



TEIKYO

末梢側の術式選択 一弓部置換の要否、Open stent graft の役割

急性大動脈解離に対する弓部置換術・OSGの功罪



帝京大学 心臓血管外科
下川智樹

上行弓部置換術の適応 @ TUH

- エントリーが弓部に存在する症例
- 弓部大動脈瘤 ($\geq 45-50\text{mm}$) を合併する症例
- Marfan症候群などの遺伝性結合組織疾患を合併する症例

- エントリーが弓部から到達可能な近位下行大動脈 (約3cm) にある症例
→ ET・FETで到達可能な症例
- エントリーが弓部置換で到達可能な弓部分枝にある症例
- 70歳未満でリスクが少ない

拡大手術の意義

弓部置換術の功罪

エントリーが上行大動脈に存在する症例に対して、
遠隔成績向上のための上行弓部置換術を行うことの妥当性？

Patency of distal false lumen in acute dissection: extent of resection and prognosis

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Surgical characteristics according to types of replacements

	Ascending	Hemi-arch	Partial arch	Total arch
Abstract				
Patency of false lumen	0.81	0.53	0.57	0.64
CPB (min)	190 ± 15*	195 ± 10*	245 ± 26	282 ± 24
Cerebral perfusion (min)	39 ± 3*	45 ± 4*	58 ± 8*	102 ± 12

We assessed the patency of the false lumen and that postoperative cerebral perfusion in patients who underwent surgical treatment for acute aortic dissection.

Among the patients with De Bakey type I dissection, the false lumen of the descending aorta was preoperatively patent in 52 patients. Distal extent of aortic replacement was ascending aorta in 16 patients, hemiarch in 15 patients, partial arch in seven patients, and total arch in 11 patients.

Patency of the false lumen was not influenced by distal extent of the aortic replacement. In a one-year follow-up, the maximum diameter of the descending aorta with patent false lumen had increased significantly than that with closed false lumen. Survival rates were 96% at one year and 67% at five years in the patients with patent false lumen and no mortality in the patients with closed false lumen. Patency of the false lumen was not influenced by extension of aortic replacement and associated with poor prognosis.

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遠位側切除範囲は残存偽腔開存率に影響を及ぼさない

Impact of an Aggressive Surgical Approach on Surgical Outcome in Type A Aortic Dissection

Teruhisa Kazui, MD, Katsushi Yamashita, MD, Naoki Washiyama, MD,

弓部置換群 → 早期成績に差がなく、遠隔期の再手術が少ない
再手術の危険因子 → 若年者、Intimal tearが切除できなかった症例

Background. To evaluate the impact of an aggressive surgical approach on early and late outcome in type A aortic dissection.

Methods. From 1983 to 2001, 240 patients underwent operation for acute (n = 138) and chronic (n = 102) type A aortic dissection. The extent of distal aortic resection included the ascending aorta in 39 (16%) patients, hemi-arch (HAR) in 47 (20%), and total arch (TAR) in 154 (64%), including 19 patients who also had their descending aorta replaced (DAR).

Results. The in-hospital mortality did not differ between TAR with or without DAR and other more conservative techniques (12.3% versus 16.3%). Actuarial survival at 10 years including in-hospital mortality was 72.4% ± 3.3% and freedom from reoperation was 77.2% ±

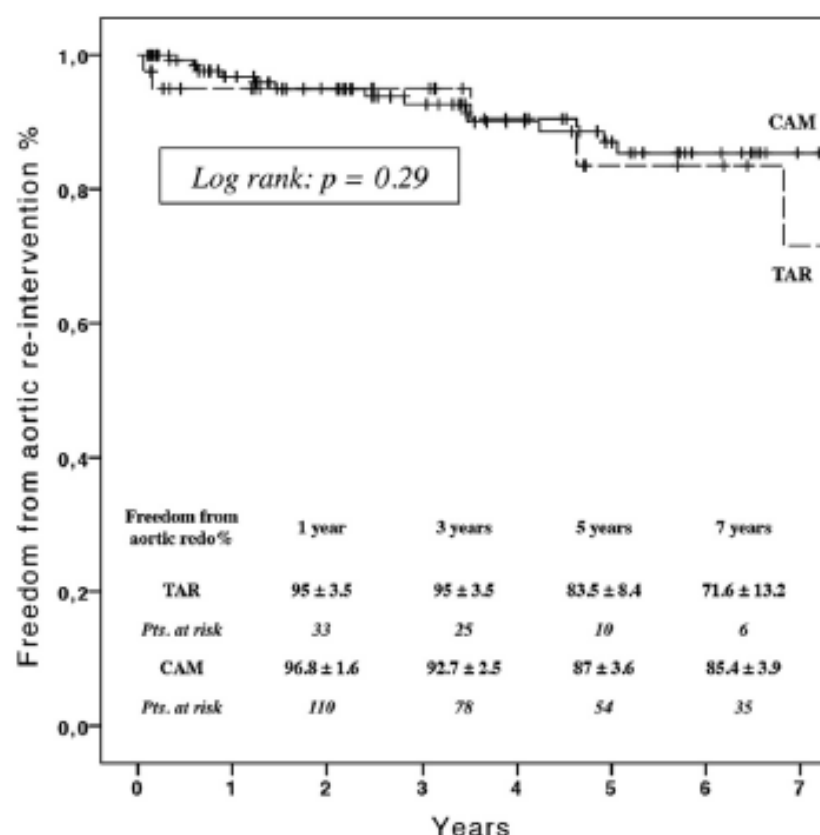
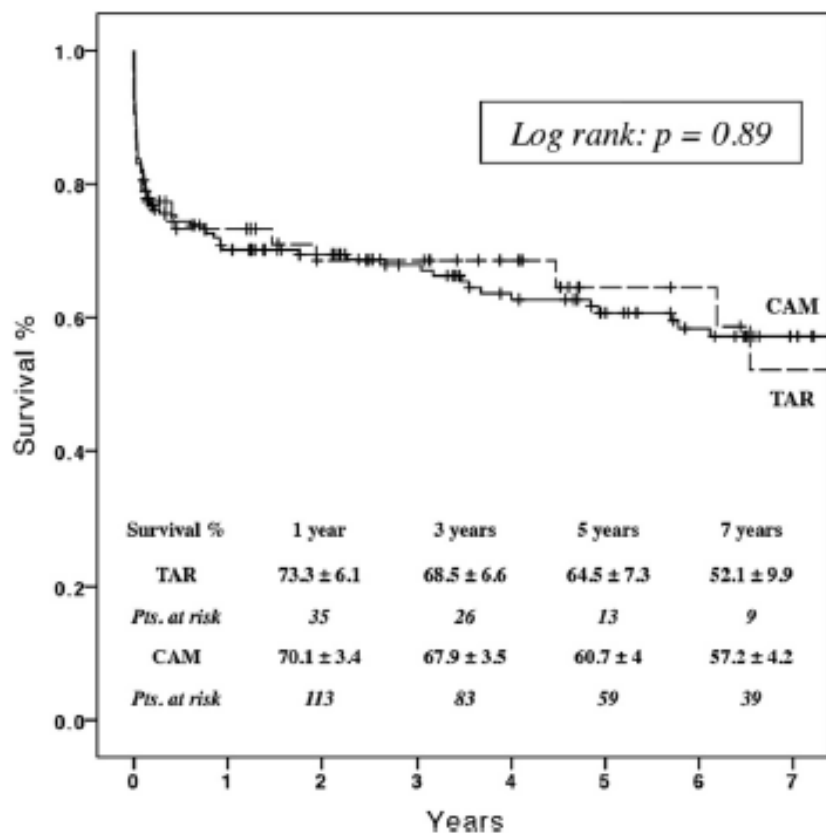
3.6% for all patients: neither was influenced by the extent of distal aortic resection or acuity of aortic dissection. Multivariate analysis revealed younger age and failure to resect the intimal tear to be independent determinants for late reoperation. However, in contrast to 22 patients who had more conservative operations, none of the patients with TAR required reoperation on the aortic arch through a sternotomy incision.

Conclusions. An aggressive surgical approach did not adversely influence early and late survival following type A aortic dissection; it reduced the necessity of late reoperation and facilitated distal aortic reoperation.

(Ann Thorac Surg 2002;74:S1844–7)

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Total Arch Replacement Versus More Conservative Management in Type A Acute Aortic Dissection



$p < 0.001$).

Results: Hospital mortality was similar in the groups

were not protective for long-term survival and freedom from aortic re-intervention. Thus, in TAAD patients TAR remains indicated by site of intimal tear and patient-specific factors.

弓部置換術の適応
 内膜亀裂の部位、患者特有の因子

emerged as independent predictors of hospital death. The

(Ann Thorac Surg 2015;100:88–94)

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Late outcomes of strategic arch resection in acute type A aortic dissection

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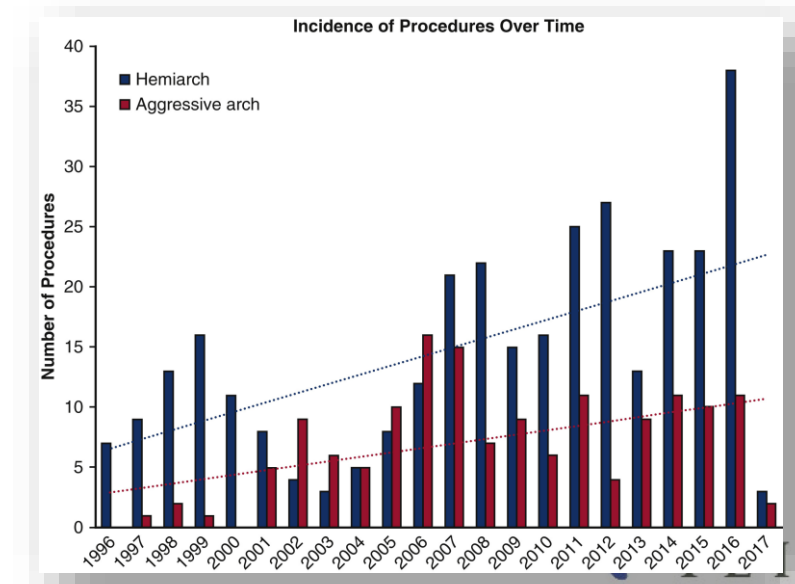
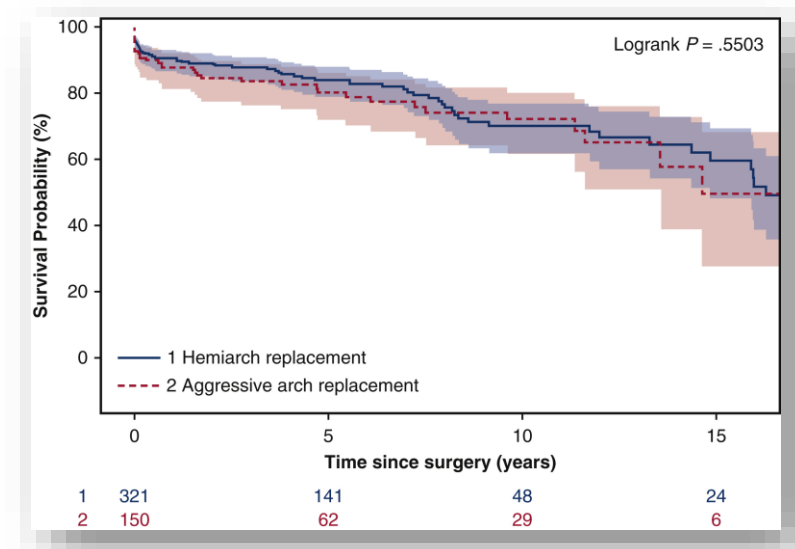
Objective: To compare perioperative and long-term outcomes in patients undergoing hemiarch and aggressive arch replacement for acute type A aortic dissection (ATAAD).

Methods: From 1996 to 2017, we compared outcomes of hemiarch (n = 322) versus aggressive arch replacements (zones 2 and 3 arch replacement with implantation of 2-4 arch branches, n = 150) in ATAAD. Indications for aggressive

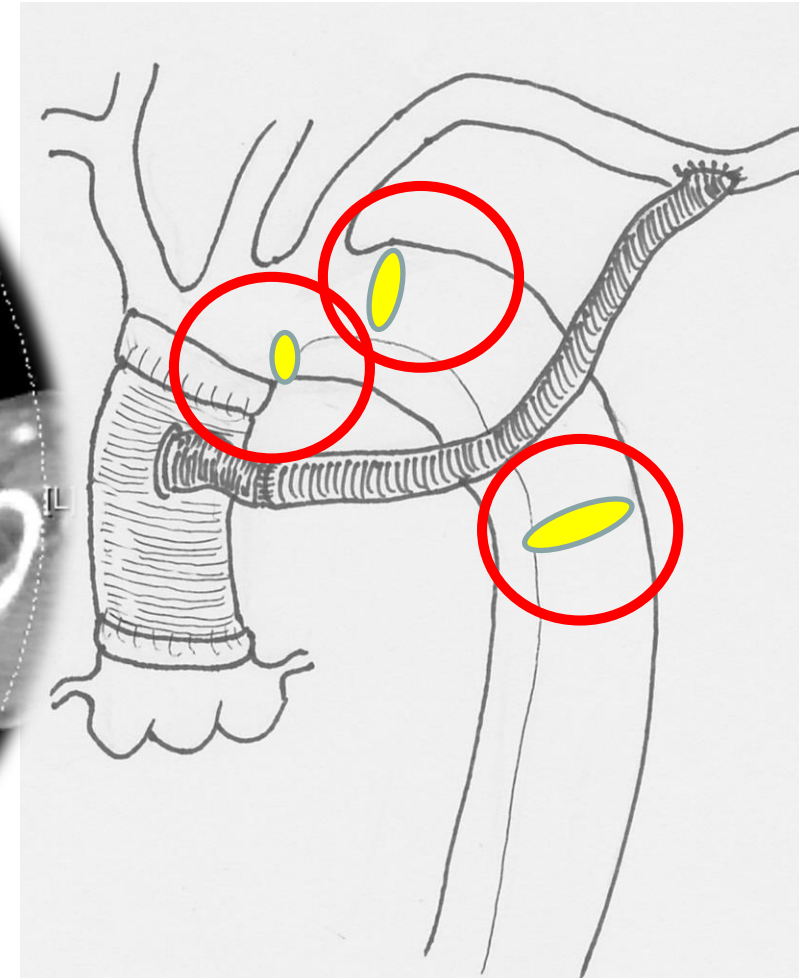
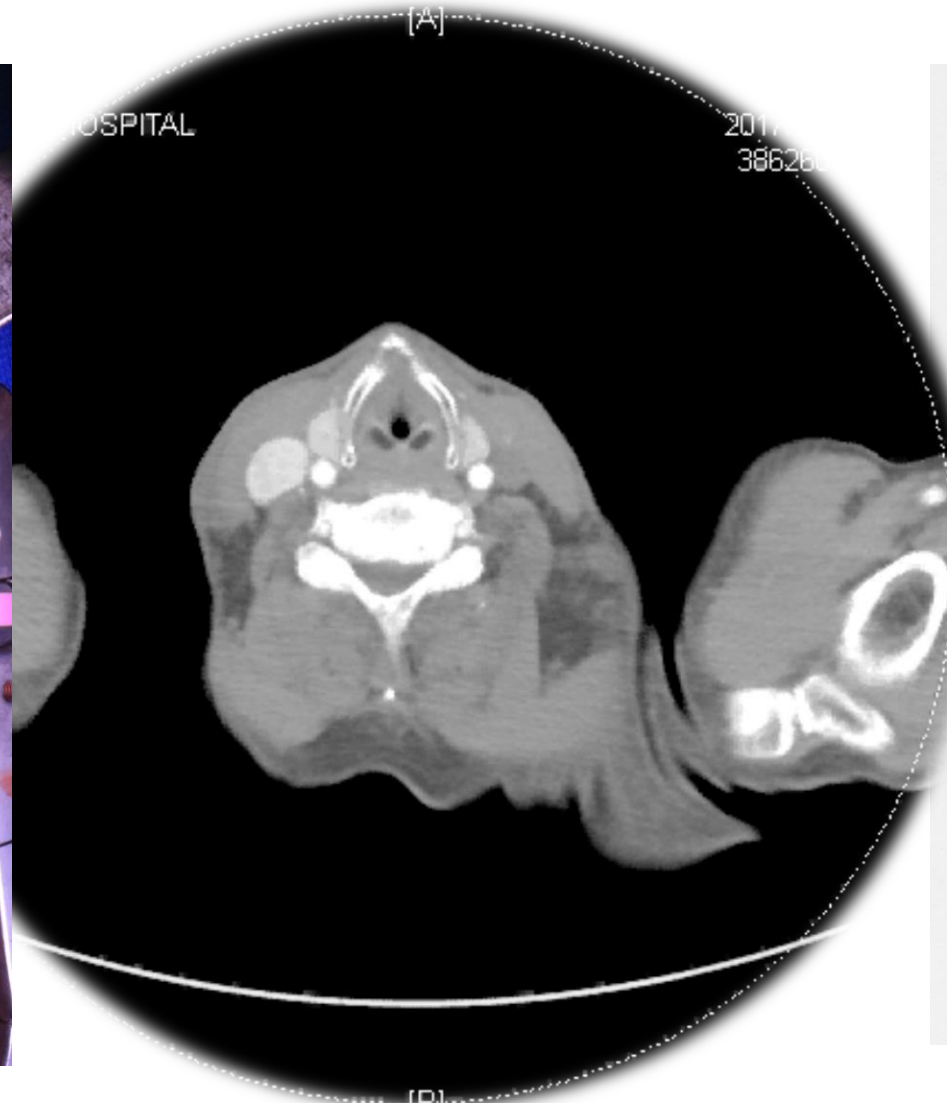
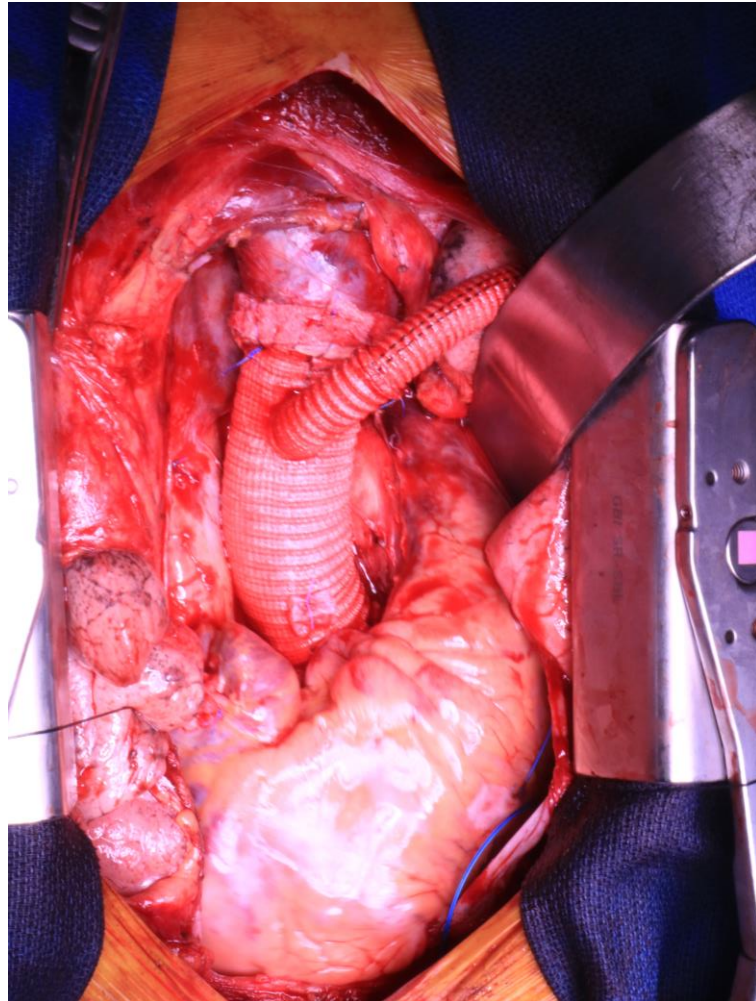
- TAR群 → 若年(57歳 VS 61歳)
- CA・CPB・Clamp時間 長い
- 30日死亡・脳梗塞 差がない
- 15年生存率・再手術率 差がない

... groups, including ... (7% vs 7%, $P = .96$). Over 15 years, Kaplan–Meier survival was similar between hemiarch and aggressive arch groups (log-rank $P = .55$, 10-year survival 70% vs 72%). Given death as a competing factor, incidence rates of reoperation over 15 years (2.1% vs 2.0% per year, $P = 1$) and 10-year cumulative incidence of reoperation (14% vs 12%, $P = .89$) for arch and distal aorta pathology were similar between the 2 groups.

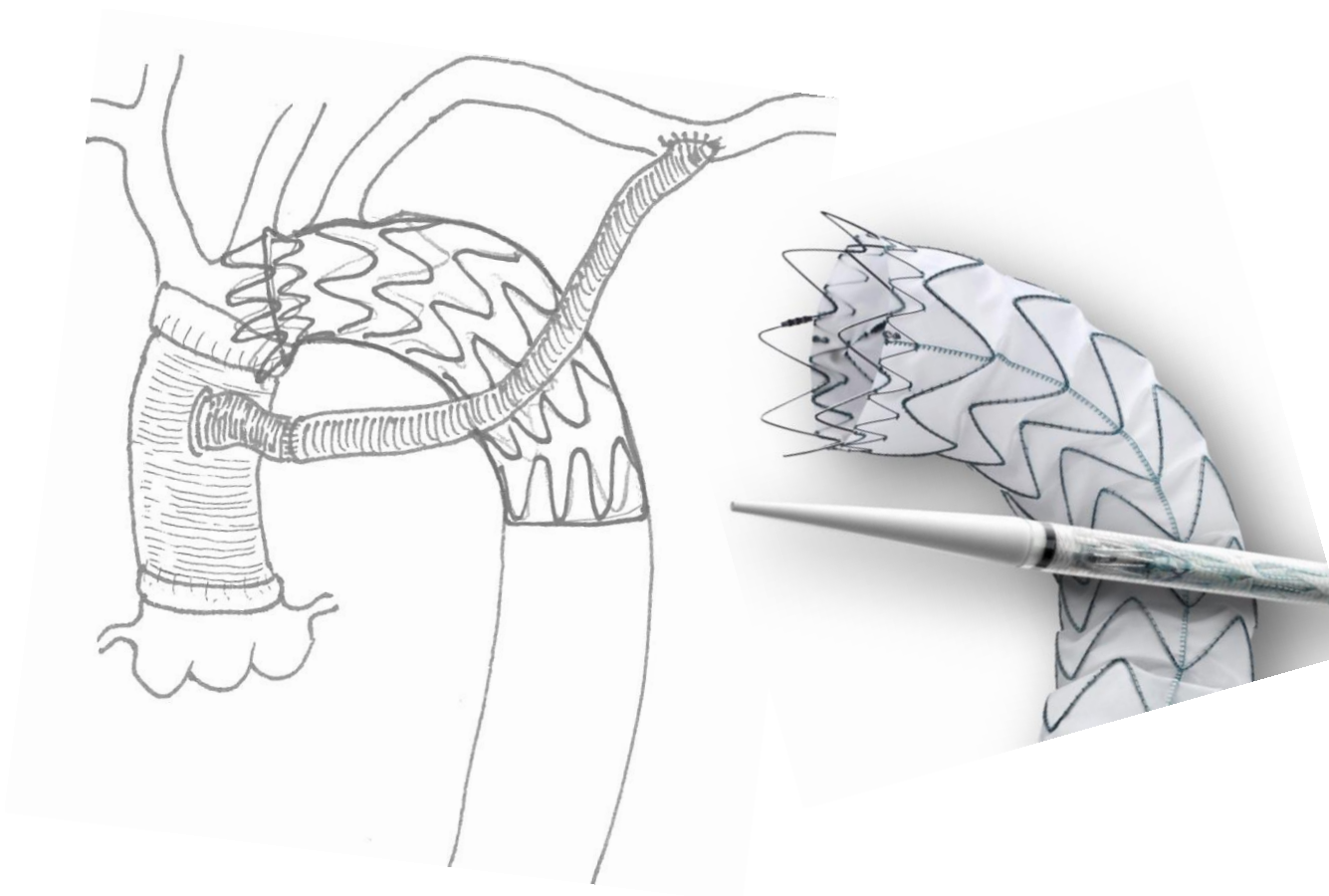
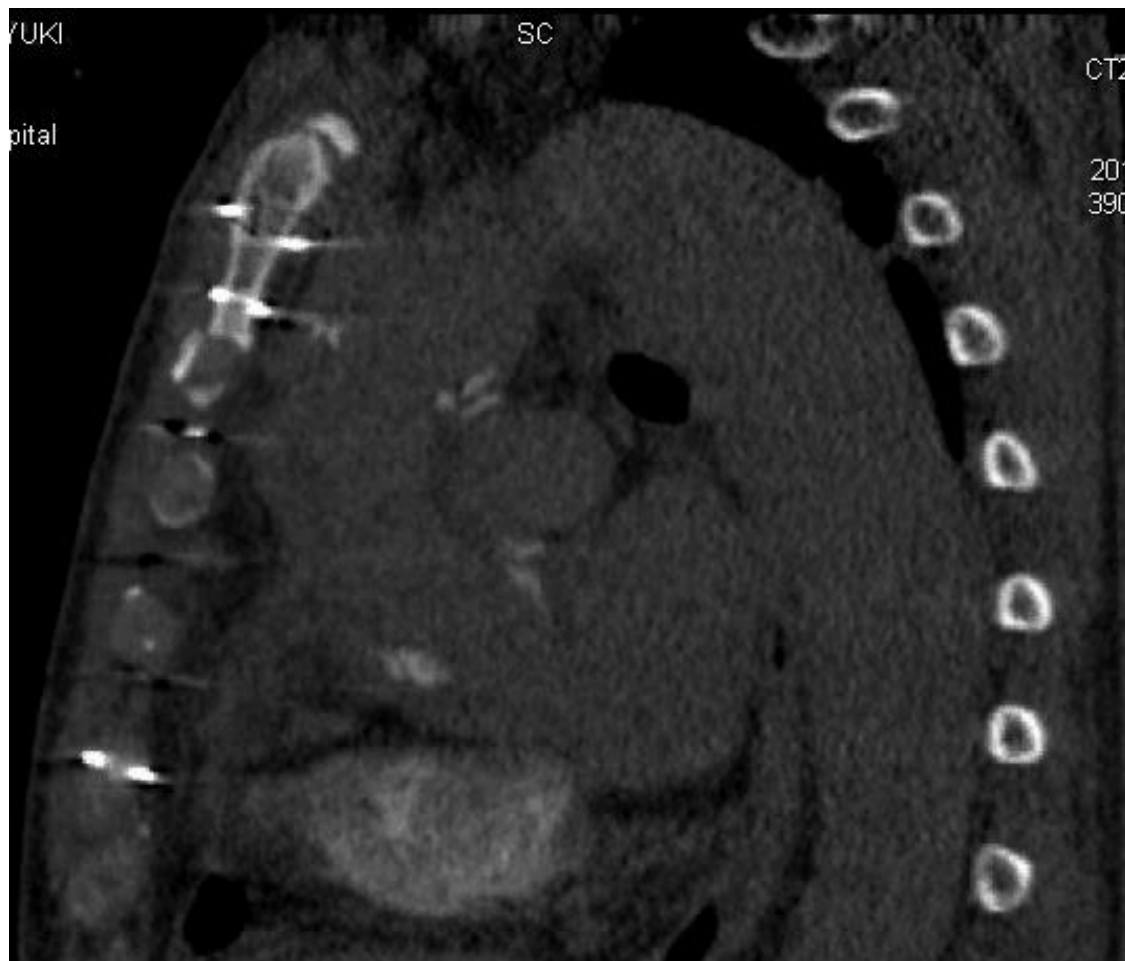
Conclusions: Both hemiarch and aggressive arch replacement are appropriate approaches for select patients with ATAAD. Aggressive arch replacement should be considered for an arch aneurysm >4 cm or an intimal tear at the arch unable to be resected by hemiarch replacement, or dissection of the arch branches with malperfusion. (J Thorac Cardiovasc Surg 2018; ■:1-9)



急性大動脈解離A型 58y M



3M after Onset & Surgery

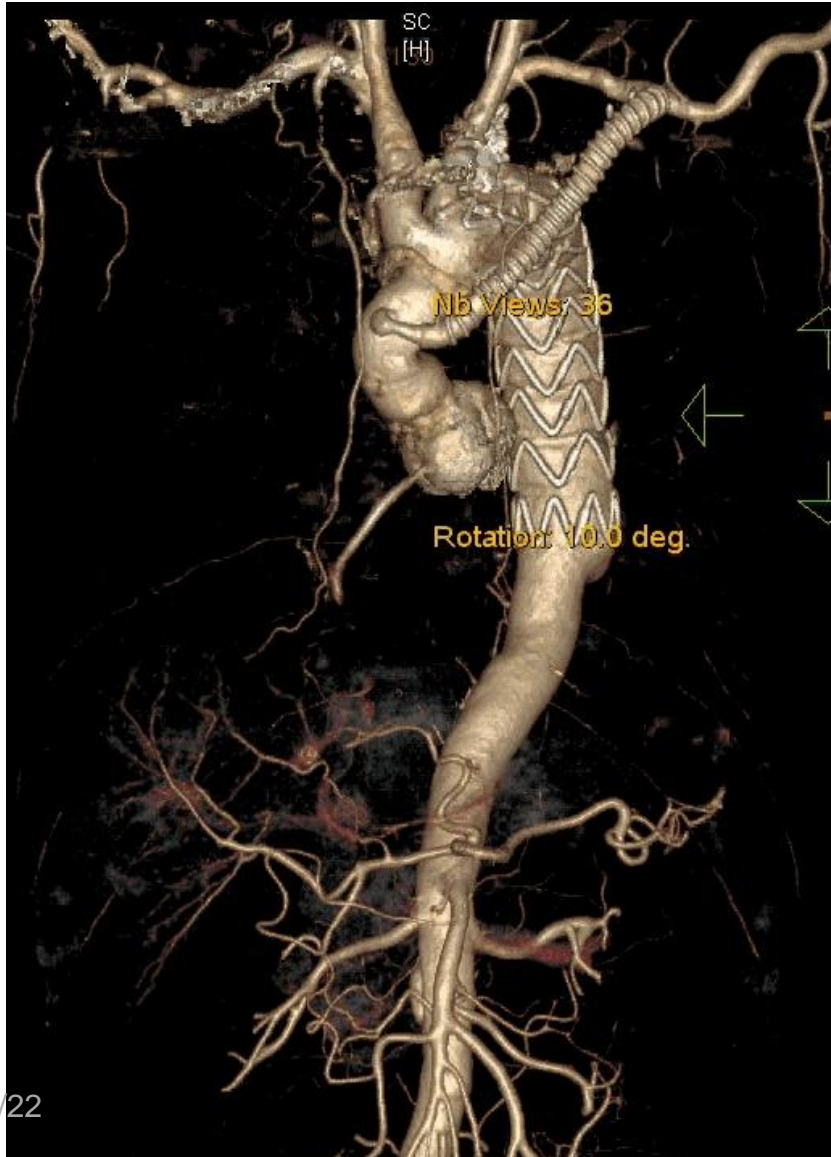


4DCT 吻合部小湾側より偽腔に入っている

2019/3/22

弓部置換・FETの功罪

1Y after Onset & Surgery & TEVAR

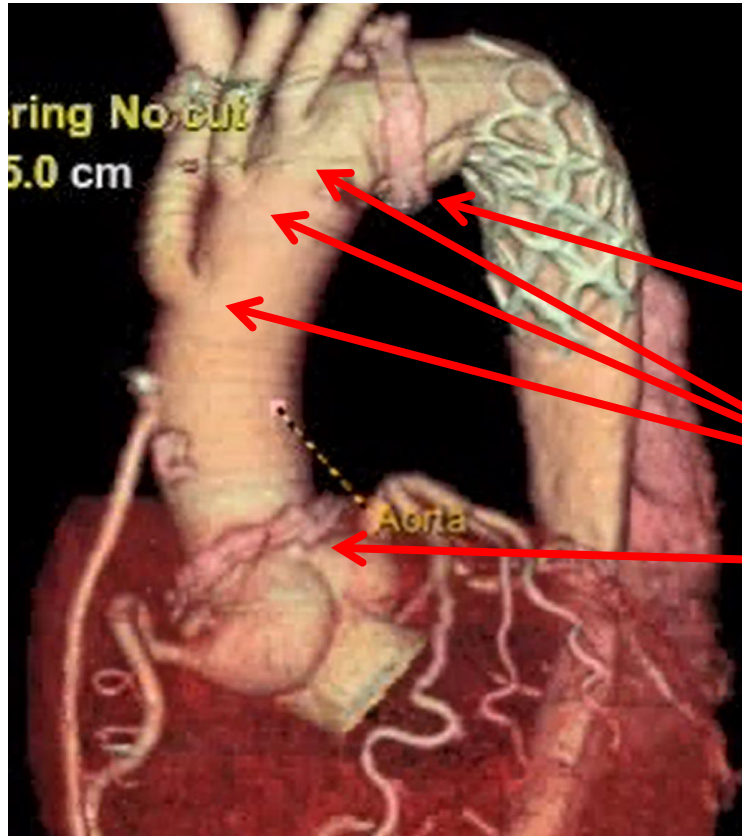


拡大手術の意義

Open Stent Graftの功罪

Fresh vs Frozen

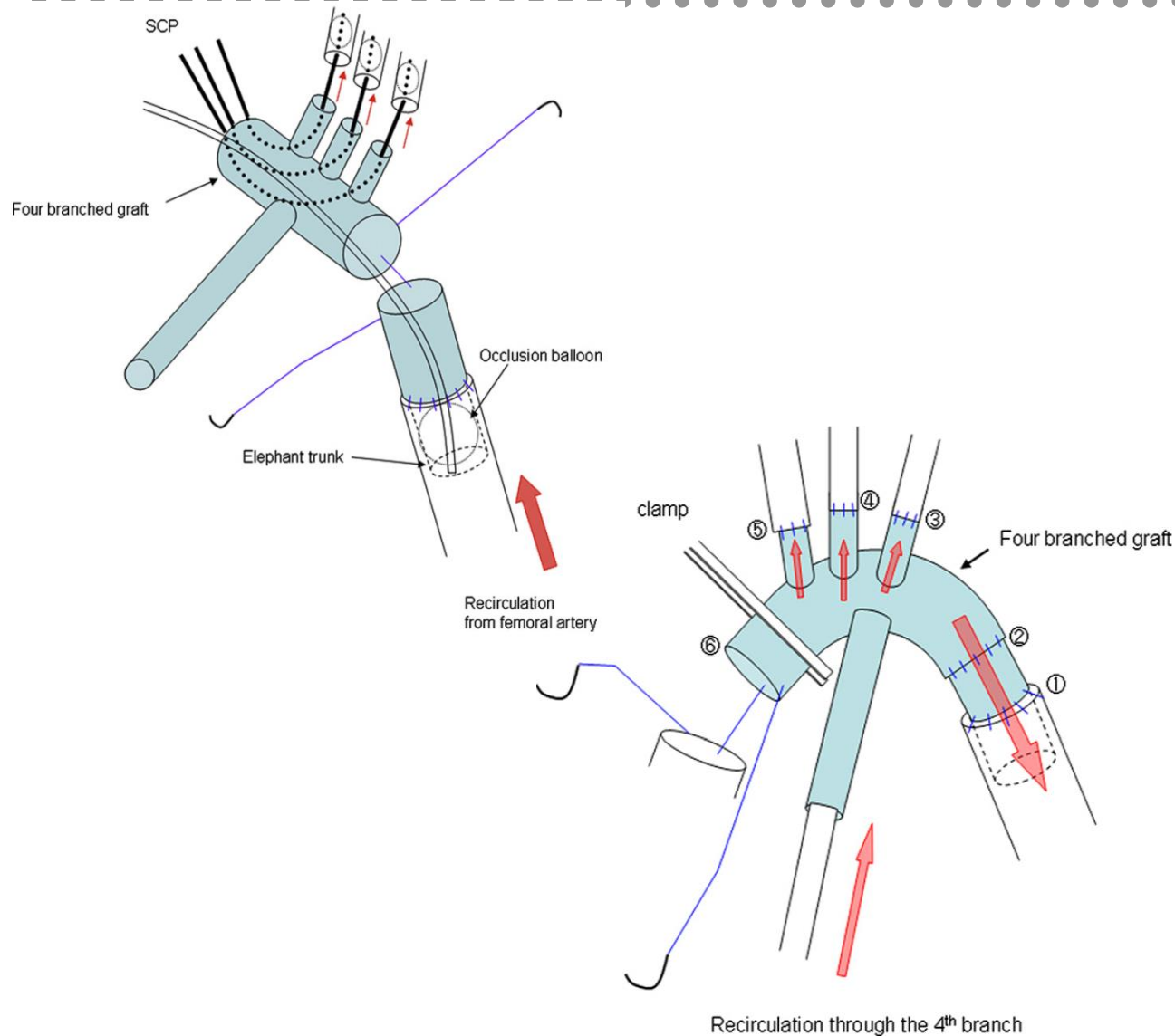
TAR with FET + Distal First



1. CPB: AD:FA or TransLV TAA: AscAo or Axillar
 2. Moderate hypothermia (20-30min, 25.0°C)
Brain SACP (10-15ml/kg/min, single roller pump, 40mmHg)
Body CA or Perfusion (60mmHg)
 - ① Distal anastomosis
 3. Warming (25→ 32→ 35°C)
SACP (50mmHg), Antegrade body perfusion via graft
 - ② Arch reconstruction LSCA→LCCA→RBCA
 - ③ Proximal anastomosis
 4. Ao declamp
- FET: frozen elephant trunk*

Conventional Elephant Trunk (cET)

TAR with stepwise distal anastomosis technique



- Distal anastomosis at 25°C
 - Brain SACP (40mmHg)
 - Body Circulatory arrest 47±15min
- Graft-graft anastomosis at 25→32°C
 - Brain SACP (50mmHg)
 - Body Perfusion via FA
- Arch reconstruction LSCA→LCCA→RBCA
- Proximal anastomosis at 32→35°C
 - Graft perfusion

SACP: selective antegrade cerebral perfusion

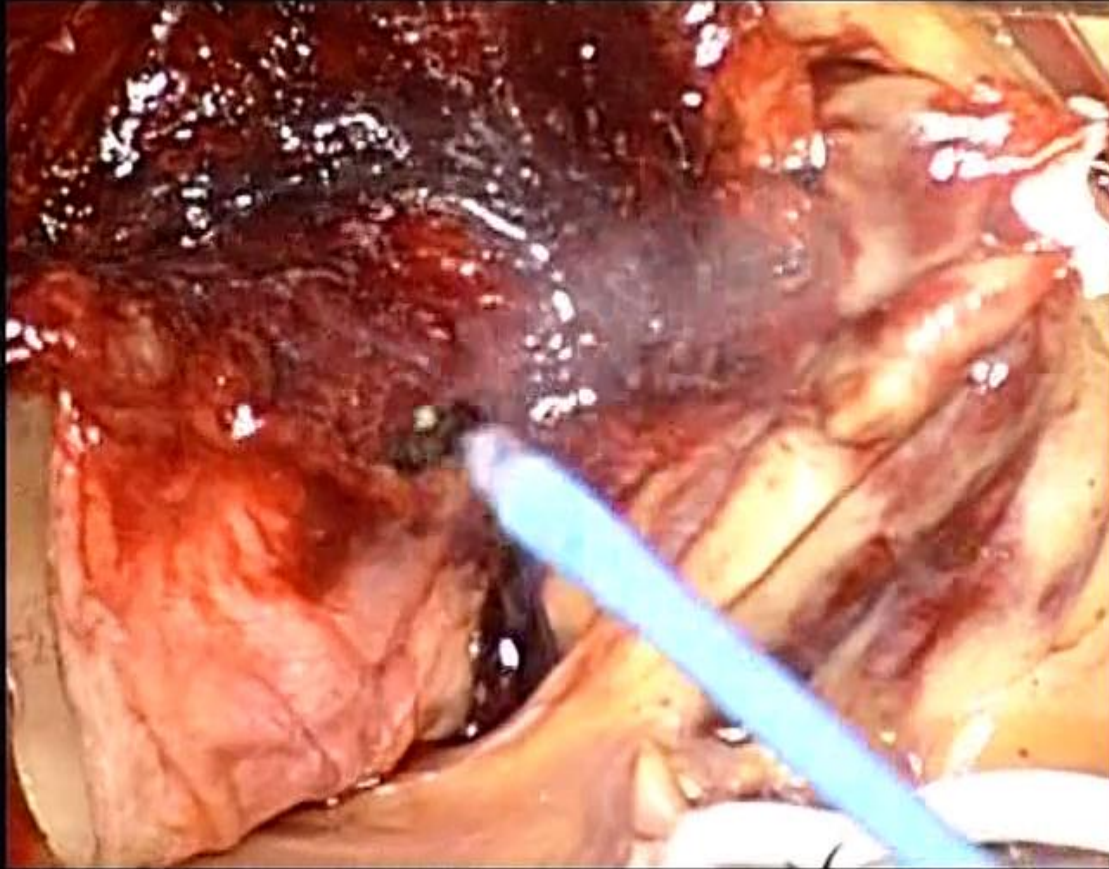
CA: circulatory arrest

LSCA: left subclavian artery

LCCA: left common carotid artery

RBCA; Right brachiocephalic artery

吻合方法



内挿法 → 面で吻合する

大動脈壁と人工血管の間にしわがない

運針はバランスよく(少なく) **Large needle・Big bite**

フェルトは吻合部にかからない

遠位吻合

人工血管-FET-内中膜-中外膜-外フェルト

FETがたくれやすい ← 3-0PPP with felt

中枢吻合

人工血管-内フェルト-内中膜-中外膜-外フェルト

注意点 STJ直上で吻合 **基部を剥離する**

FET Sizing - Diameter & Length

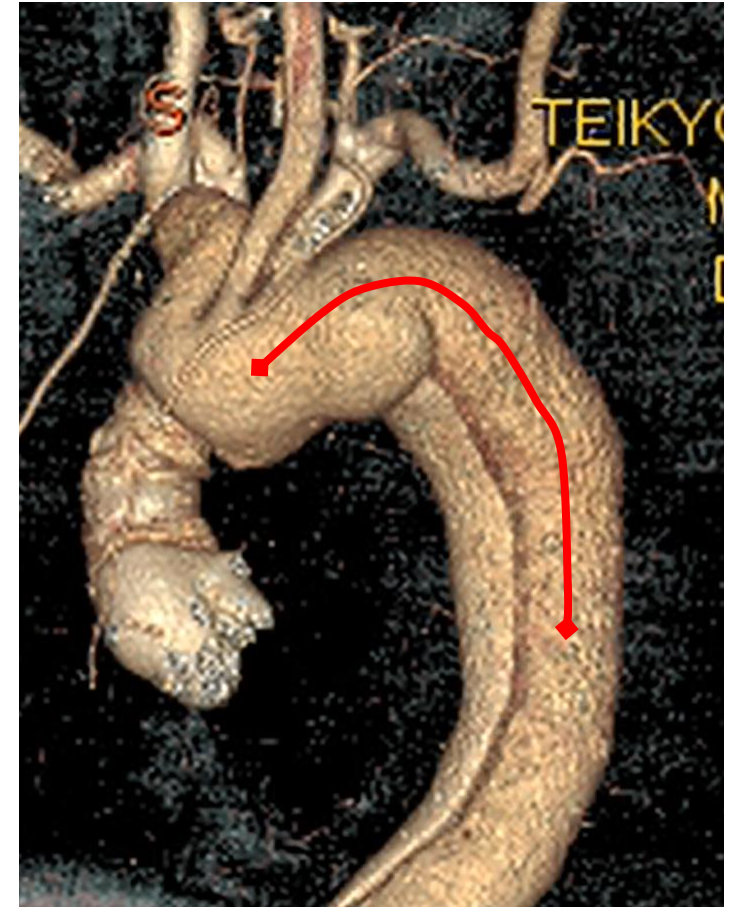
Stent graft diameter

- TAA: $(D) \times 110\text{--}120\%$ (mm)
- **Acute dissection:** $(T+F) \times 90\%$ (mm)
- Chronic dissection: $(T) \times 105\text{--}110\%$ (mm)

D: diameter T: true lumen F: false lumen

Stent graft length

- Determined preoperatively with 3D-CT
- Distal end of the stent at a more proximal level of Th8, but in the **straight area of the aorta**
- **Acute dissection: 9cm**



Prevention of Paraplegia

- ・ OSG挿入深度 Th7レベルまで
- ・ LSCA再建・灌流
- ・ 中等度低体温 25°C
- ・ 体循環停止時間短縮
- ・ 血圧管理
- ・ 浮腫予防
- ・ 留置時灌流 Emboli防止
- ・ OSGの空気抜き

(肋間・Adamkiewiczの術前同定)

(CSF脊髄ドレナージ)



Current status and recommendations for use of the frozen elephant trunk technique: a position paper by the Vascular Domain of EACTS[†]

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Roberto Di Bartolomeo^f, Christian D. Etz^g, Martin Grabenwöger^h, Michael Grimmⁱ, Axel Haverich^a,
Heinz Jakob^j, Andreas Martens^a, Carlos A. Mestres^{k,l}, Davide Pacini^f, Tim Resch^m, Marc Schepensⁿ,
Paul P. Urbanski^o and Martin Czerny^{p,q,*}

European Journal of Cardio-Thoracic Surgery 47 (2015) 759–769

POSITION STATEMENT

Indication

- Ila The FET technique should be considered in patients with
- **Acute type A aortic dissection** with a primary entry in the distal aortic arch or in the proximal half of the descending aorta.
 - **Complicated acute type B aortic dissection** when primary TEVAR is not feasible or the risk of retrograde type A aortic dissection is high.
 - **Extensive thoracic or thoraco-abdominal aortic disease** when a second procedure can be anticipated.

A Meta-Analysis of Total Arch Replacement With Frozen Elephant Trunk in Acute Type A Aortic Dissection

Vascular and Endovascular Surgery
2016, Vol. 50(1) 33-46
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DOI: 10.1177/1538574415624767
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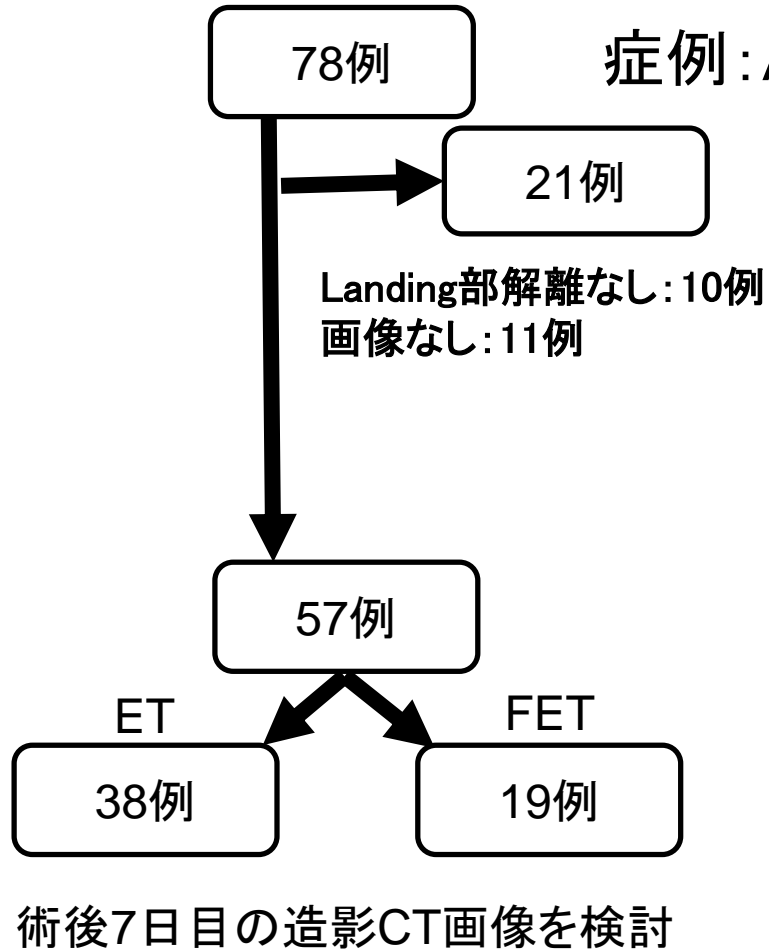


遠隔期再治療 9.6%、偽腔閉塞率 96.8%
FETにより、遠隔期の再治療と開存した残存偽腔が減少するかもしれない

Abstract

Objectives: To assess the safety and efficacy, we performed a meta-analysis of total arch replacement with frozen elephant trunk in exclusive acute type A (neither chronic nor type B) aortic dissection. **Methods:** Databases including MEDLINE and EMBASE were searched through March 2015 using Web-based search engines (PubMed and OVID). Eligible studies were case series of frozen elephant trunk enrolling patients with acute type A (neither chronic nor type B) aortic dissection reporting at least early (in-hospital or 30-day) all-cause mortality. Study-specific estimates were combined in both fixed- and random-effect models. **Results:** Fifteen studies enrolling 1279 patients were identified and included. Pooled analyses demonstrated the cardiopulmonary bypass time of 207.1 (95% confidence interval [CI], 186.1-228.1) minutes, aortic cross-clamp time of 123.3 (95% CI, 113.1-133.5) minutes, selective antegrade cerebral perfusion time of 49.3 (95% CI, 37.6-61.0) minutes, hypothermic circulatory arrest time of 39.0 (95% CI, 30.7-47.2) minutes, early mortality of 9.2% (95% CI, 7.7-11.0%), stroke of 4.8% (95% CI, 2.5-9.0%), spinal cord injury of 3.5% (95% CI, 1.9-6.6%), mid- to long-term (≥ 1 -year) overall mortality of 13.0% (95% CI, 10.4-16.0%), reintervention of 9.6% (95% CI, 5.6-15.8%), and false lumen thrombosis of 96.8% (95% CI, 90.7-98.9%). **Conclusions:** Total arch replacement with frozen elephant trunk provides a safe alternative to that with conventional elephant trunk in patients with acute type A aortic dissection, with acceptable early mortality and morbidity. The rates of mid- to long-term reintervention and false lumen non-thrombosis may be lower in patients undergoing the frozen than conventional elephant trunk procedure.

急性大動脈解離に対するTotal arch replacement @帝京
 ET vs FET: 偽腔の血栓化・真腔の拡張・SINEについて検討



症例: A型解離に対するTAR (2010 - 2018)

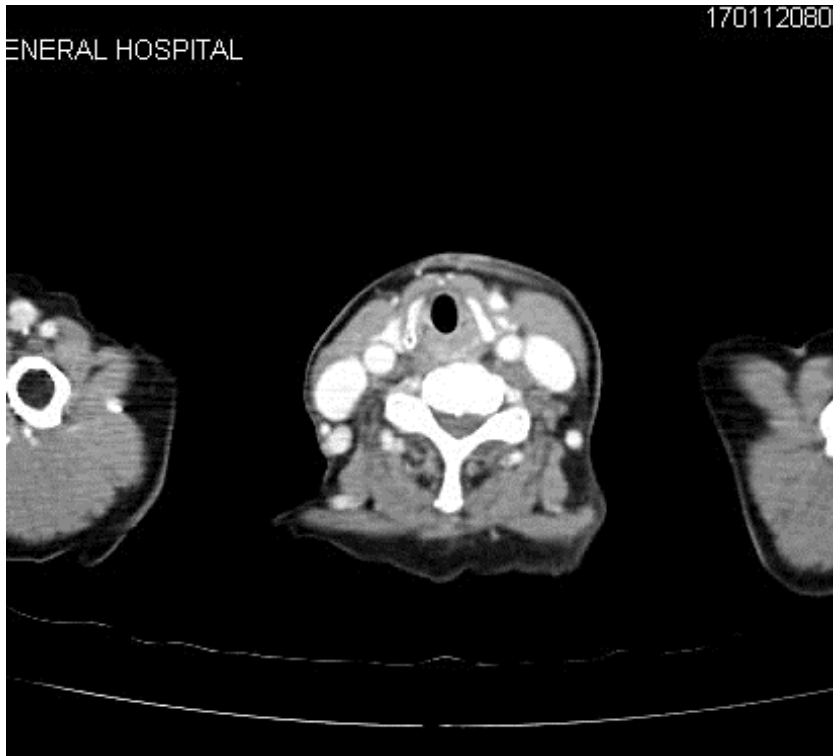
	ET (n=38)	FET (n=19)	P
平均年齢(才)	56.1 ± 10.4	57.2 ± 11.9	N.S
男性	30(79%)	15(79%)	N.S
偽腔閉塞			
近位下行	26(68.4%)	16(84.2%)	N.S
中位下行	11(28.9%)	8(42.1%)	N.S
遠位下行	10(26.3%)	7(36.8%)	N.S
Δ真腔径(mm)	5.5 ± 4.1	9.6 ± 4.9	0.00013
Δ血管径(mm)	0.6 ± 2.1	1.2 ± 2.7	N.S
SCI	0	1(paraparesis)	N.S
遠隔期SINE	—	1	—

Aortic Arch Reconstructive Surgery With Conventional Techniques vs Frozen Elephant Trunk: A Systematic Review and Meta-Analysis

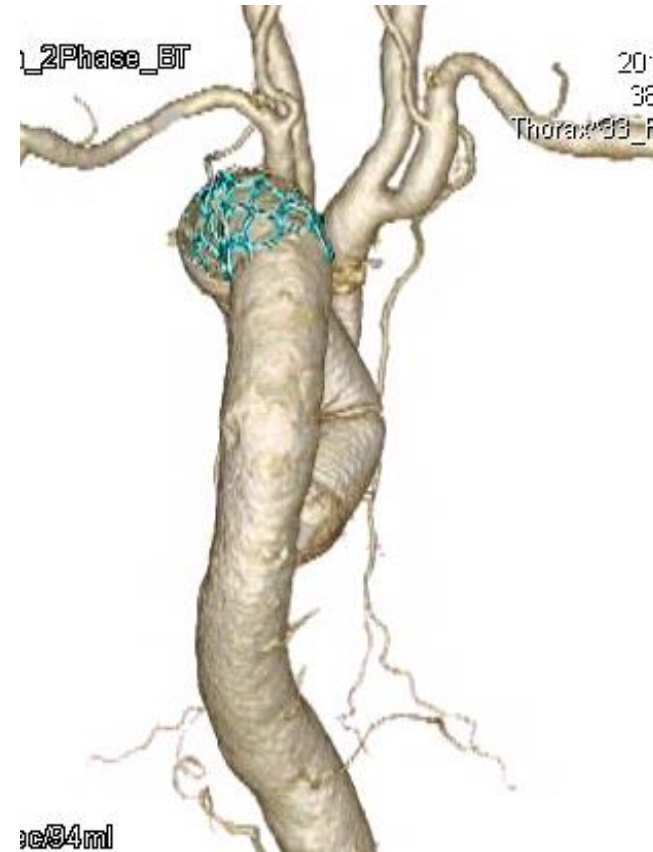
Canadian Journal of Cardiology 34 (2018) 262–273

FET vs. Conventional Surgery		GRADE ANALYSIS			
Bibliography: see paper					
Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with Mortality (95% CI)
Mortality	1803 (12 studies)	⊕⊕⊕⊕ LOW due to risk of bias, plausible counfounding would change the effect	OR 0.55 (0.39 to 0.78)	Study population	
				145 per 1000	60 fewer per 1000 (from 28 fewer to 83 fewer)
				Moderate	
Stroke	1803 (12 studies)	⊕⊕⊕⊕ LOW due to risk of bias, plausible counfounding would change the effect	OR 0.78 (0.52 to 1.15)	Study population	
				97 per 1000	20 fewer per 1000 (from 44 fewer to 13 more)
				Moderate	
Major bleeding	1531 (9 studies)	⊕⊕⊕⊕ VERY LOW due to risk of bias, inconsistency, imprecision, plausible counfounding would change the effect	OR 0.83 (0.57 to 1.19)	Study population	
				115 per 1000	18 fewer per 1000 (from 46 fewer to 19 more)
				Moderate	
Spinal Cord Ischemia / Paraplegia	1476 (9 studies)	⊕⊕⊕⊕ VERY LOW due to risk of bias, imprecision, plausible counfounding would change the effect	OR 2.2 (1.1 to 4.37)	Study population	
				27 per 1000	30 more per 1000 (from 3 more to 80 more)
				Moderate	
				24 per 1000	27 more per 1000 (from 2 more to 73 more)

Complex ascending & arch Ao disease after AVR

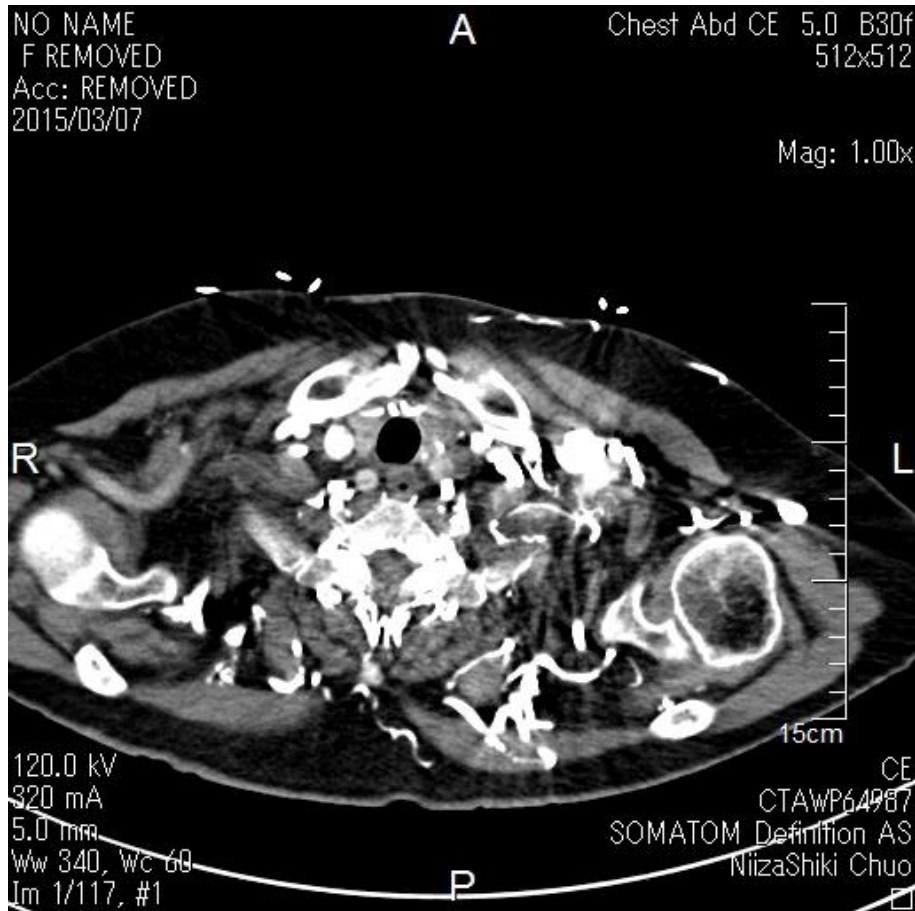


78y F AD typeA pAVR(生体弁25mm)+Maze

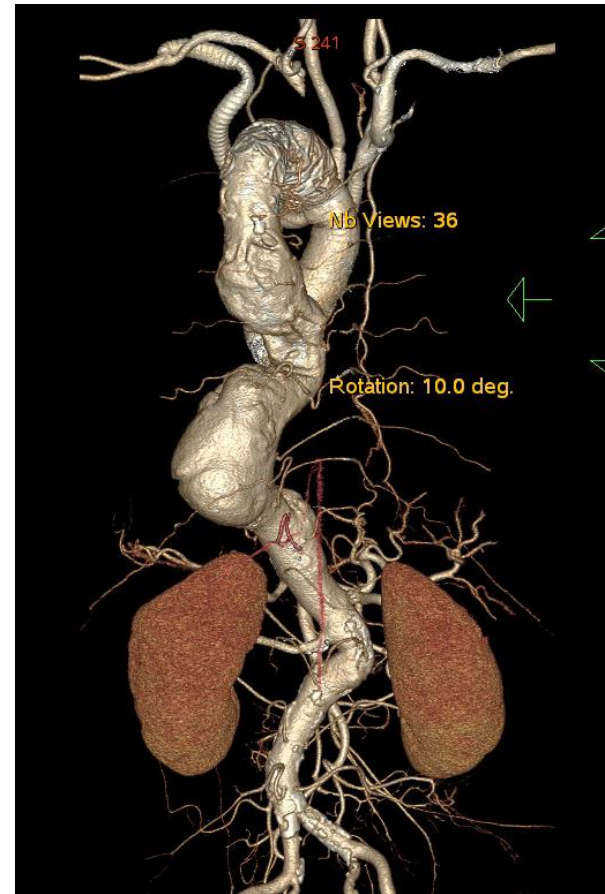


⇒ARR(生体弁25mm)+TAR+FET (31x60mm)

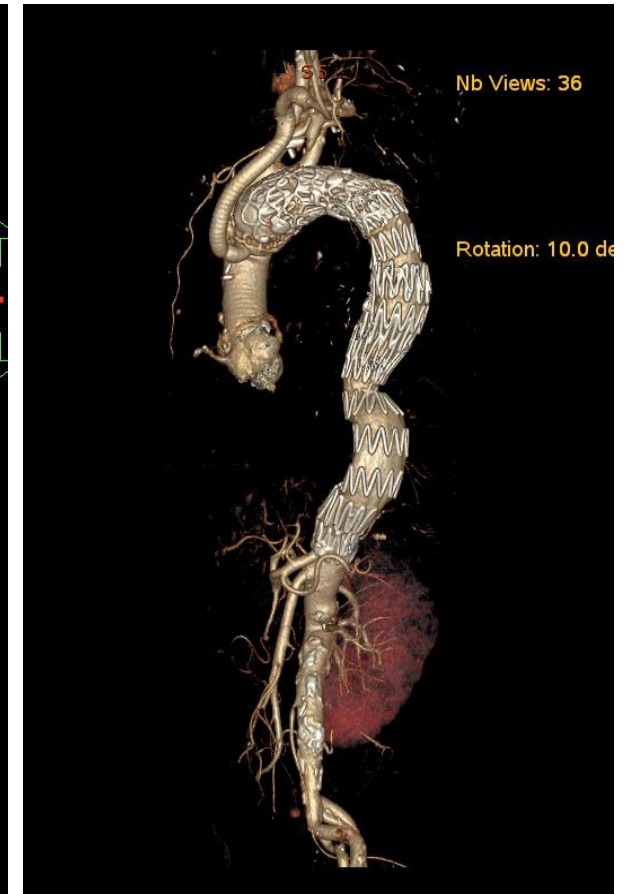
Complex distal arch & descending Ao disease



72y F AD typeA(T) dArch&DesAo Aneurysm



⇒TAR+FET (33x90mm)



⇒TEVAR (2nd Stage)

Take Home Message

.....

Aggressive arch replacement → appropriate operations for **select patients** with AAD

- Arch aneurysm >4 cm
- Connective tissue disease
- Intimal tear at the arch
- Dissection of the arch branches with malperfusion
- Younger patient (< 70 years)

– **Tailored approach** based on surgeon, center experience and patient presentation

• **Frozen ET** → a safe alternative to cET with AAD during arch replacement

- Benefit: mortality ⇔ Damage: spinal cord ischemia
- Rates of late reintervention and false lumen non-thrombosis may be lower
- FET may be considered with **complex distal arch & descending Ao disease**

ご清聴ありがとうございました!!



ご清聴ありがとうございました!!