Secondary Open Aortic Surgery After Thoracic Endovascular Aortic Repair : Surgical Strategy and Clinical Problems

Department of Cardiovascular Surgery, Sapporo Medical University

Yutaka Iba

Tomohiro Nakajima, Junji Nakazawa, Tsuyoshi Shibata, Shuhei Miura, Ayaka Arihara, Takakimi Mizuno, Keitaro Nakanishi, Kei Mukawa, Nobuyoshi Kawaharada

【Objective】

- Thoracic endovascular aortic repair (TEVAR) is becoming more widely used in aortic surgery due to its minimally invasive nature, which does not require thoracotomy.
- However, some patients require secondary open aortic repair for various reason, so the surgical strategy and the management of endoprosthesis in such situation are still controversial.

We report our experience of secondary open aortic repair after TEVAR

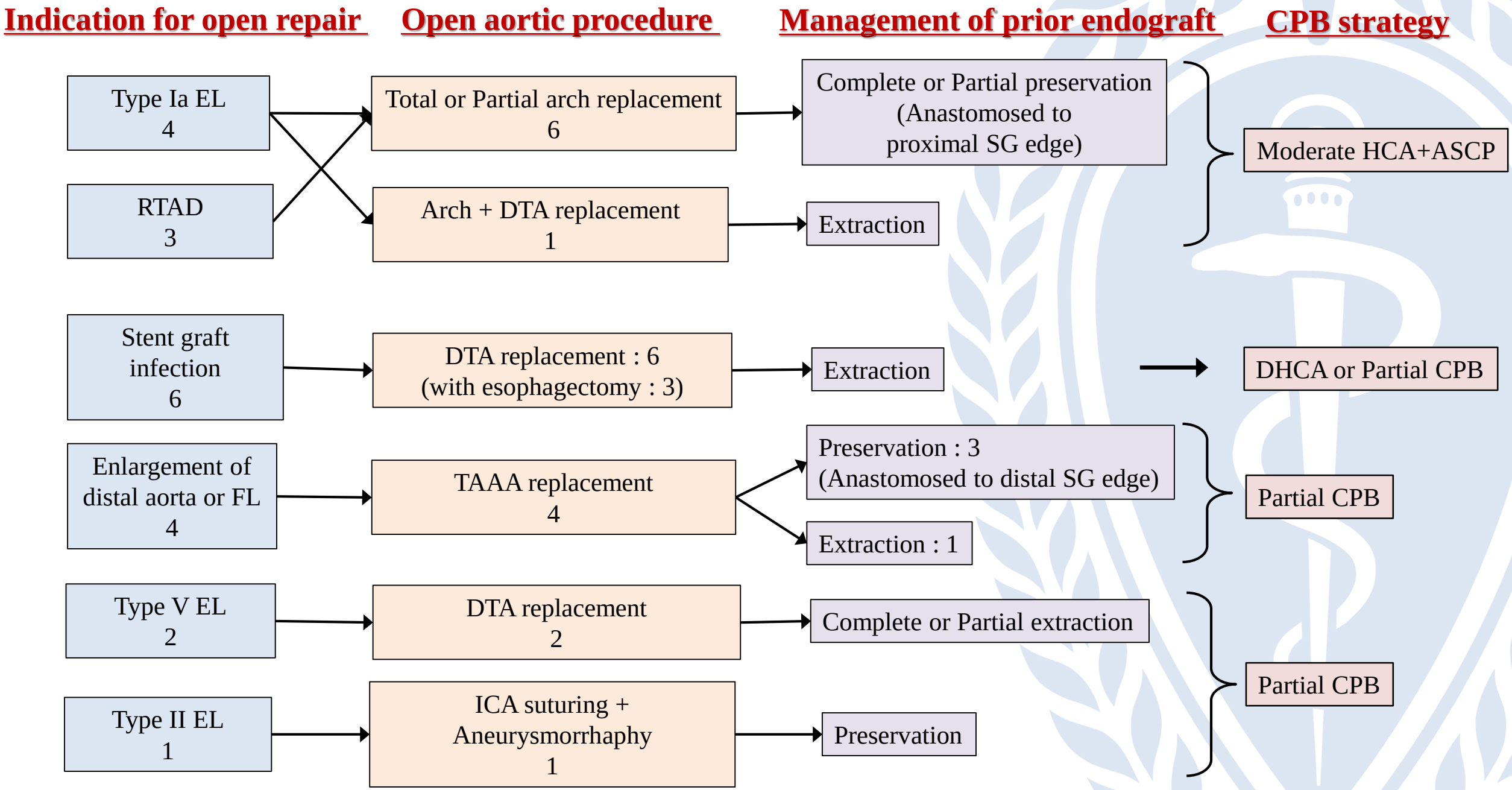
【Patients and Methods】

Period : Jan 2012 – Dec 2022

Patient : 20 patients who received open aortic repair for the same or adjacent site after TEVAR

Age		65±11
Gender (Male : Female)		19 : 1
Etiology	Degenerative	10 (50%)
	Dissection	10 (40%)
Connective tissue disorder		2 (10%)
Previous history of aortic surgery (times)		2 (1-2)
Emergent		4 (20%)
Interval from TEVAR to open repair (months)		21 (3 - 60)
Maximum aortic diameter (mm)		60 (52-69)

Continuous data was expressed as mean ± standard deviation or median (interquatile range) and categorial data as the number (%)


Indication for open repair
Open aortic procedure
Management of prior endograft
CPB strategy
Type Ia EL
4
RTAD
3
Total or Partial arch replacement
6
Arch + DTA replacement
1
Complete or Partial preservation
(Anastomosed to
proximal SG edge)
Extraction
Moderate HCA+ASCP
Stent graft
infection
6
DTA replacement : 6
(with esophagectomy : 3)
Extraction
DHCA or Partial CPB
Enlargement of
distal aorta or FL
4
TAAA replacement
4
Preservation : 3
(Anastomosed to distal SG edge)
Extraction : 1
Partial CPB
Type V EL
2
DTA replacement
2
Complete or Partial extraction
Type II EL
1
ICA suturing +
Aneurysmorrhaphy
1
Preservation
Partial CPB

Surgical strategy

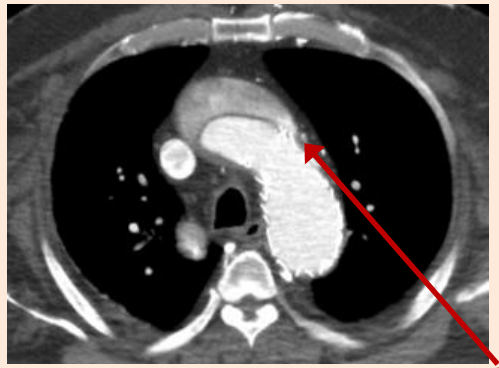
Approach		
	median sternotomy	6 (30%)
	left thoracotomy	9 (45%)
	median + left thoracotomy	1 (5%)
	thoracoabdominal	4 (20%)
Strategy of CPB		
	Partial CPB with beating heart	10 (45%)
	Moderate HCA with ASCP	7 (40%)
	Deep HCA with RCP	3 (15%)
Management of stentgraft		
	Complete explantation	9 (45%)
	Partial preservation	4 (20%)
	Full preservation	7 (35%)

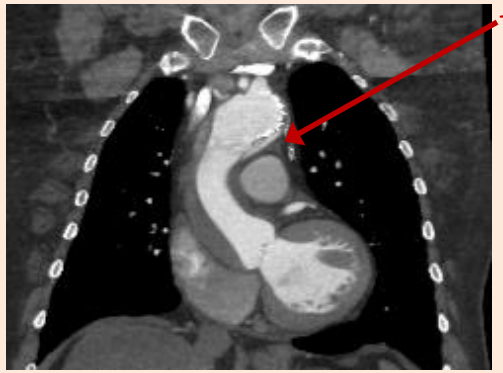
Case 1. RTAD after TEVAR for TBAD

〈58 y.o Male〉

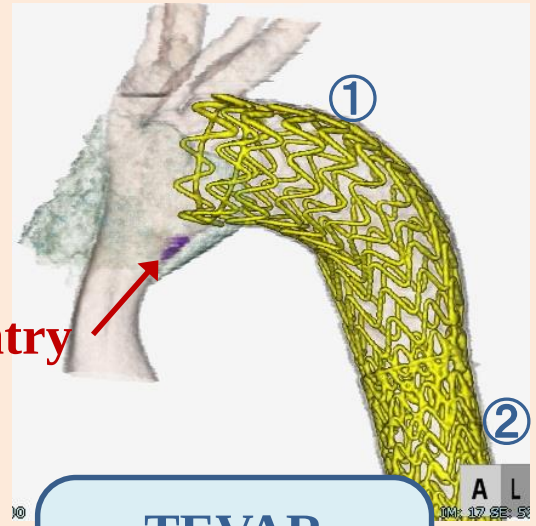
P.H: 51 y.o TEVAR for TBAD

Sudden chest & back pain
→enhanced CT revealed RTAD

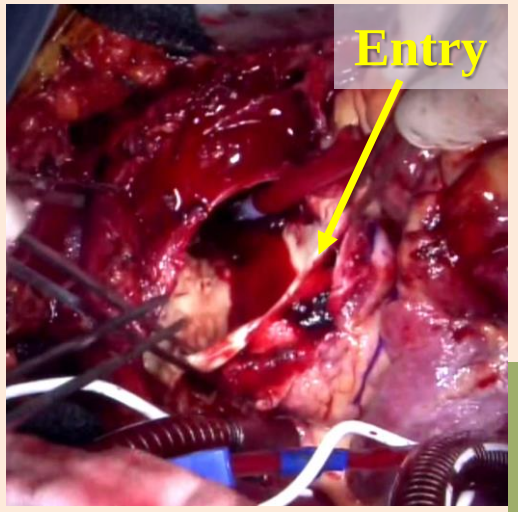




Entry



TEVAR
①cTAG 40mm
②cTAG 31mm



- ✓ **Entry resection**
- ✓ **Adventitia inversion technique**

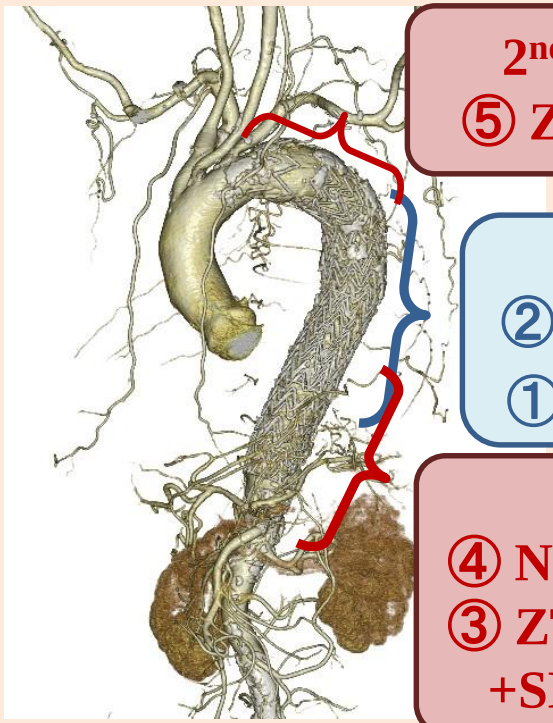
- ✓ Stentgraft was preserved.

➢ **Partial arch replacement**

Case 2. Stentgraft infection with aorto-esophageal fistula

〈68 y.o Male〉

PH: TEVAR for impending rupture of DTA (67 y.o)
Re-TEVAR for typeIa and Ib EL (67y.o)
Drainage of abscess in the left pleural cavity

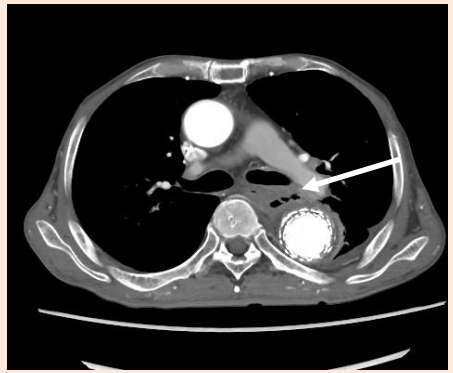


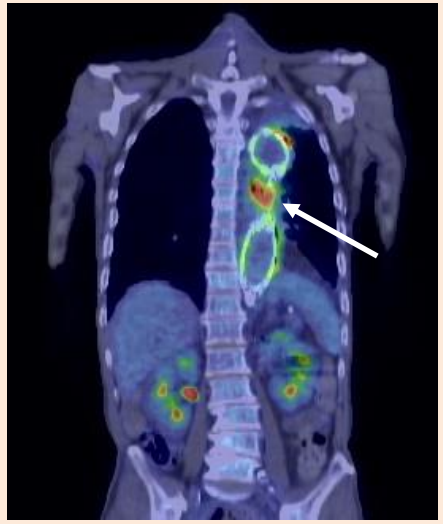
2nd TEVAR
⑤ ZTAP 38-167

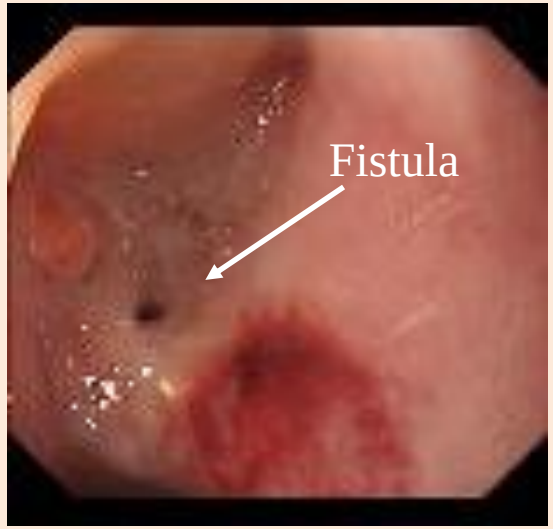
1st TEVAR
② cTAG 3737200
① cTAG 3434150

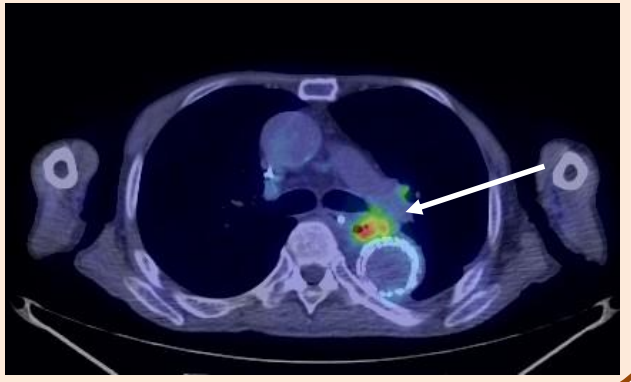
2nd TEVAR
④ Navion 3434182
③ ZTA 30-108(1 fenestration)
+SMA branch(VBX7mm)

Anemia and tarry stool ⇨ **AEF**

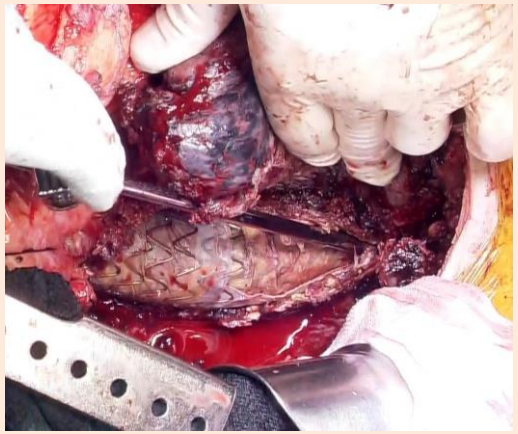


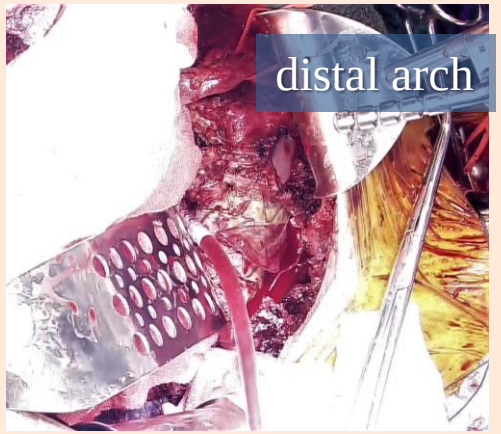


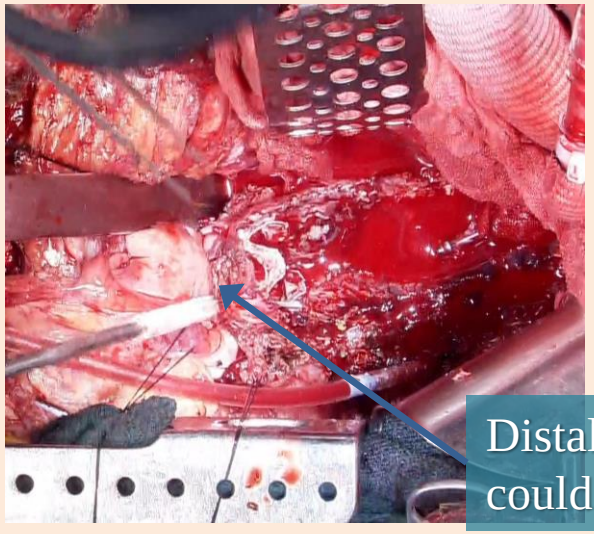




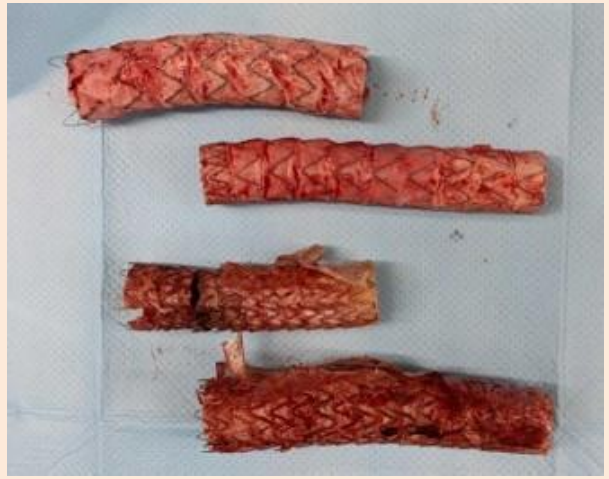
- **Explantation of infected stentgraft + DTA graft replacement**
- **Esophagectomy**

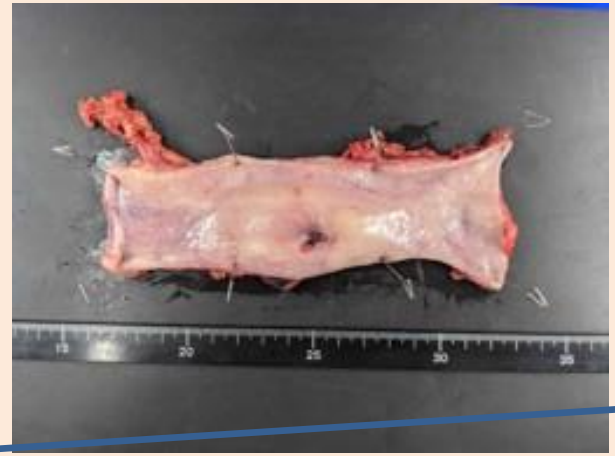






Distal stentgraft with branch could not be extracted





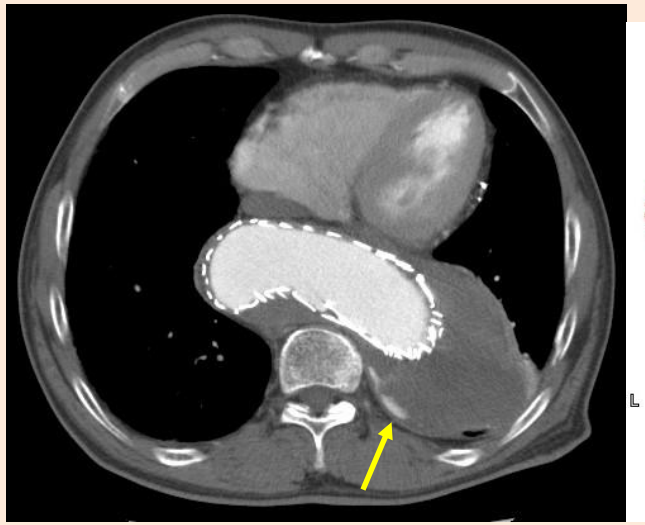
Case 3. Aneurysmal enlargement due to persistent Type II EL

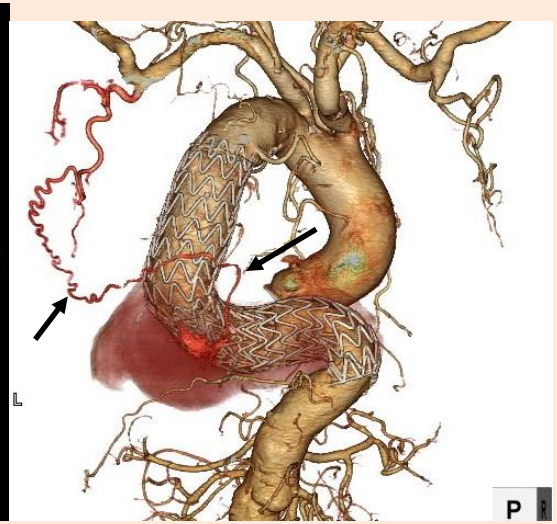
〈72 y.o Male〉

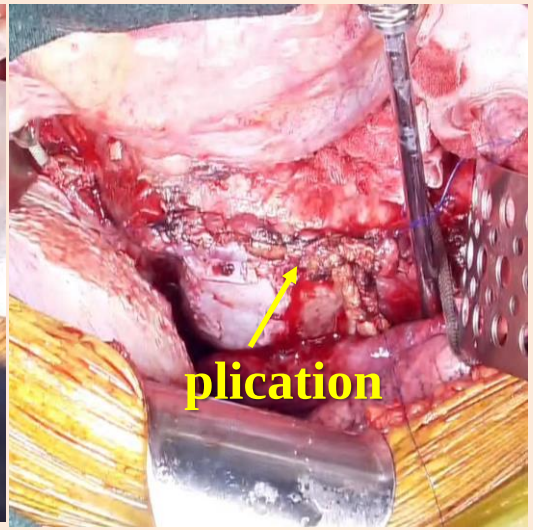
- The aneurysm expanded to 83mm three years after TEVAR.
- Type II EL from ICA and the thoracodorsal artery was persistent.
- Coil embolization failed.

→

- **ICA suture ligation from inside of aneurysm & Aneurysmorrhaphy**







【Results】

Early mortality		**2 (10%)**	✓ Sepsis: SG infection with AEF *(Case 2 presented in the previous slide)* ✓ Sudden arrhythmia
Morbidity			
Stroke		**2 (10%)**	✓ In both cases, surgery was performed using DHCA to extract the stent graft. ✓ Both cases resulted in extended total aortic replacement.
SCI	**Paraplegia**	**2 (10%)**	
	Paraparesis	**2 (10%)**	
Reentry for bleeding		**6 (30%)**	
Prolonged ventilation		**4 (20%)**	
Tracheostomy		**3 (15%)**	✓ All cases with infection with AEF
Length of ICU stay (days)		**3 (1 - 4)**	
In-hospital day (days)		**46 ± 25**	

【Discussion】

Late open conversion after thoracic endovascular aortic repair

Hyun-Chel Joo, MD, PhD,[a] Joon Ho Kwon, MD,[b] Jung-Hwan Kim, MD,[a] Seung Hyun Lee, MD, PhD,[a] Sak Lee, MD, PhD,[a] Young-Nam Youn, MD, PhD,[a] *and* Kyung-Jong Yoo, MD, PhD,[a] *Seoul, Republic of Korea*

〈*J Vasc Surg 2019*〉

Table II. Indications for late conversion to open repair

Cause	N = 33
Endoleak type I	14 (42.4)
Type IA	10 (30.3)
Type IB	4 (12.1)
SINE	6 (18.2)
RTAD	4 (12.1)
Stent migration and fracture	4 (12.1)
Stent infection	3 (6.1)
Aortopulmonary fistula	1 (3.0)
Sac enlargement without endoleak	1 (3.0)

RTAD, Retrograde type A dissection; *SINE*, stent graft-induced new entry tear.
Data are presented as the number of patients (%).

Table V. Early outcomes from open conversion

Variable	Total (N = 33)	No arch involvement (n = 19)	Arch involvement (n = 14)	*P* value
Hospital mortality	3 (9.1)	0 (0.0)	3 (21.4)	.03
30-day mortality	2 (6.1)	0 (0.0)	2 (14.3)	.09
Complication				
Myocardial infarction	0 (0.0)	0 (0.0)	0 (0.0)	NS
Neurologic	3 (9.1)	0 (0.0)	3 (21.4)	.03
Permanent stroke	2 (6.1)	0 (0.0)	2 (14.3)	.09
Paraplegia	1 (3.0)	0 (0.0)	1 (7.1)	.22
Bleeding (requiring surgery)	6 (18.1)	3 (15.8)	3 (21.4)	.60
Pulmonary	6 (18.1)	2 (10.5)	4 (28.6)	.18
Need for dialysis	1 (3.0)	0 (0.0)	1 (7.1)	.22
Gastrointestinal complication	2 (6.1)	0 (0.0)	2 (14.3)	.09
ICU stay, days	6.2 ± 17.3	3.7 ± 6.5	10.2 ± 22.7	.01
Hospital stay, days	19.3 ± 21.4	18.6 ± 15.9	20.7 ± 30.1	.29

ICU, Intensive care unit; *NS*, not significant.
Categorical variables are presented as number (%). Continuous variables are presented as mean ± standard deviation.

Comment

Incidence of open conversion after TEVAR — 2 - 8 %

Mortality rate : 0 - 30%

Endograft management at the time of open conversion

→There is no need to remove the stent completely, expect in limited cases such as infection

【Conclusion】

- Secondary open aortic repair after TEVAR may be required for various reasons and pathologies, however, the operative outcomes of this open conversion surgery seem to be acceptable, except for those in AEF.

- Previous stent grafts may be available in some situations; therefore, it is necessary to consider the surgical strategy including how to manage the stentgraft according to each individual case.