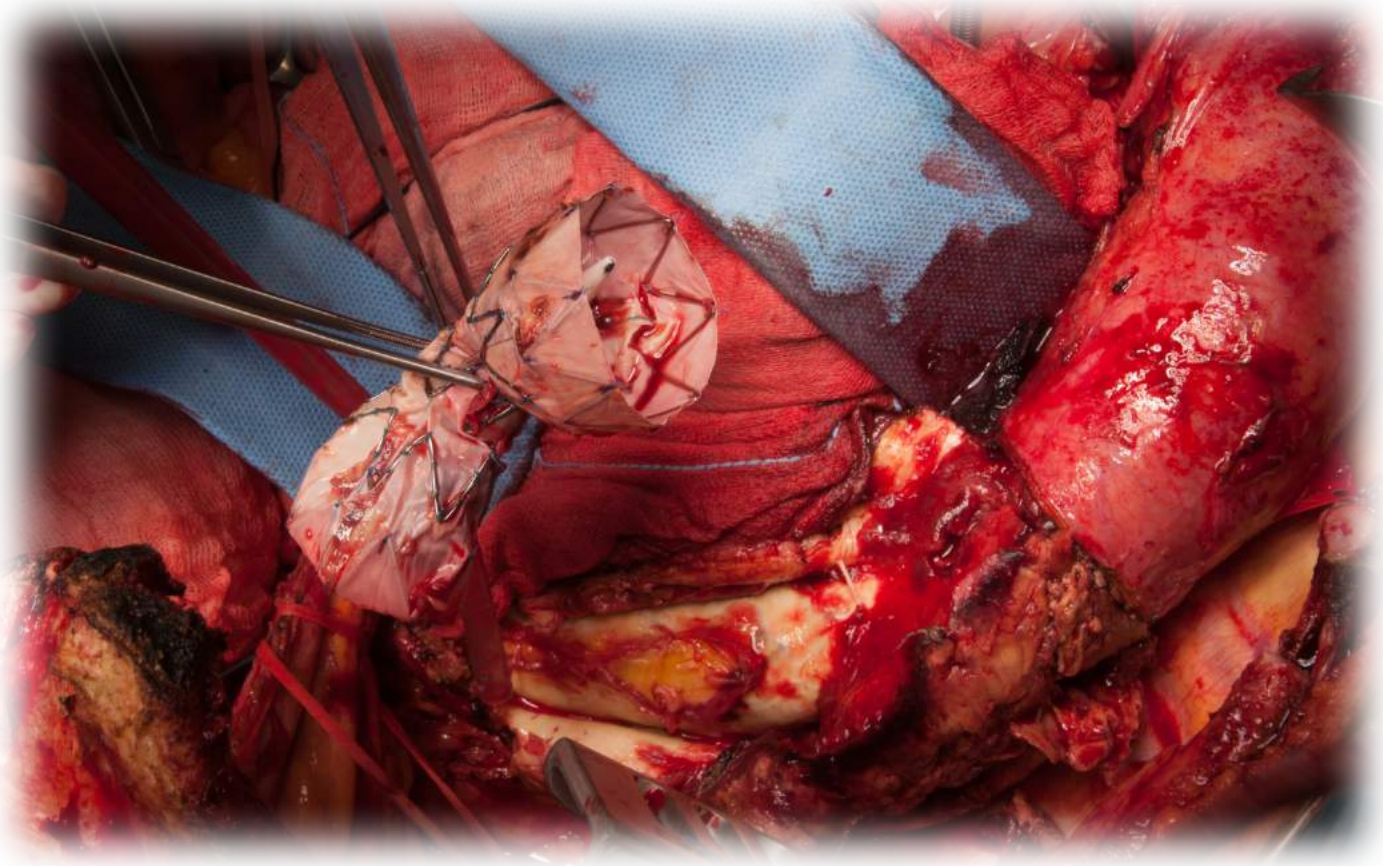
… if further evolution (1 OSR case)

Thoracic FL: fixed

….If abdominal FL growth…

… open or endo repair

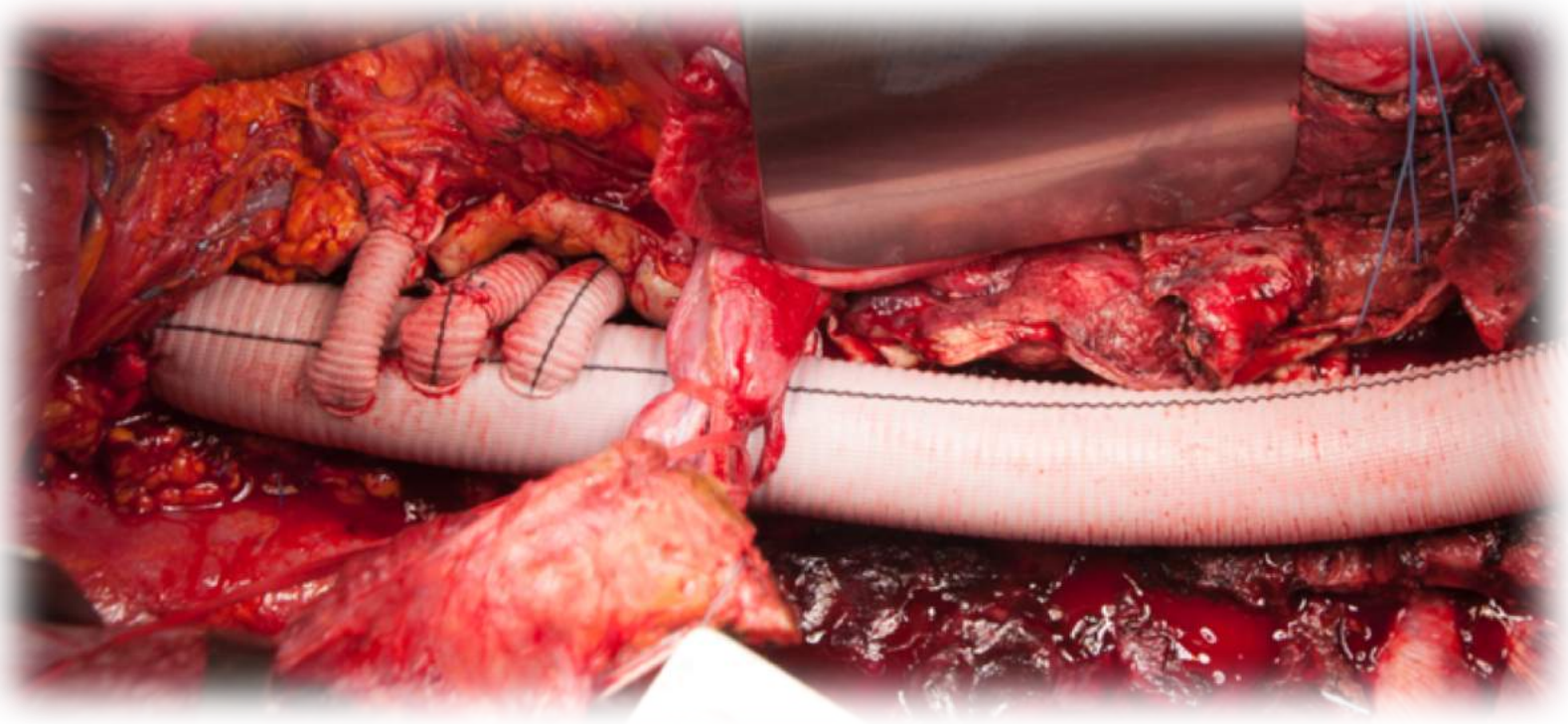
No cases published

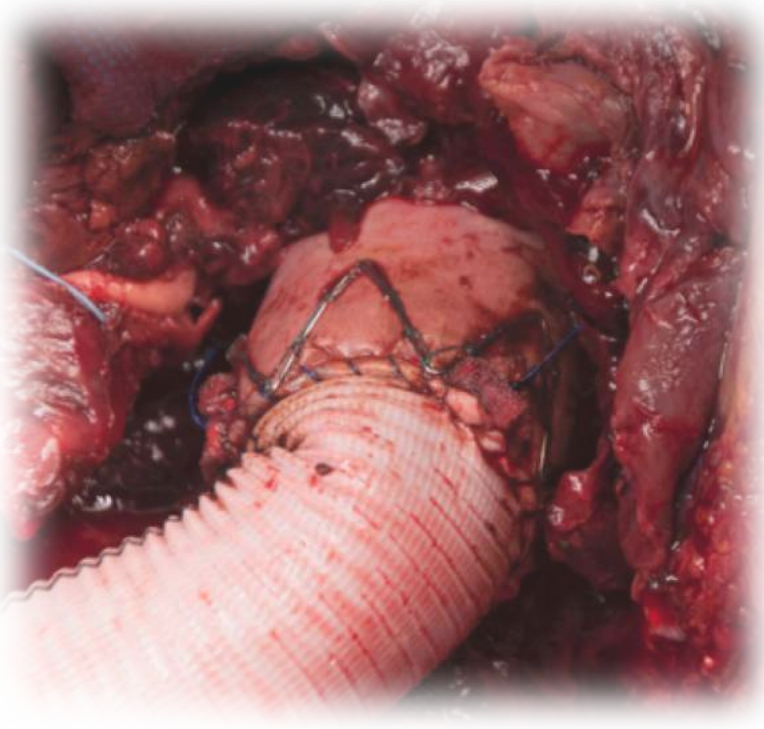


Candy removal from FL

… open or endo repair

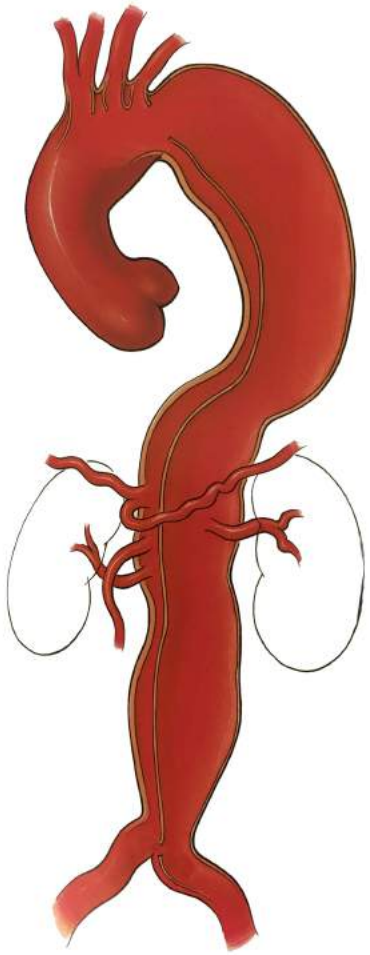
No cases published





Open repair with a stent-graft to graft anastomosis

Thoraco-abdominal FL evolution



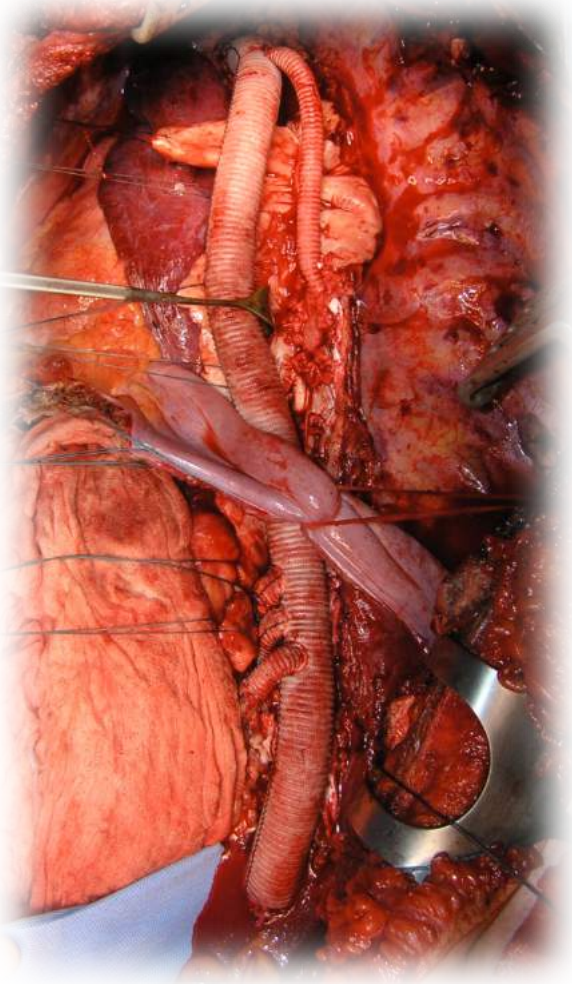
- Fix permanently the thoracic and abdominal FL
- Durable repair

OPEN: TAAA repair

Guidelines recommendation

…. Chronic dissection, without significant comorbid disease, […] open repair recommended particularly in case of cTBD

(Level of Evidence: B)

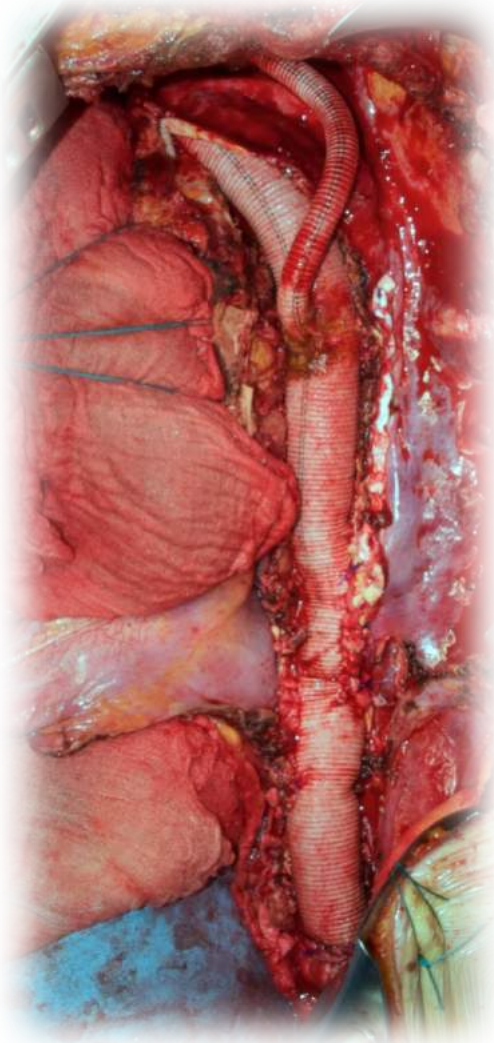


ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM Guidelines. J Am Coll Cardiol 2010
ESVS guidelines. Eur J Vasc Surg 2017

OSR post-dissecting TAAA open repair

56 cases (1993 - 2016)

	30-day results
Mortality	5 (8.9%)
Major cerebrovascular events	0 (0%)
Spinal cord ischemia	4 (7.1%)
Renal injury / failure (AKI 2-4)	3 (5.4%)
Respiratory failure	14 (25.0%)



Chiesa et al. [Unpublished series]

ENDO: Fenestrated / branched repair

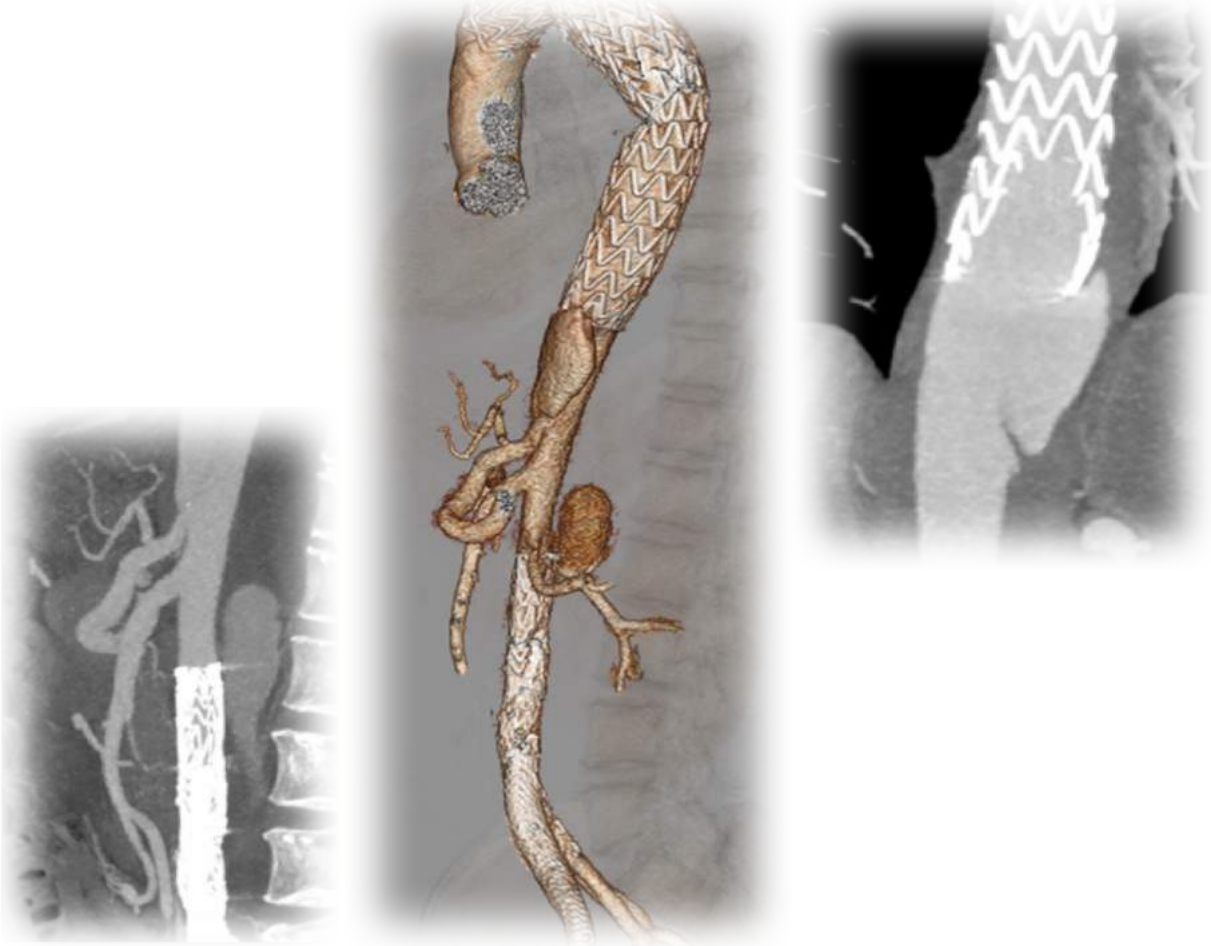
Limited worldwide experience

	Cleveland (USA)	**Lille (France)**	**Nurnberg (Germany)**
	Greenberg[1] (15 cases)	Haulon[2] (15 cases)	Verhoven[3] (31 cases)
Median dissection onset	124 months	48 months	31 months
Previous aortic surgery	80%	73%	74%
Technical success	100%	100%	93.5%
30-day mortality	0	7%	9.6%
Mean follow-up	20 months (r. 1 – 62)	12 months (r. 1-36)	17 months (r. na)
Unplanned reinterventions	53%	13%	23%

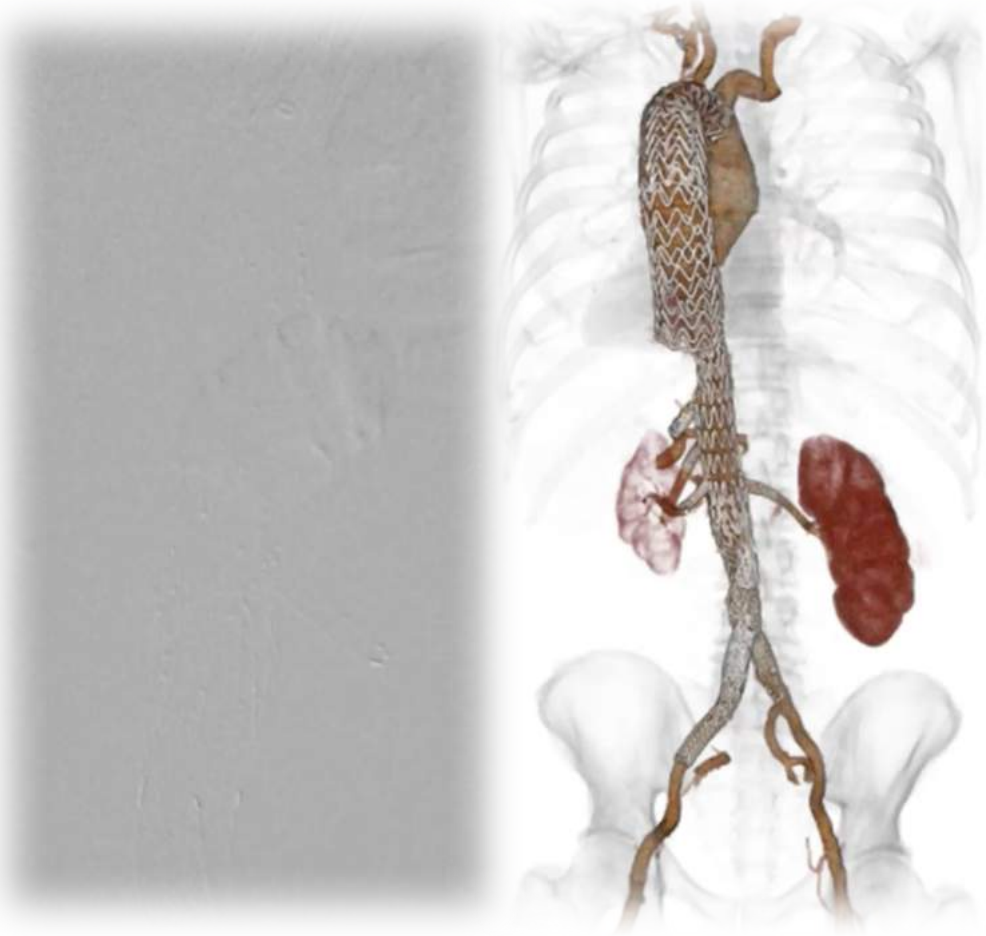
Kitagawa A et al. J Vasc Surg 2013, Sobocinski J et al. J Cardiovasc Surg 2014, Oikonomou K et al. Eur J Endovasc Surg 2014

OSR B/FEVAR for TAAA dissection

OSR Experience (2014-2017): 9 out 48 endo TAAAs (19%)



Multiple SINE after isolated TEVAR and EVAR



FEVAR

B/FEVAR specific problems

- Narrow / Collapsed True Lumen
- Distal iliac re-entry tear
- Visceral vessels dissection
- Target vessels from the opposite lumen

Narrow / Collapsed true Lumen

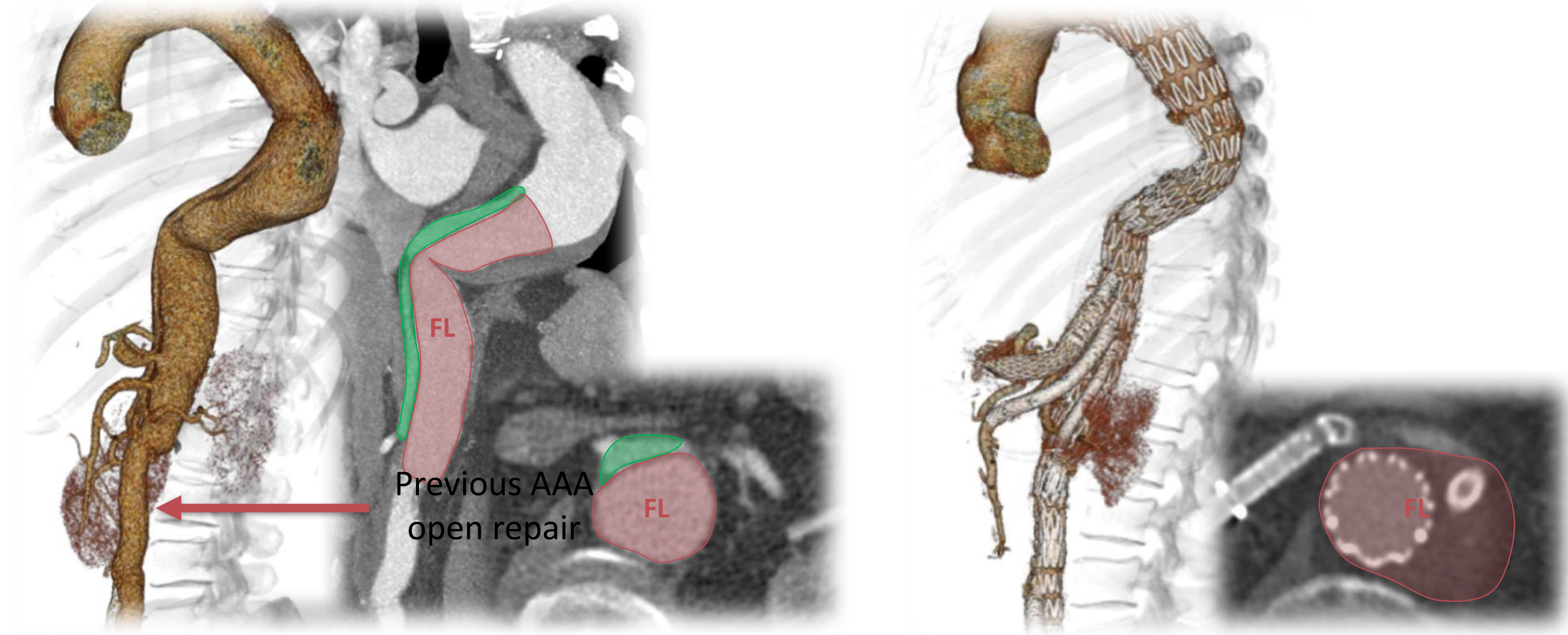
Thoracic Staging

Collapsed TL

TL partial re-expansion

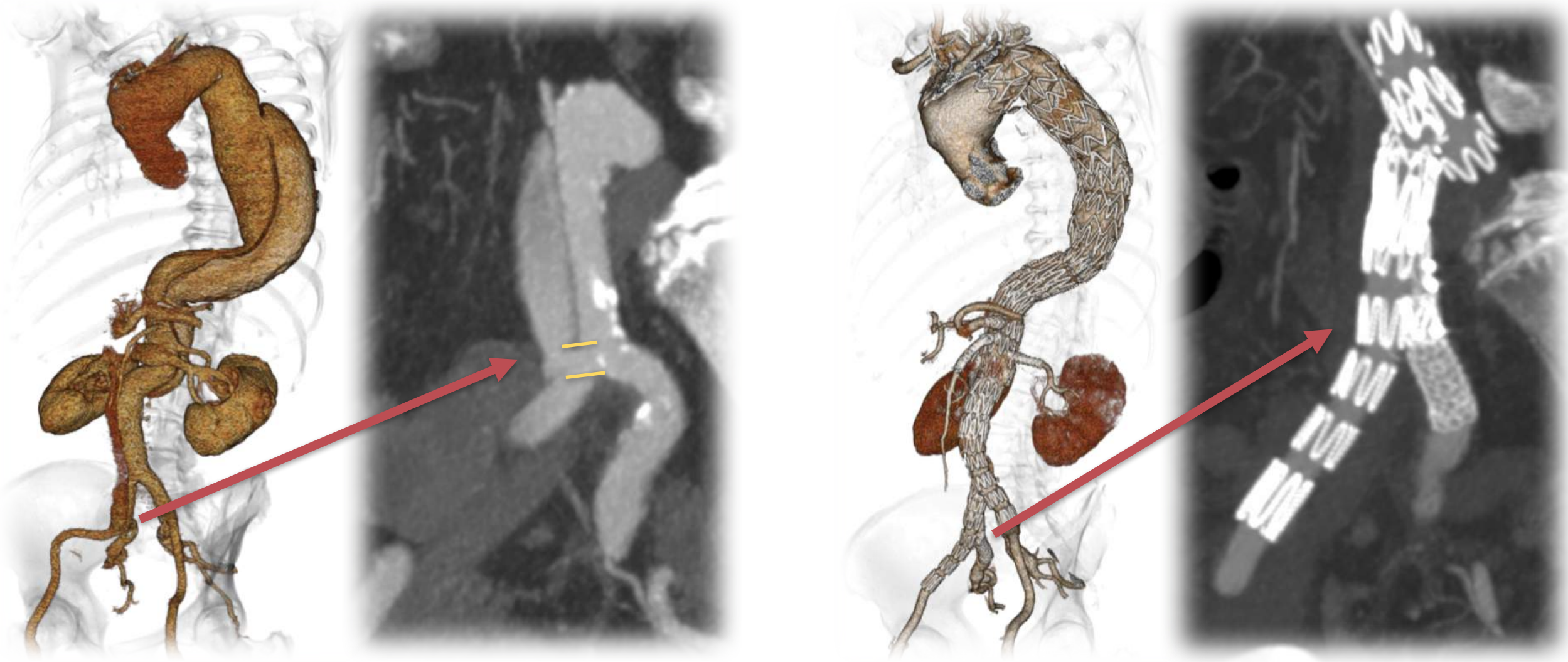
Narrow / Collapsed true Lumen

False lumen deployment



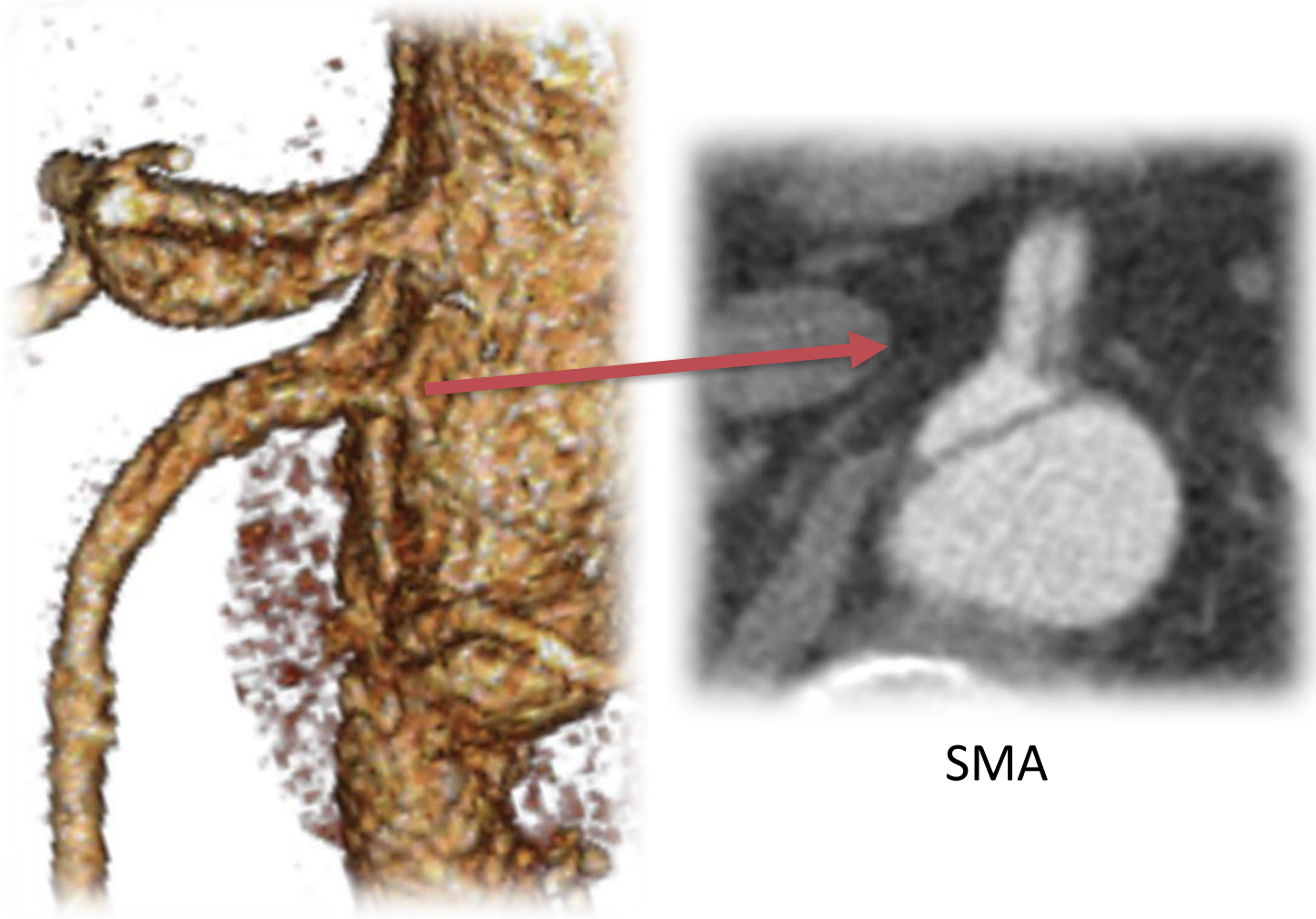
Distal iliac re-entry tears

IBD use



Visceral vessels dissection

Important for both end organ perfusion and FL thrombosis

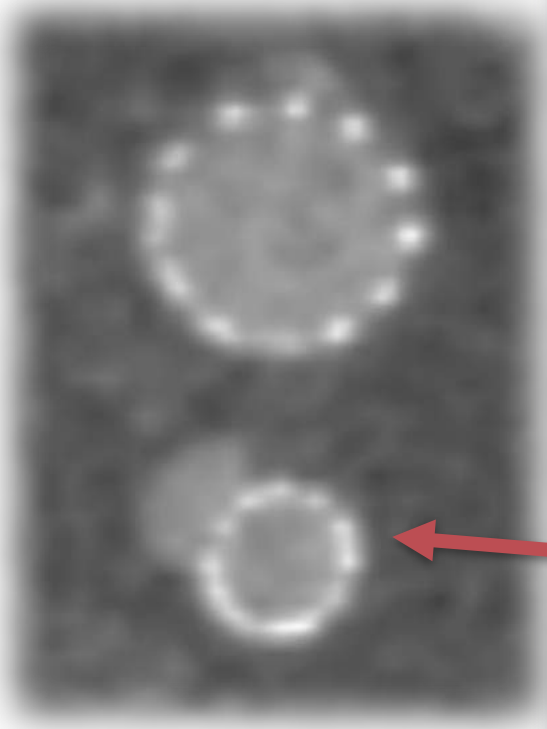


SMA

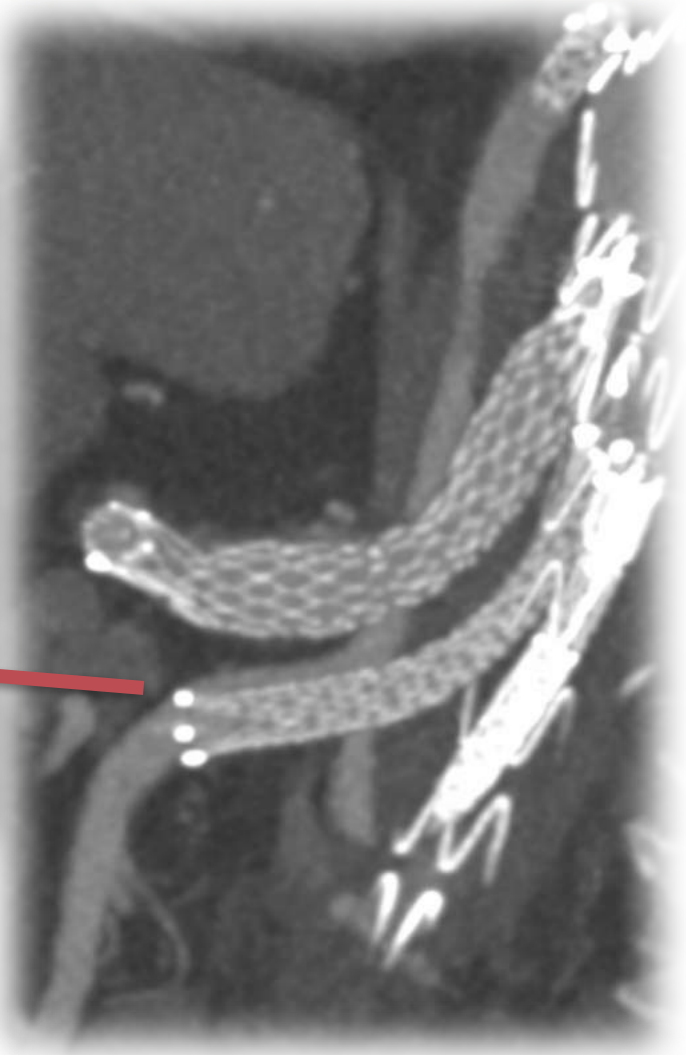
Visceral vessels dissection

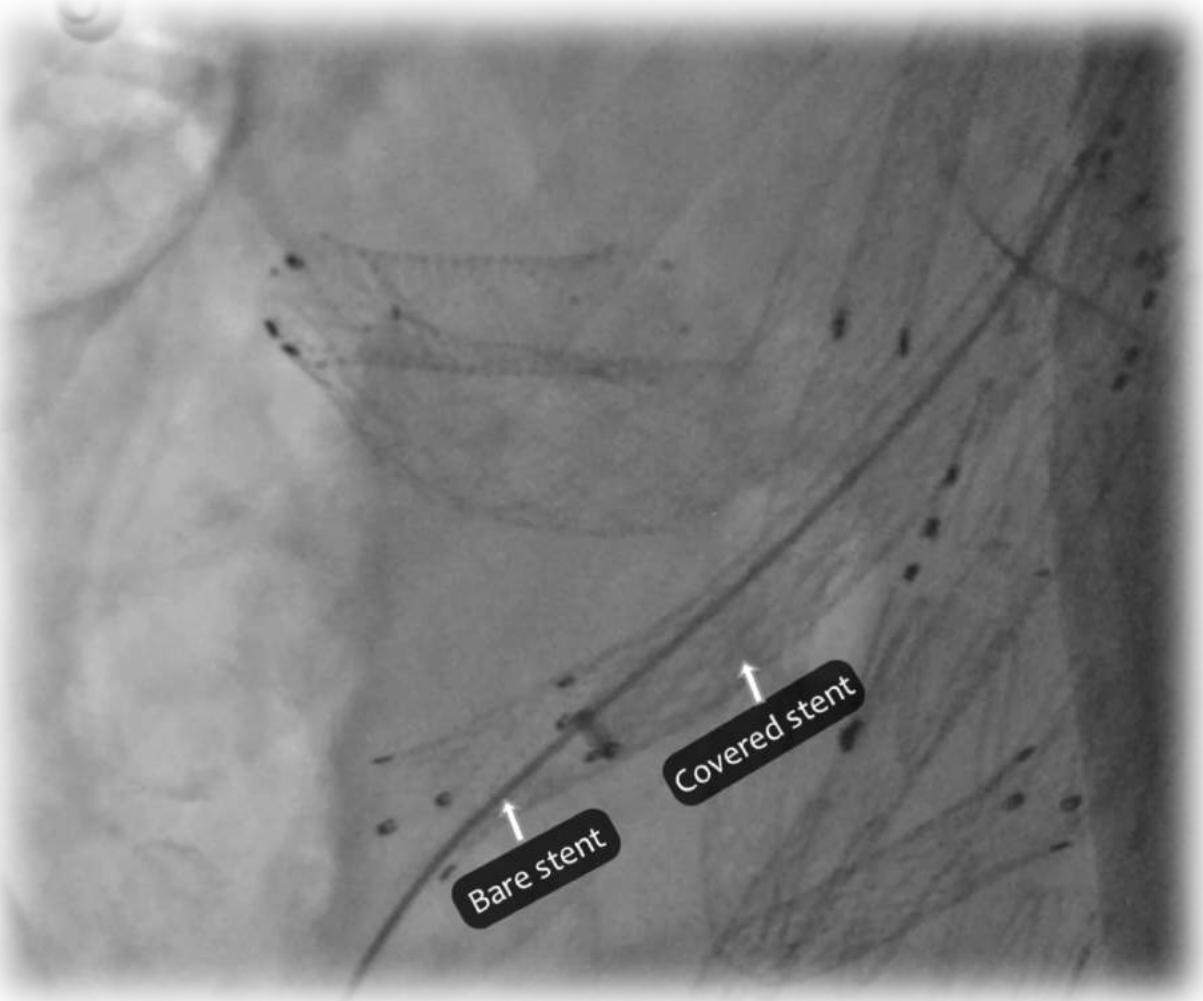
Land deeper in the target vessels and consider the flap recoil

CT



SMA

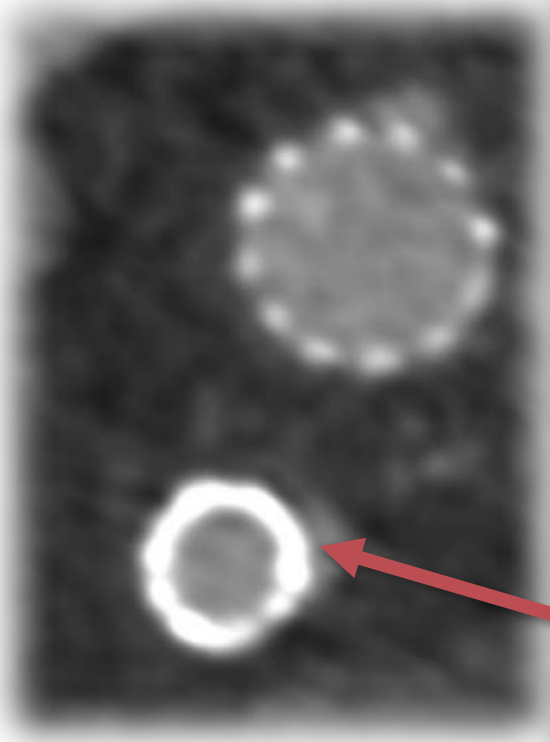




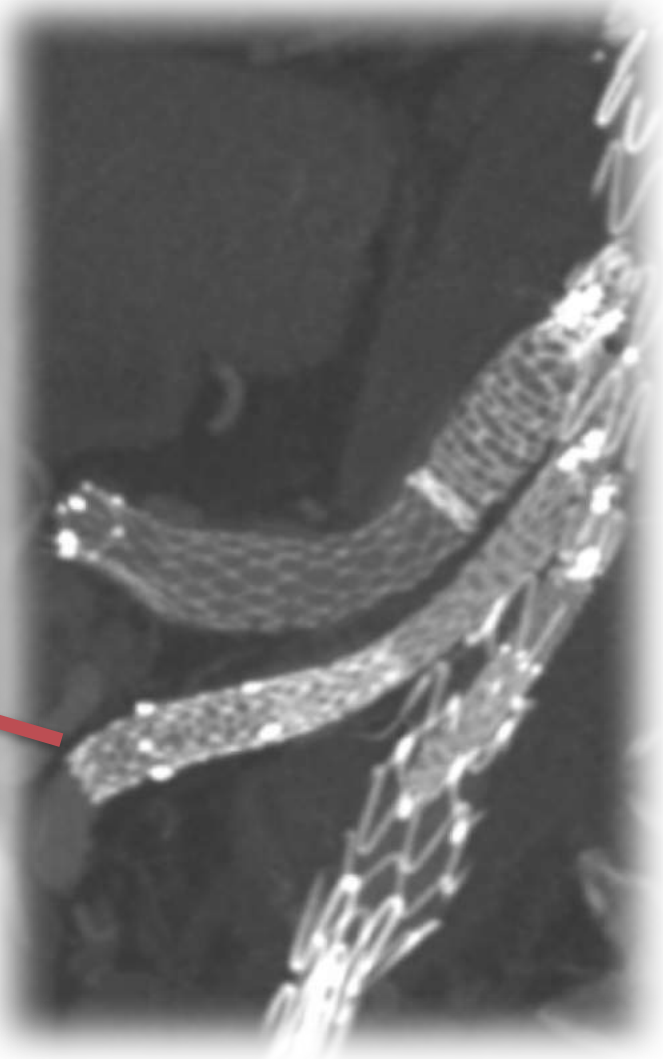
Visceral vessels dissection

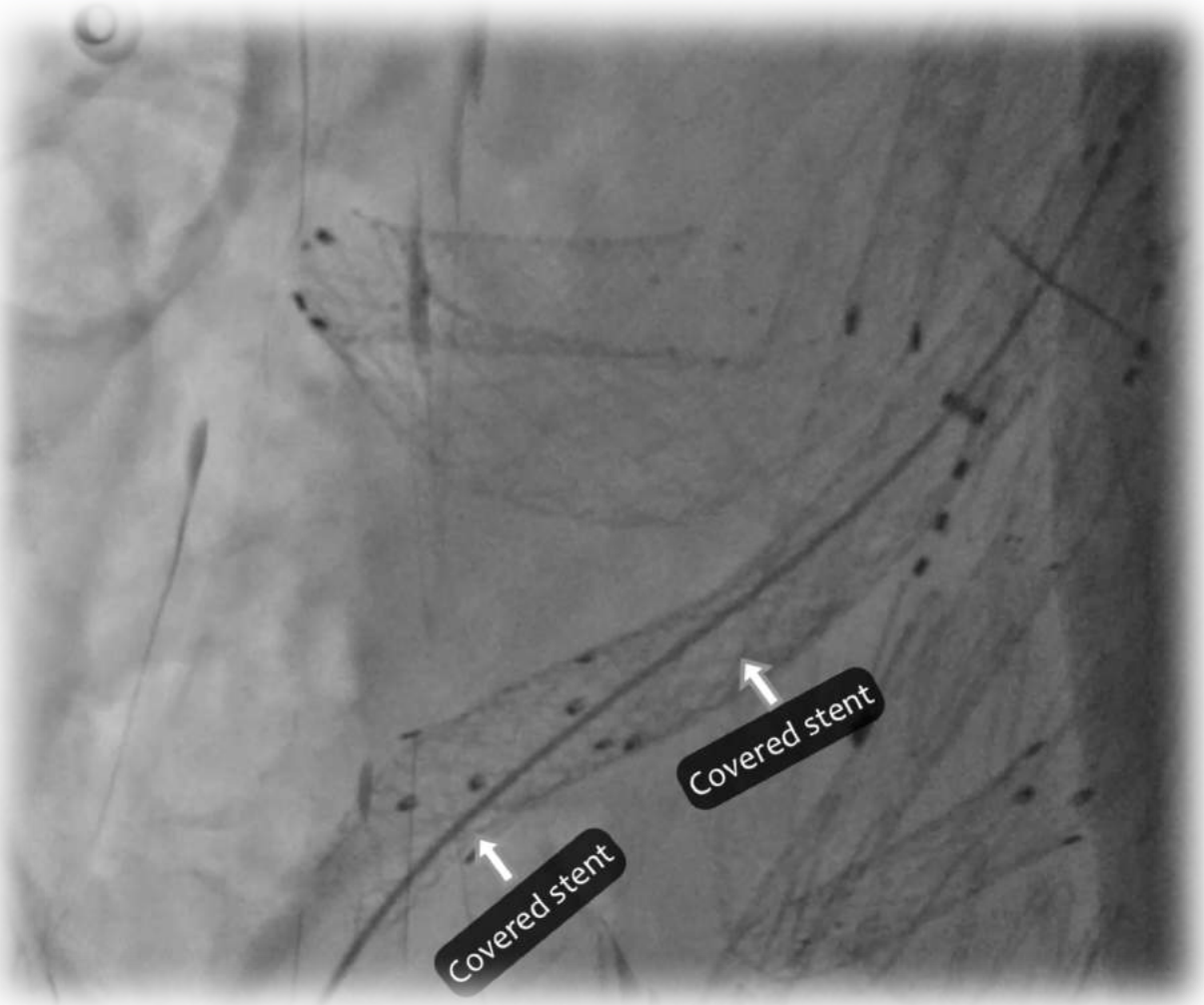
Land deeper in the target vessels and consider the flap recoil

CT



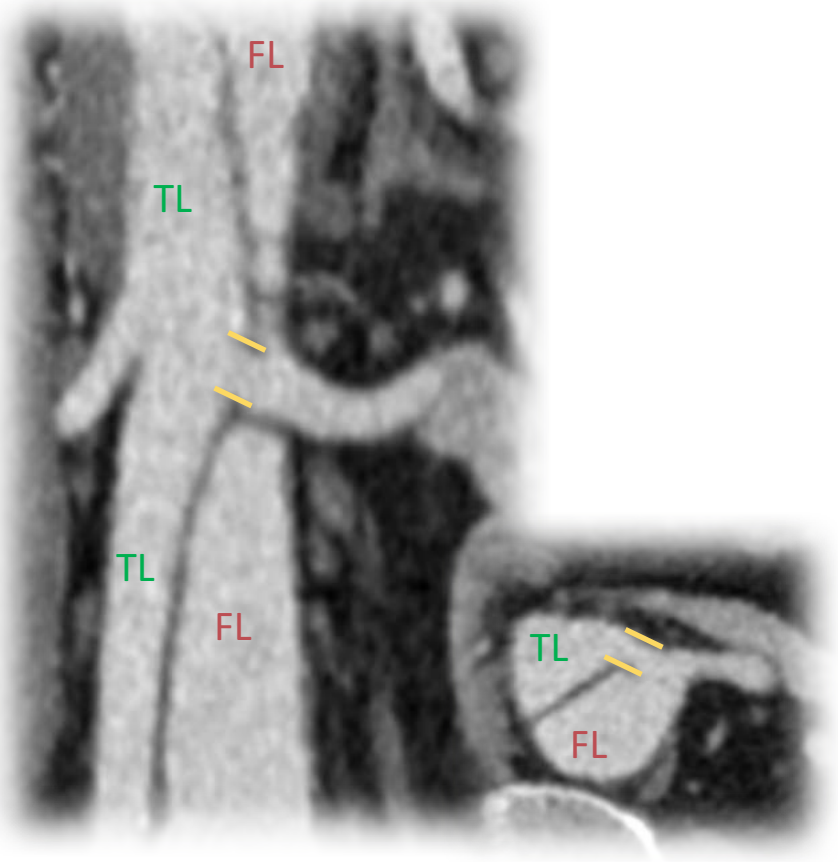
SMA



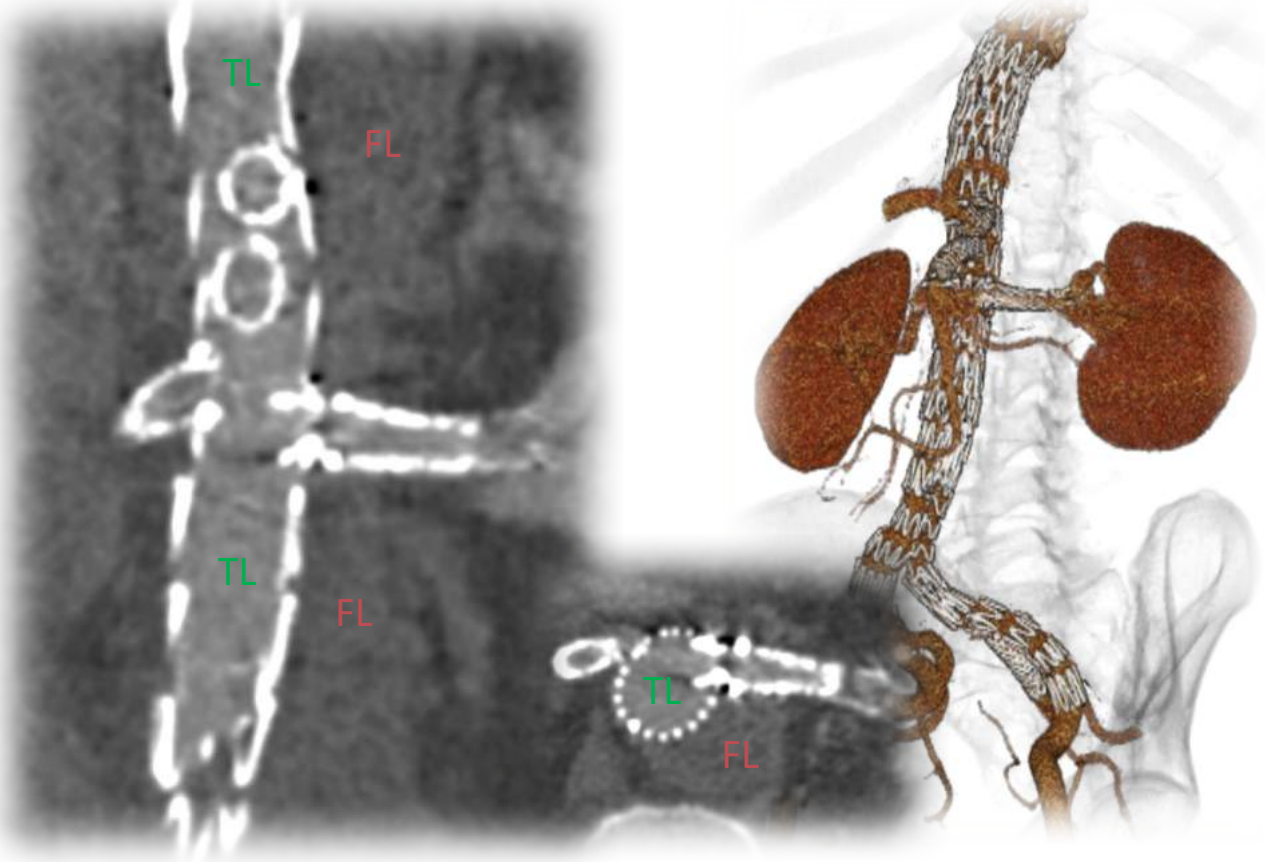


Target vessels from the opposite lumen

from TL to FL



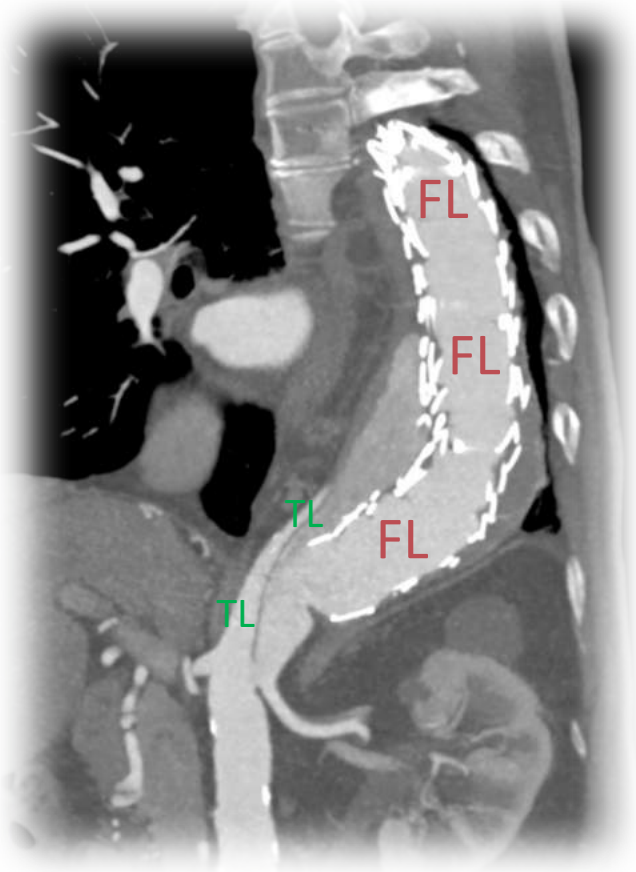
LRA from FL



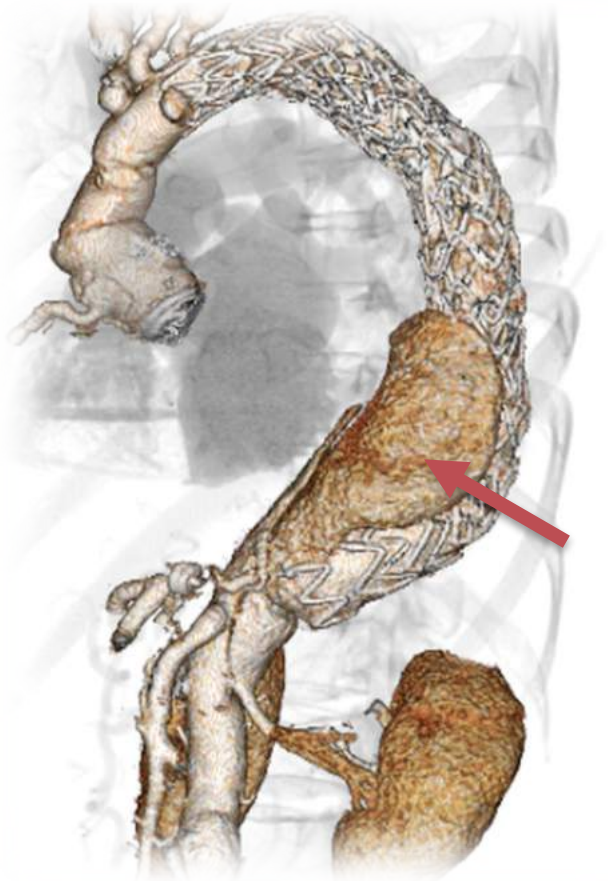
Through the natural intimal tear

Target vessels from the opposite lumen

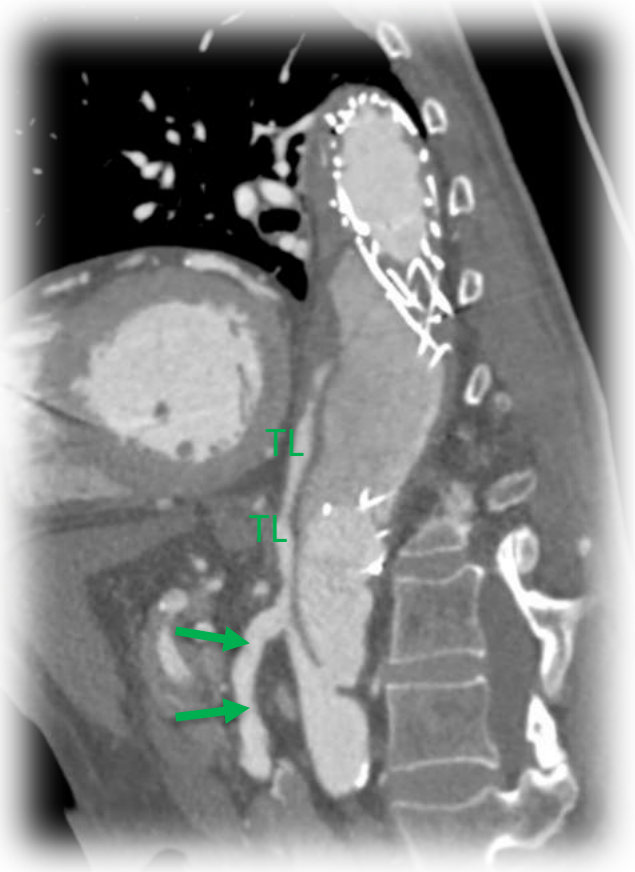
from FL to TL



FET and TEVAR in the FL



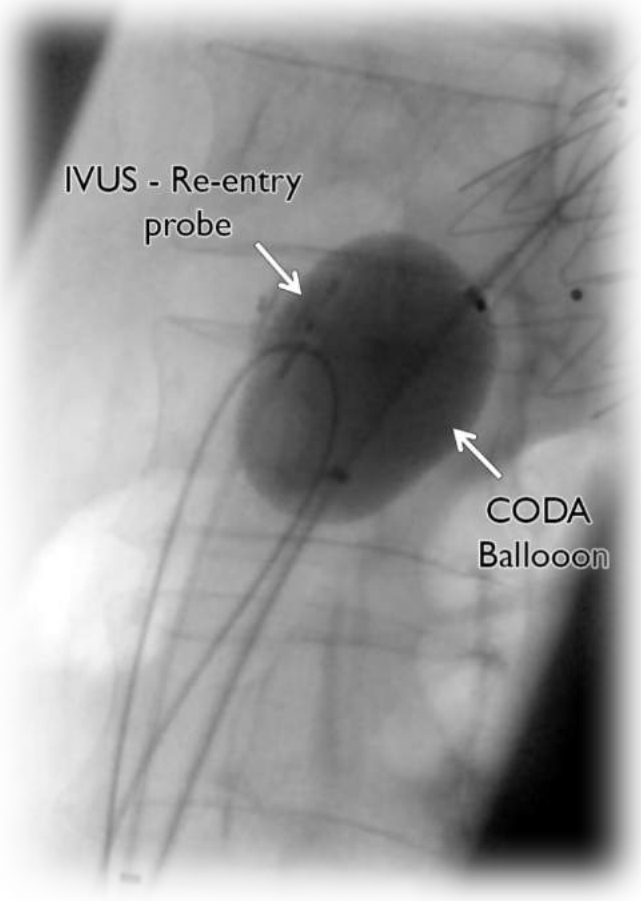
Type IB endoleak



SMA from the other lumen

Neofenestration with IVUS guided re-entry device

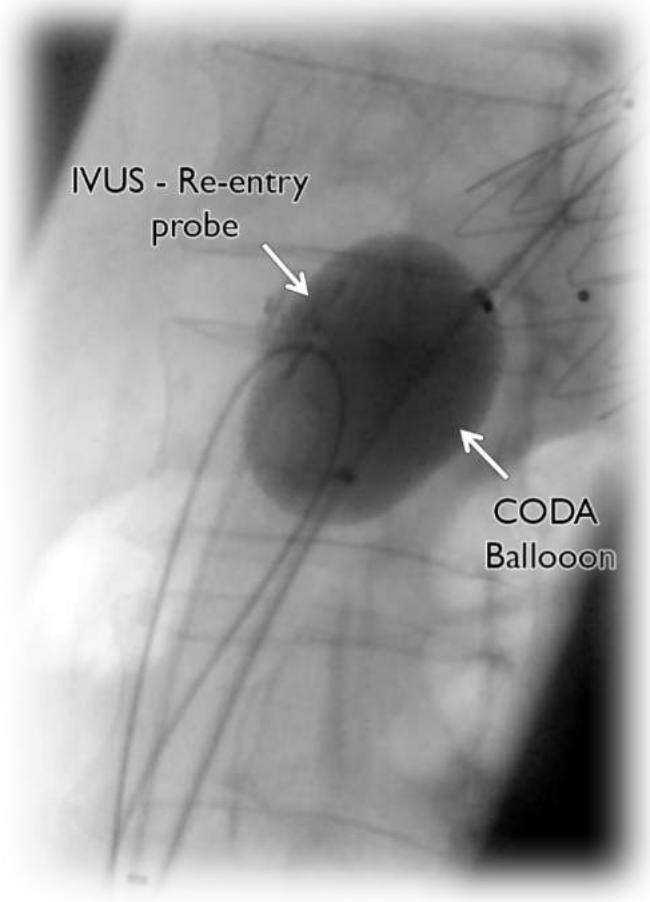
Stabilize the lamella with a compliant balloon inflated in the opposite lumen



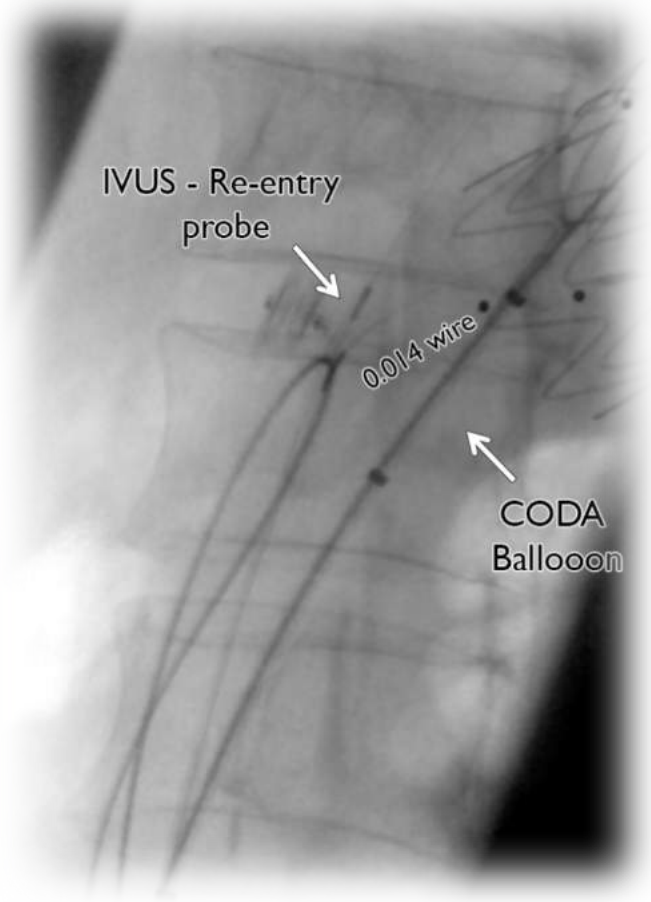
Neofenestration IVUS guided

Neofenestration with IVUS guided re-entry device

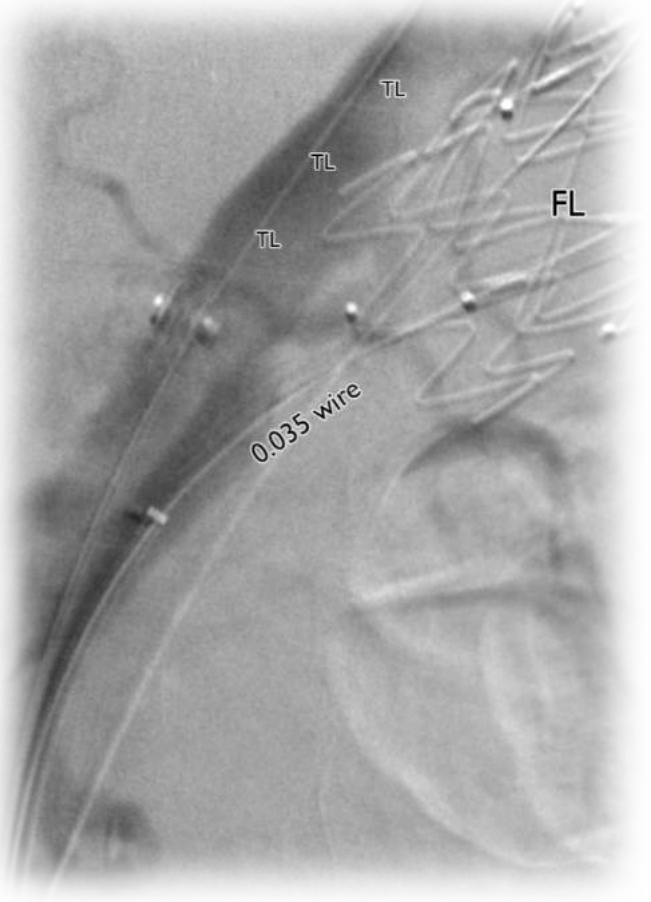
Stabilize the lamella with a compliant balloon inflated in the opposite lumen



Neofenestration IVUS guided



0.014 crossing



0.035 crossing

Bertoglio L et al. J Endovasc Ther 2017 [Submitted]

B/FEVAR repair

SMA targeted with a branch

SMA Branch crossing the lamella

Renal fenestrations

Fl exclusion

Bertoglio L et al. J Endovasc Ther 2017 [Submitted]

Conclusions

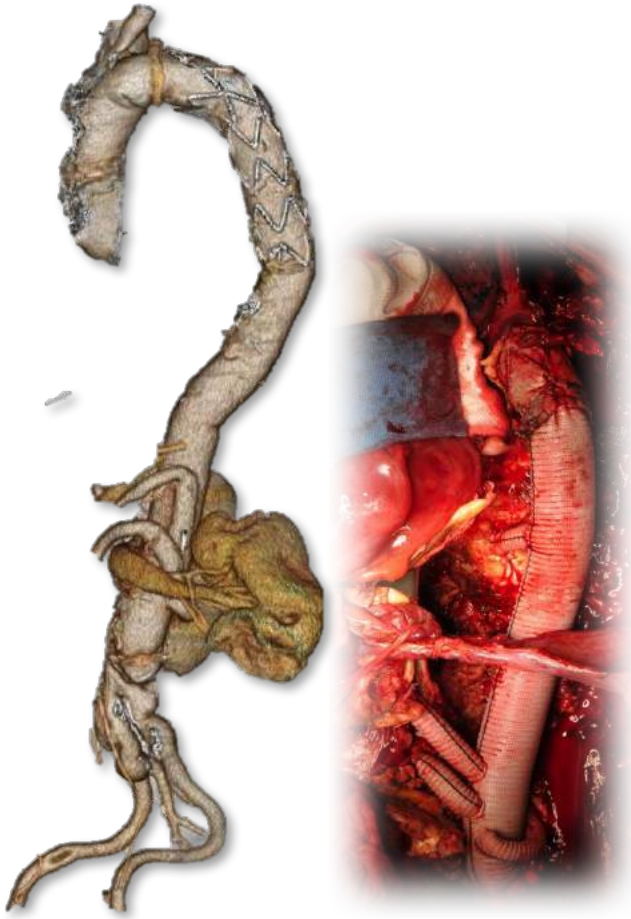
Chronic Type B dissection still a surgical disease? Probably, YES

Residual TAD

1 st Step

FET

2 nd Step



TAAA open

Conclusions

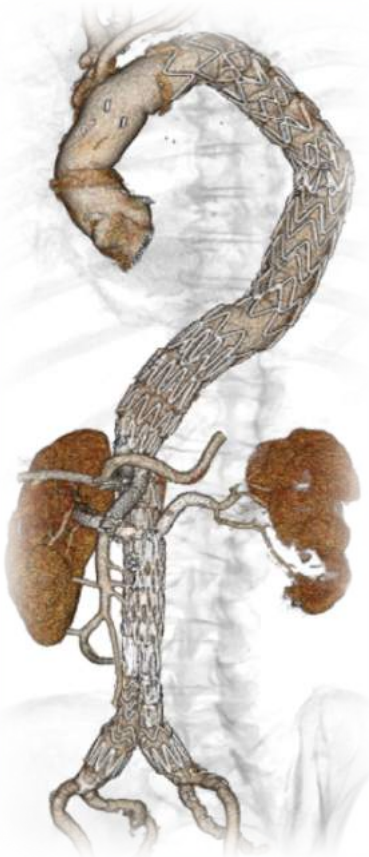
Chronic Type B dissection still a surgical disease? However….

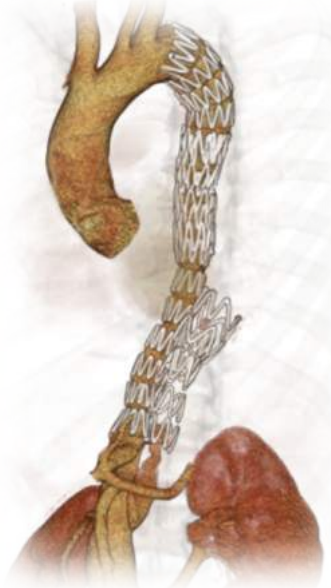
Residual TAD

1 st Step

FET

2 nd Step





F/BEVAR or Candy Plug

Conclusions

Chronic Type B dissection still a surgical disease? However….

Residual TAD

1 st Step

Inner branch

2 nd Step

F/BEVAR or Candy Plug