acute aortic syndrome

- Decision making for management -

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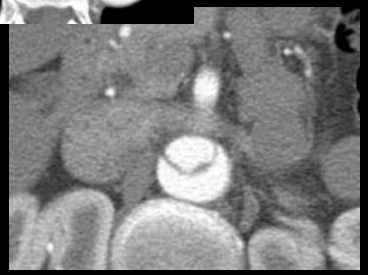
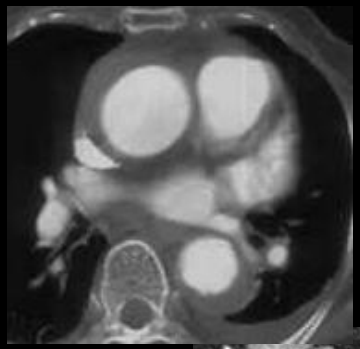
Seoul National University Bundang Hospital

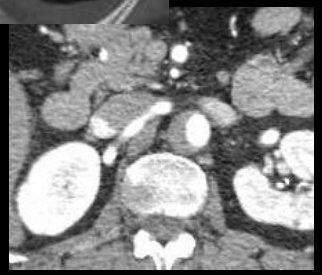
Acute aortic syndrome

Dissection

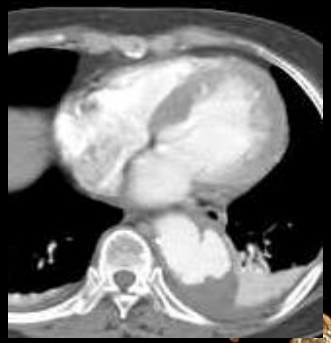


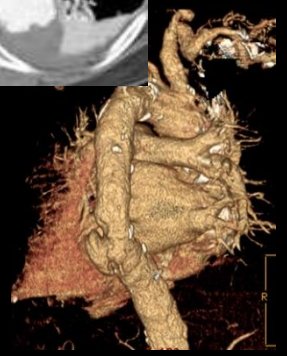
Intramural hematoma





Penetrating ulcer





Medical Management: aims

- prevent sudden death and later complications
  - halt distal progression of dissection
  - decrease the expanding pressure on false lumen
  - maintain vital organ perfusion

  --- decrease arterial blood pressure

  --- decrease the velocity of LV contraction (dP/dT)

Medical Management: BP control

- Beta-blocker
  - atenolol, propranolol, esmolol, labetalol
  - initial target: systolic BP 90~100, HR 60~70
  - *monitoring: peripheral & vital organ perfusion*
- Vadodilator
  - sodium nitroprusside, nitroglycerine
  - *reflex positive inotropism & chronotropism*
  - *consider volume status*
- Calcium channel blocker
  - nicardipine
- Sedatives & analgesics, *prn*

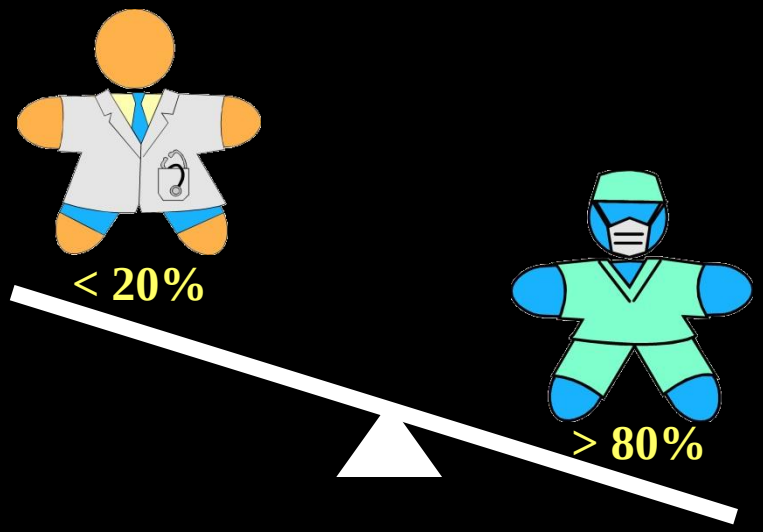
Medical Management: others

- Avoid undue irritation to the patient
- Establishment of monitoring lines
  - A-line: Right radial is preferable.
  - Central venous line: right internal jugular is preferable.
  - *must be done by an experienced member of the team.*

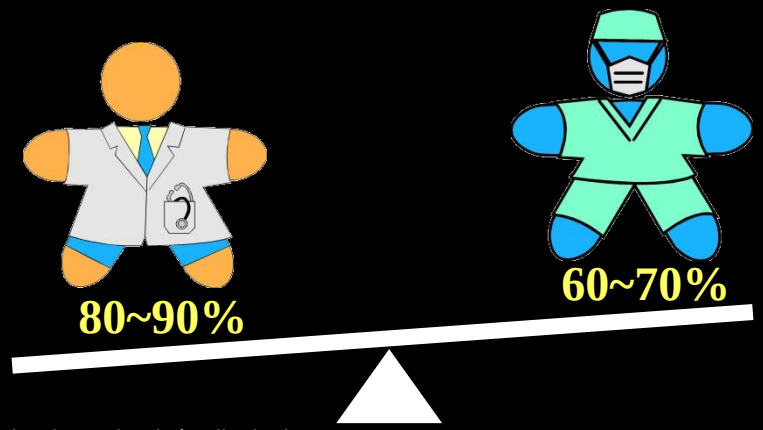
- Palliative pericardiocentesis for tamponade
- Management of irreversible malperfusion
  - fasciotomy, amputation, hemodialysis, bowel resection

Survival chance in acute dissection

Type A



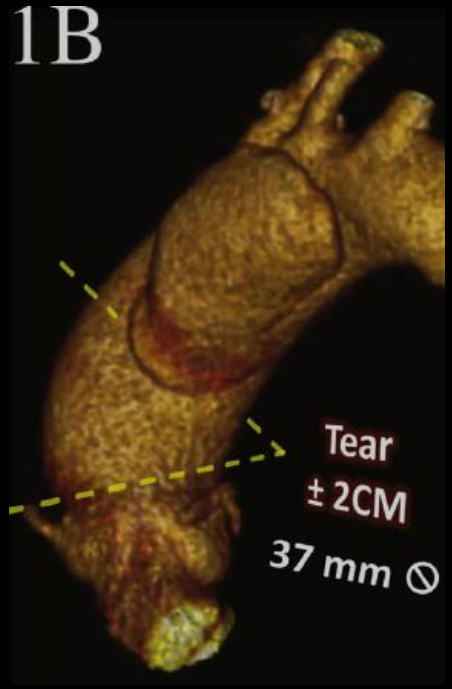
Type B

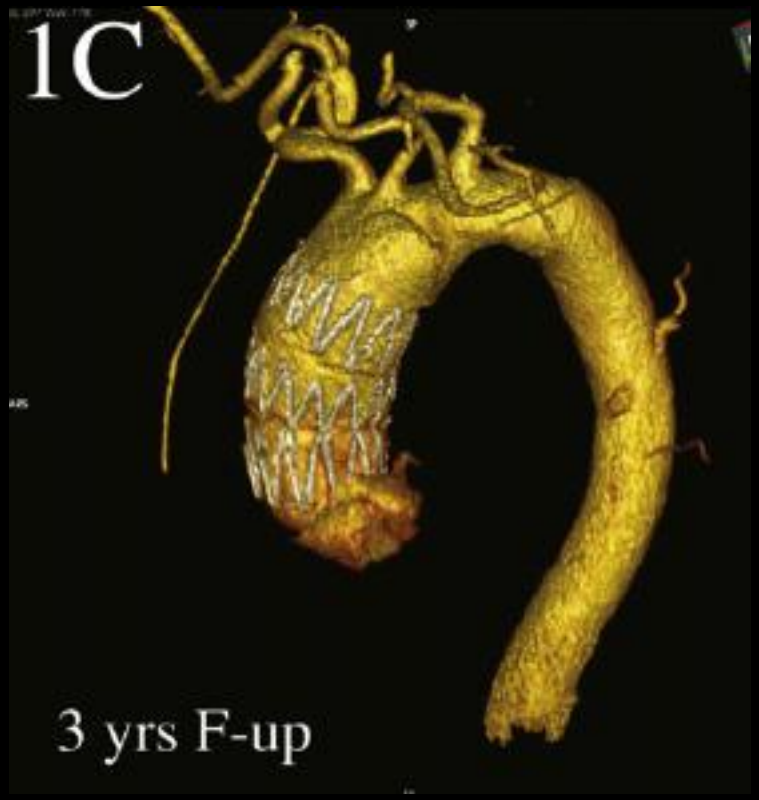


Acute aortic syndrome
- conventional principle -

	complicated	uncomplicated
• Dissection		
– Type A		
– Type B		
• IMH		
– Type A		
– Type B		
• PAU		

Endovascular repair of type A dissection

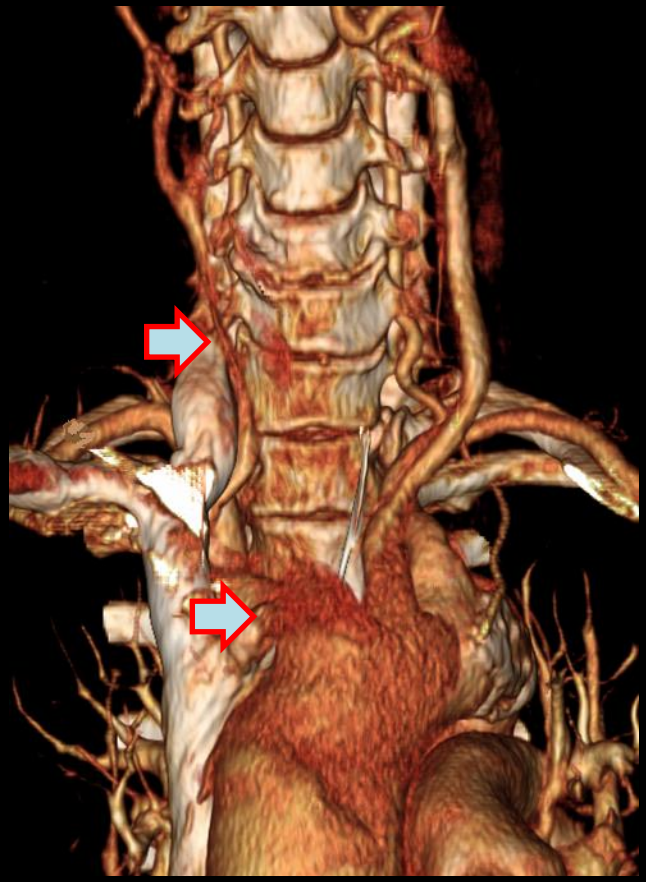


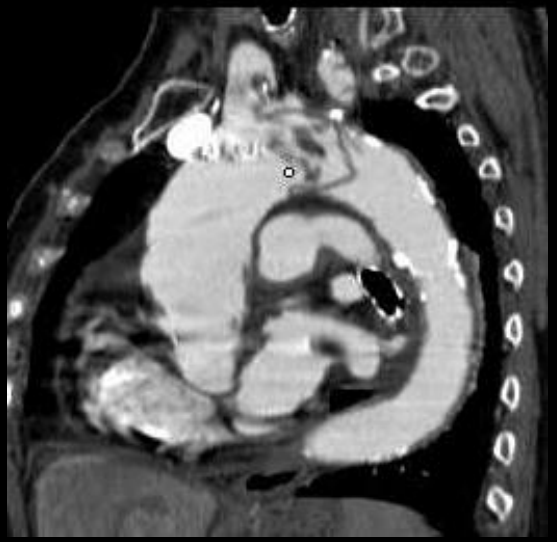


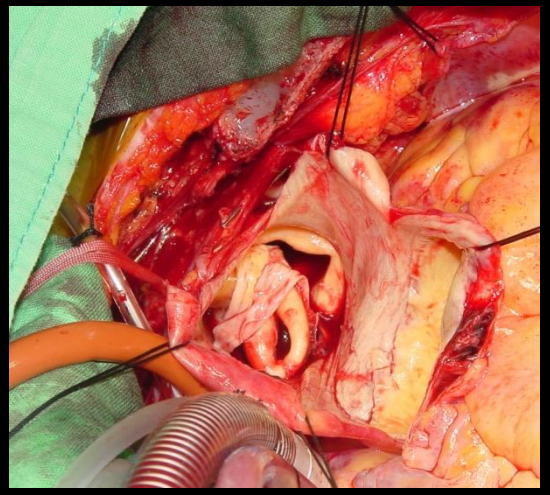
Issues in surgery for type A dissection

- Indication & timing
  - preoperative cardiac arrest / CPR
  - very old age
  - severe malperfusion
  - Preoperative anticoagulation / antiplatelet / thrombolysis
- Extent of aortic replacement
  - when to replace the root and/or arch
  - Frozen elephant trunk
- Technical issues
  - cardiopulmonary bypass / brain protection
  - hemostasis

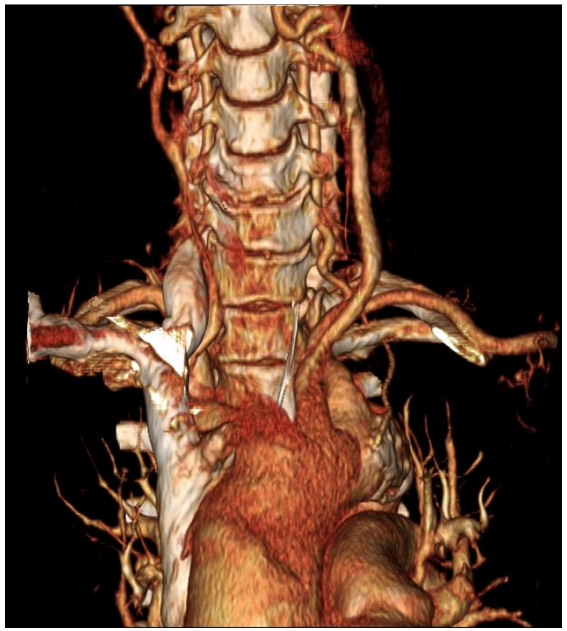
Brain malperfusion



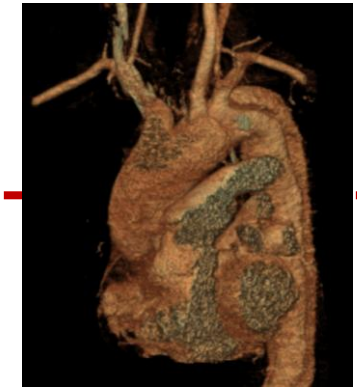


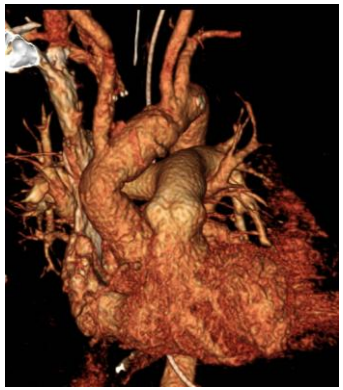


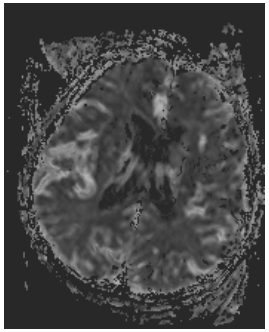
Aorta first or Branch first ?

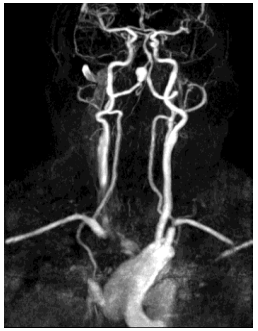


Carotid first

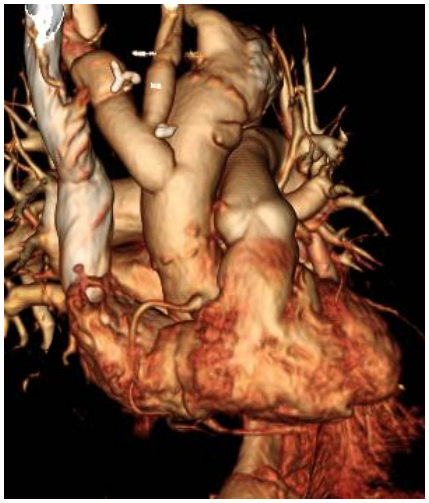




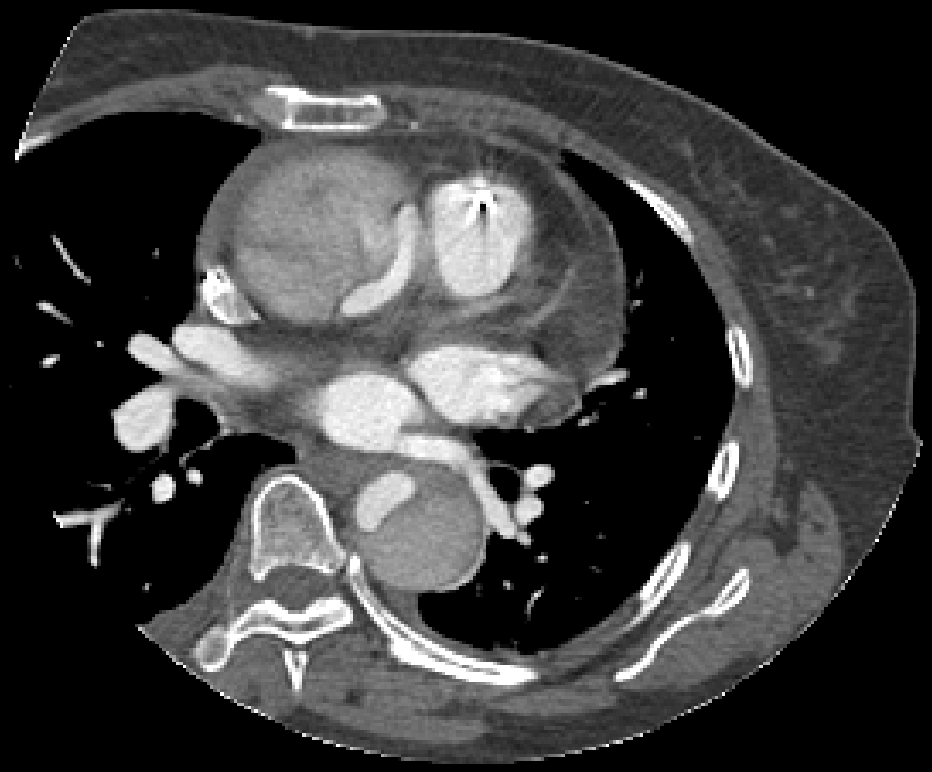




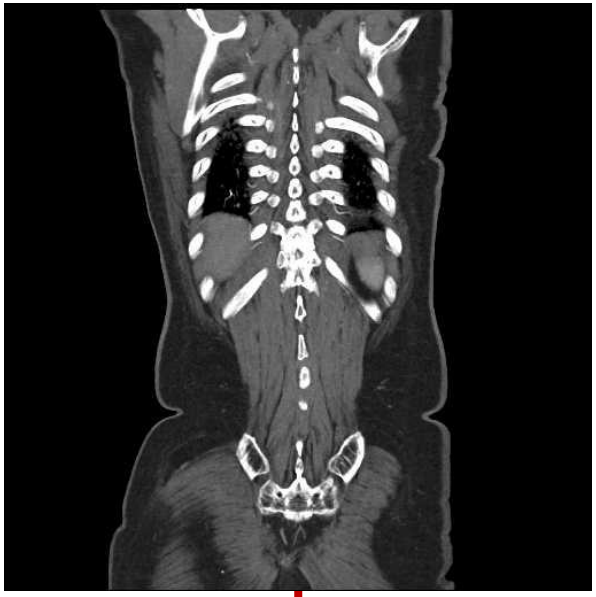
Aorta first

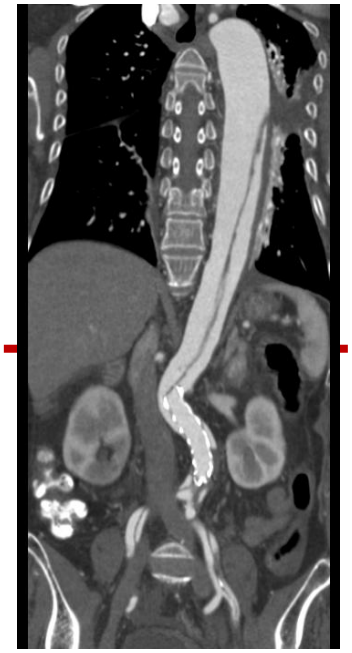


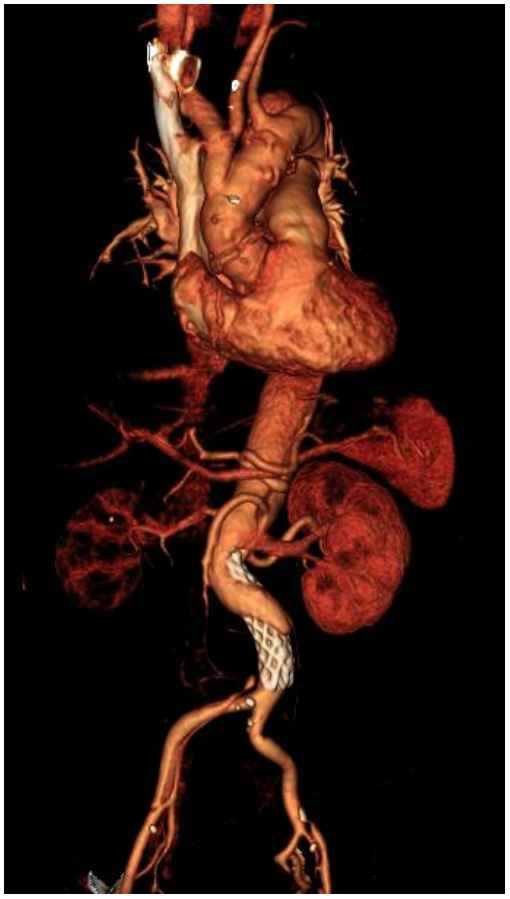
Coronary malperfusion

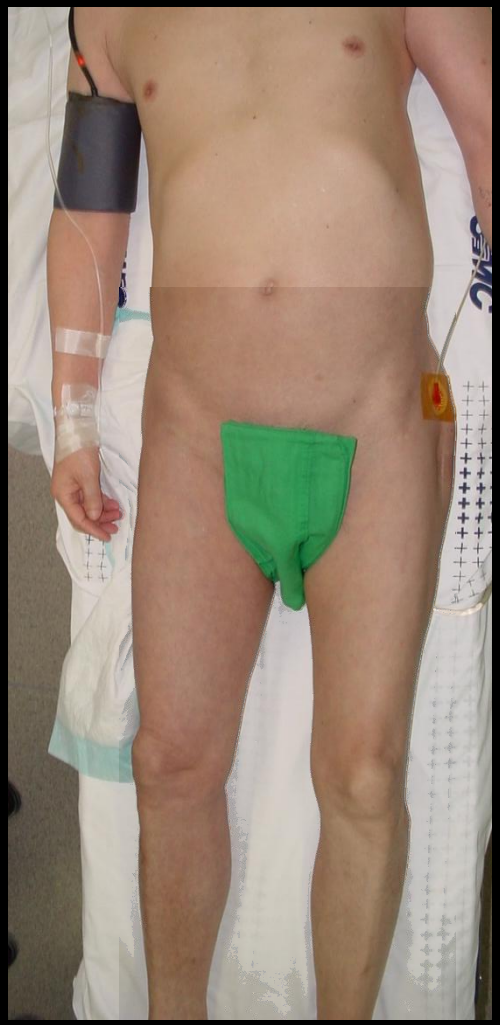


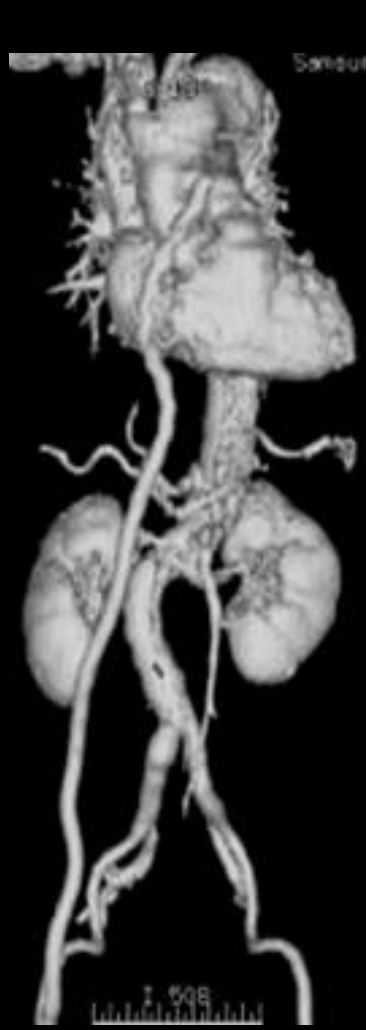
Total occlusion of abdominal aorta

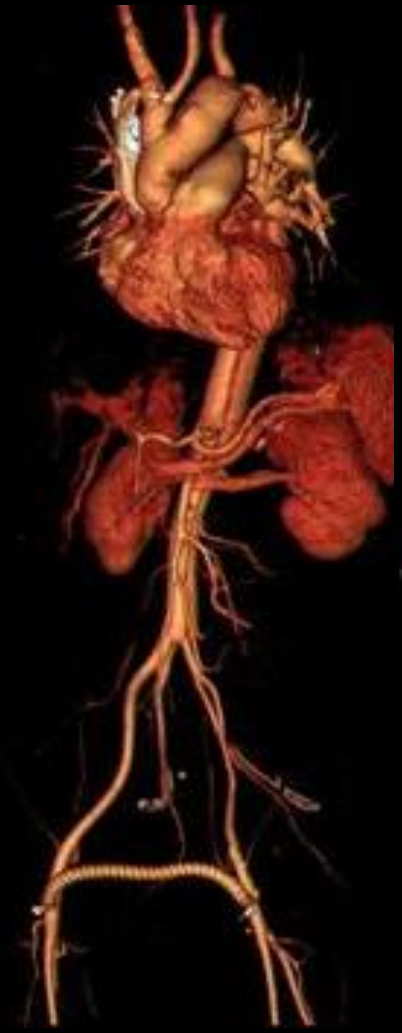


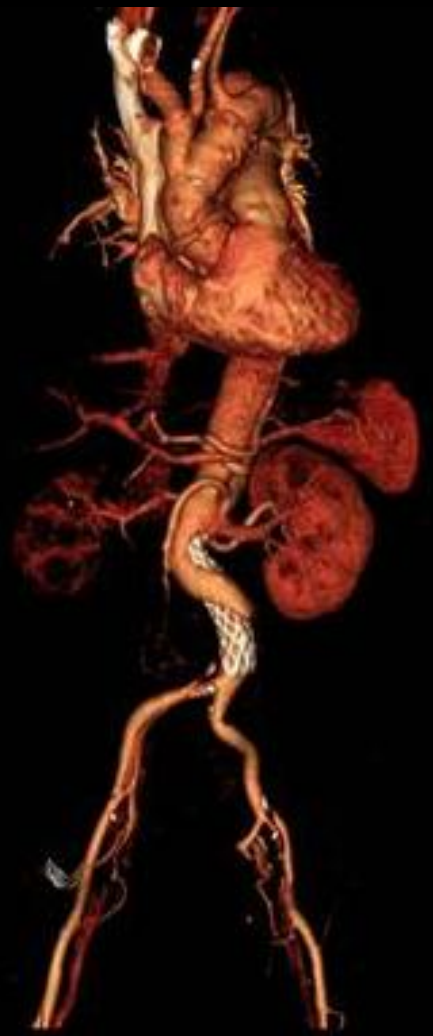




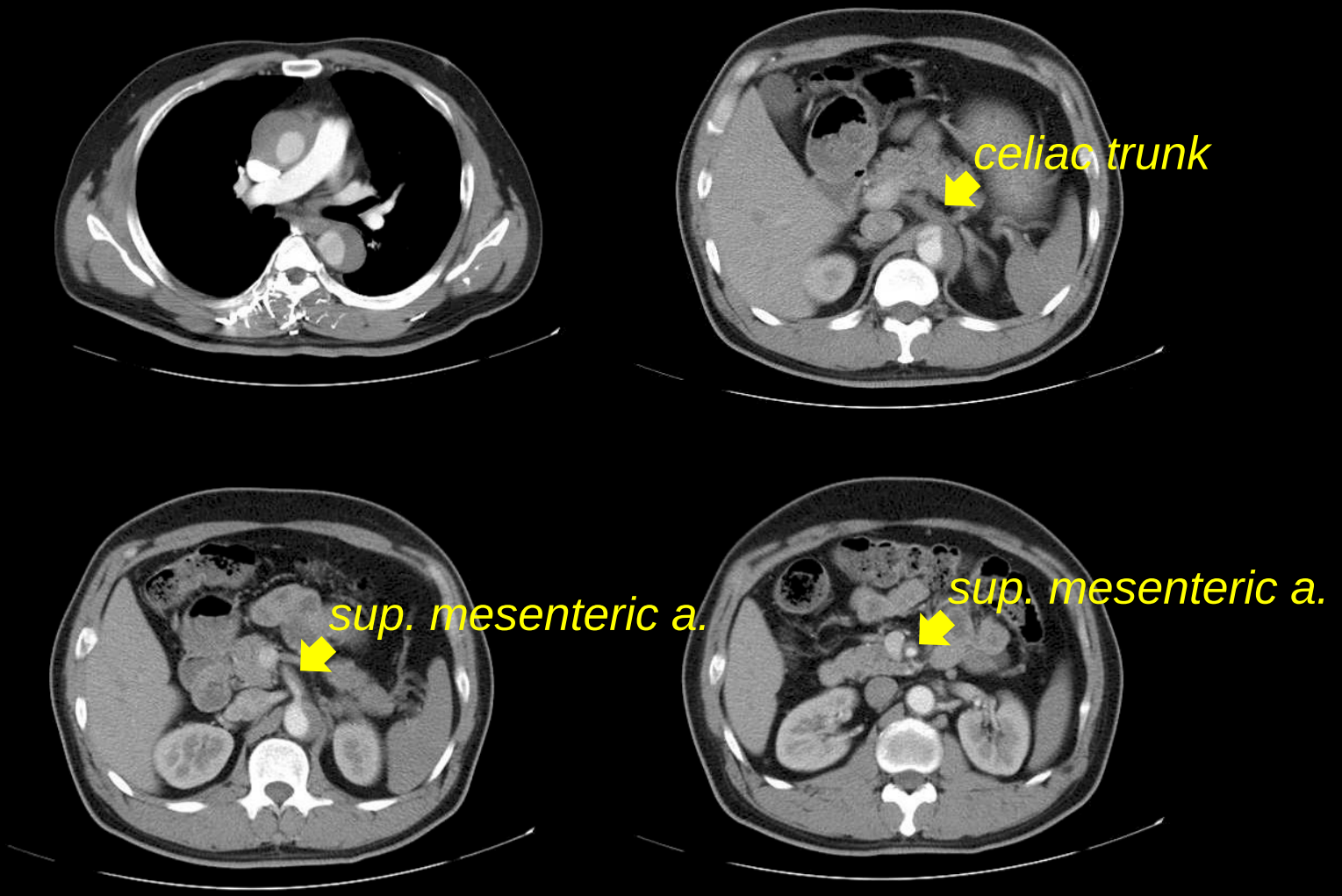



Samsun



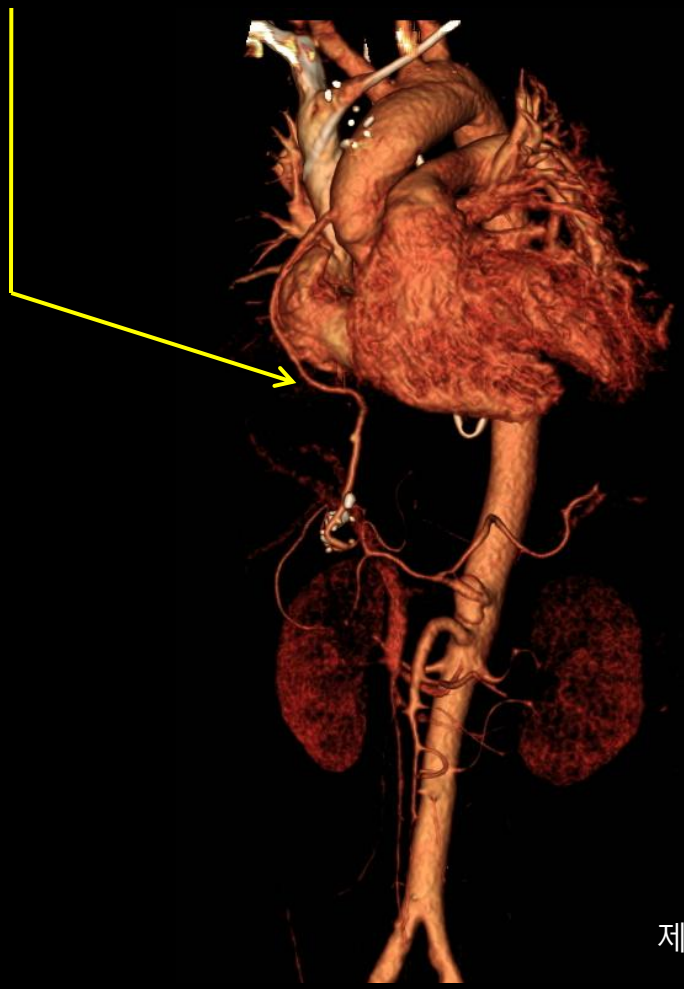


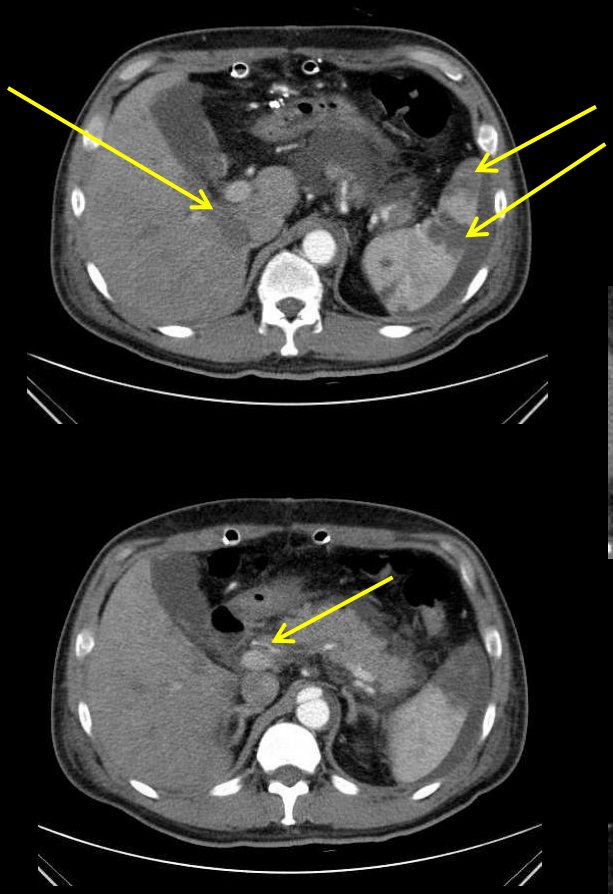
- M / 41 y
  - Upper back pain & abdominal pain, nausea, vomiting

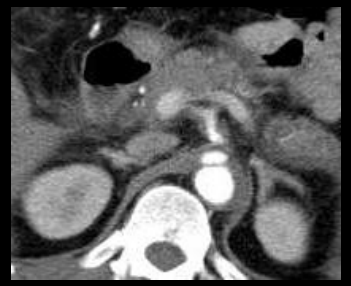


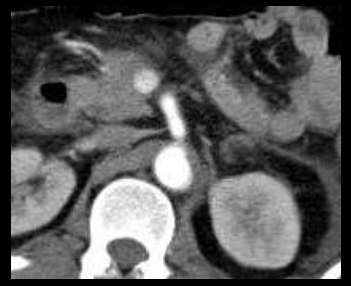
CT angiography on POD #1

Ascending aortic graft-to-RGEA saphenous vein graft

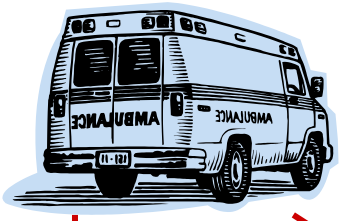








Management scheme for aortic dissection

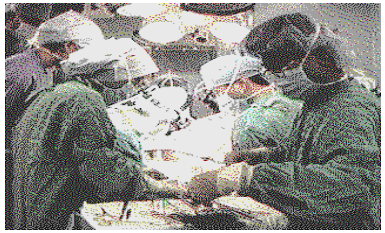


type B

- *(high risk of) rupture*
- *intractable pain*
- *organ ischemia*
- *retrograde progression*

type A

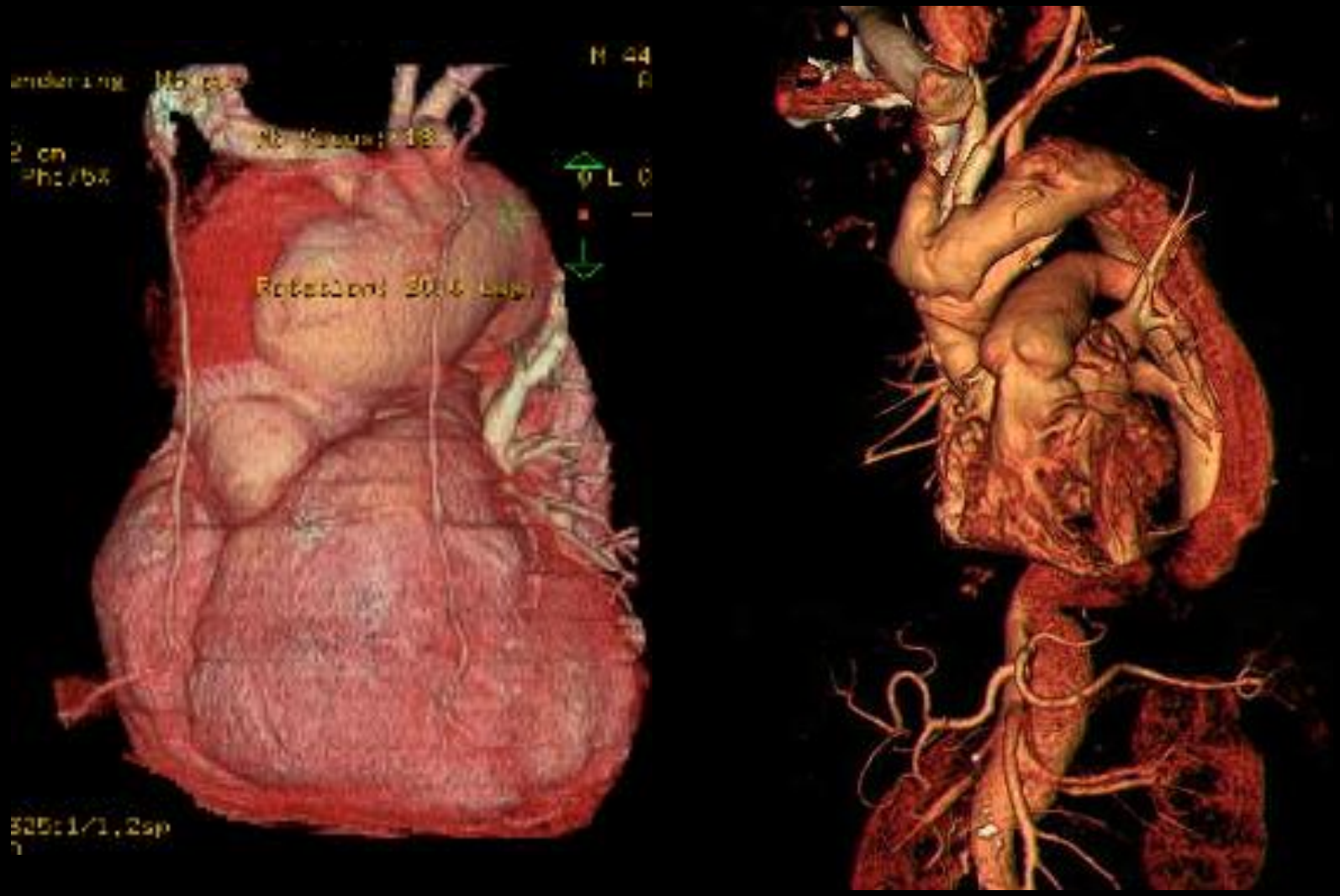
malperfusion



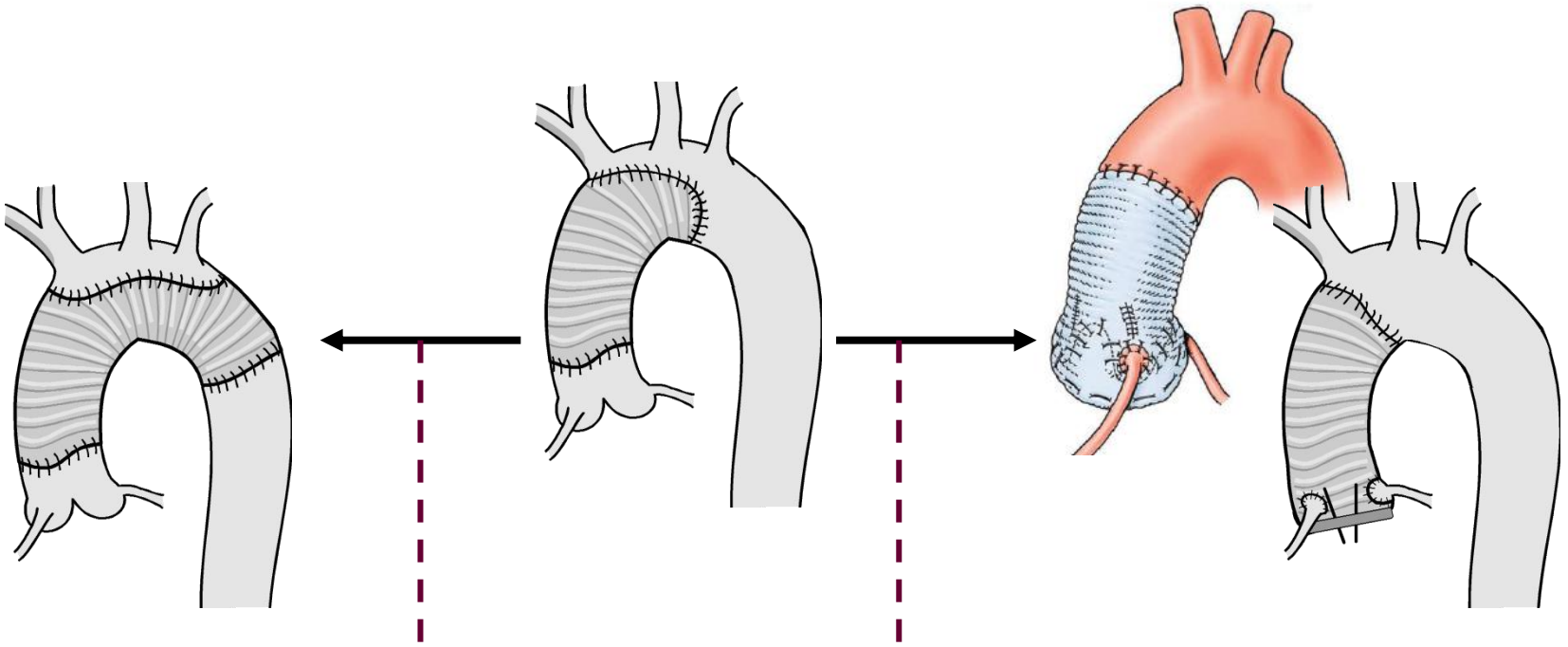
aneurysm

type B

Inadequate operation : unhappy outcome



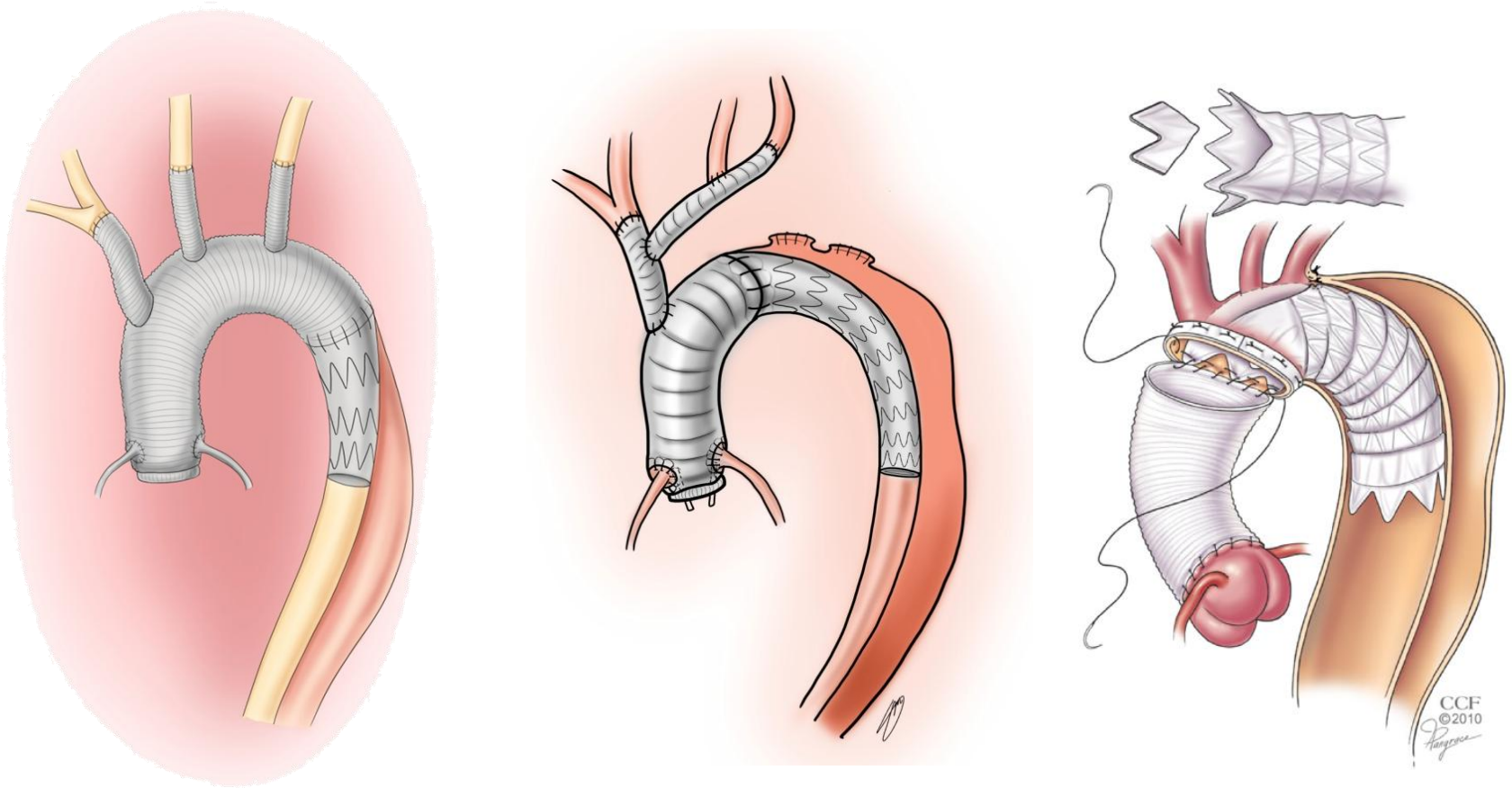
Extent of surgery for acute type A dissection



- intimal tear in the arch
- large arch (> 4cm)
- future need of descending thoracic aorta surgery

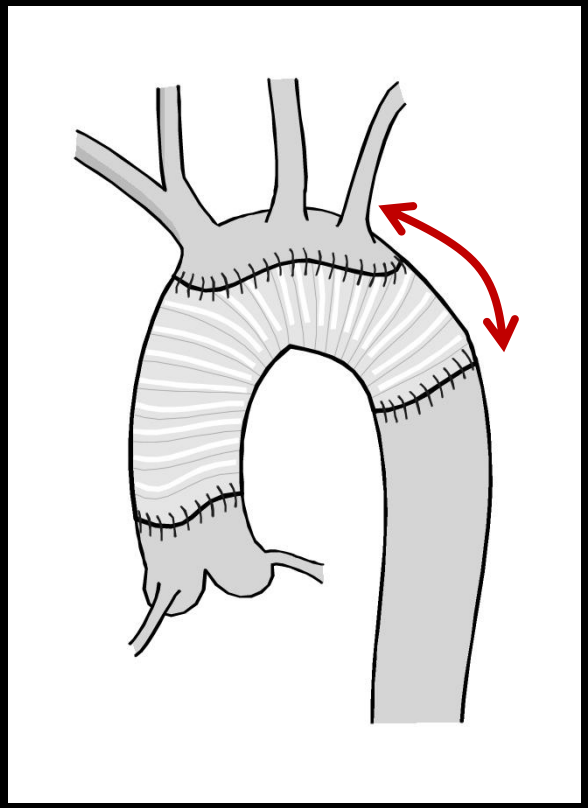
- Marfan syndrome
- large sinus (> 3.5~4cm)
- large tear in sinus
- large false lumen in sinus

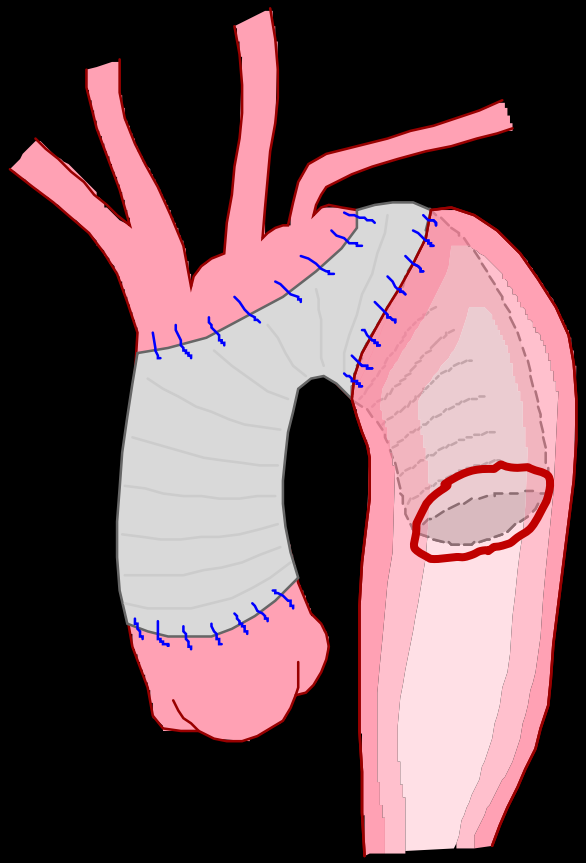
Hybrid repair (frozen elephant trunk) for acute type A dissection



Roselli EE, et al.
J Thorac Cardiovasc Surg 2013;145:S197-201

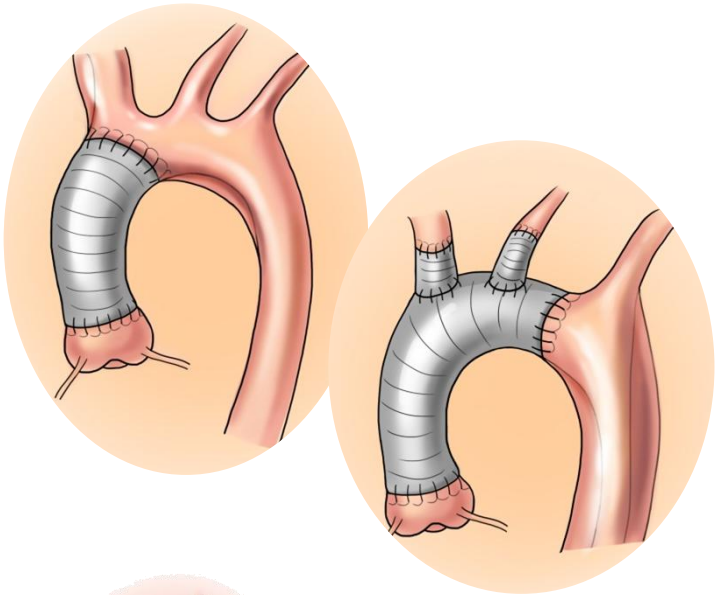
Elephant trunk
for aortic arch replacement

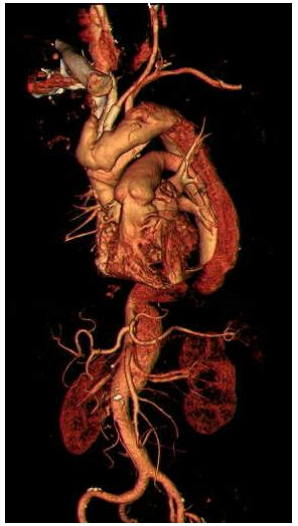


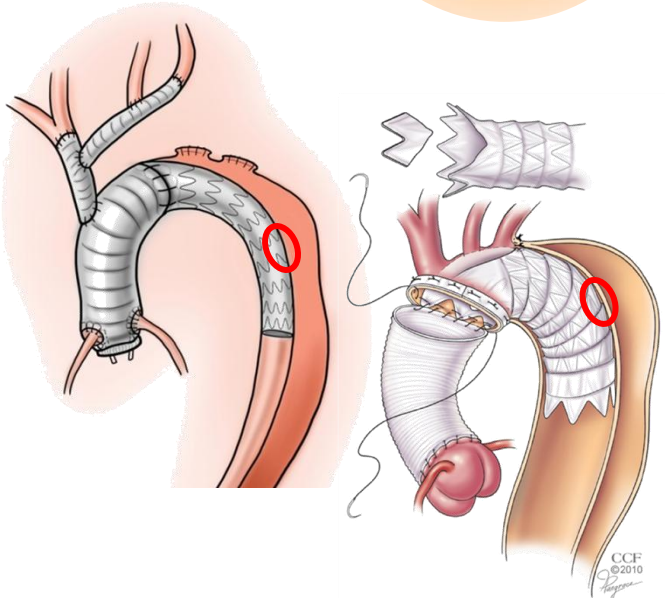


Frozen elephant trunk (FET)

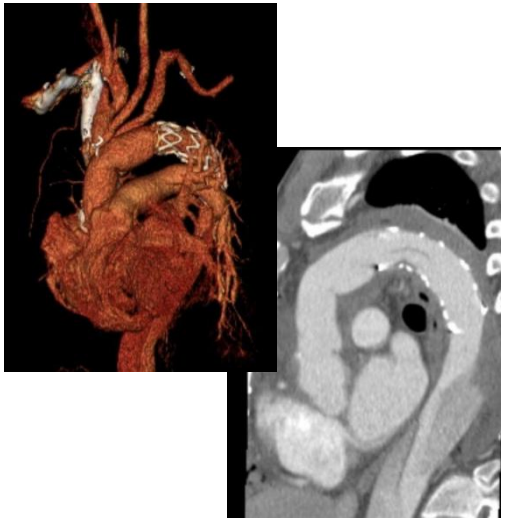
- ideas of the advocates -





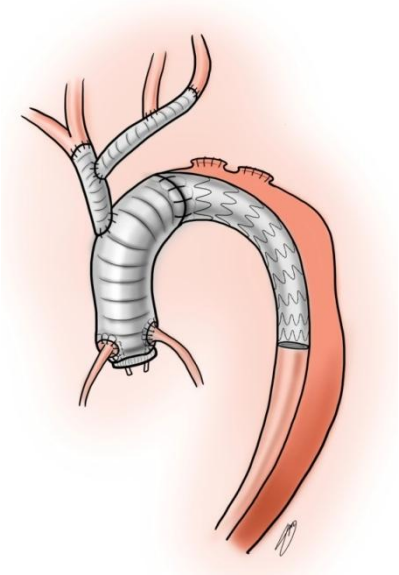


exclusion of distal tear



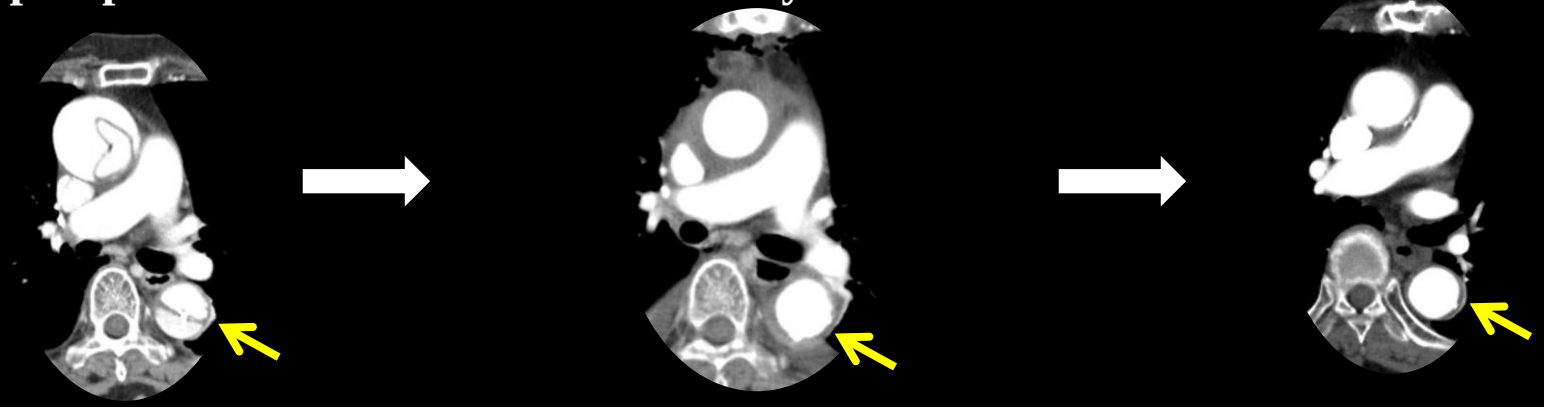
FET for type A dissection: debates

- FET has some drawbacks.
  - Prolongation of *procedural time*, esp. total circulatory arrest
  - Risk of *paraplegia*
  - Uncovered aorta is still at the risk of aneurysmal dilatation.
- Even after conventional surgery without FET, improvement of residual descending false lumen does occur in some patients.



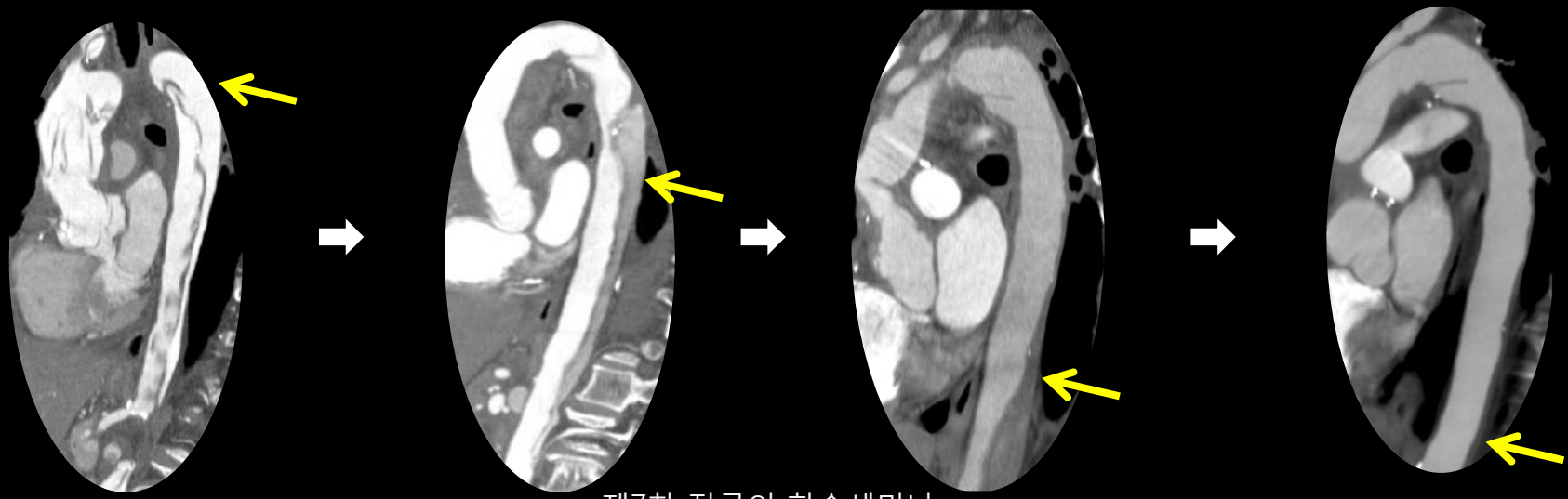
F / 78, ascending aorta replacement

preoperative | 4 days | 26 months

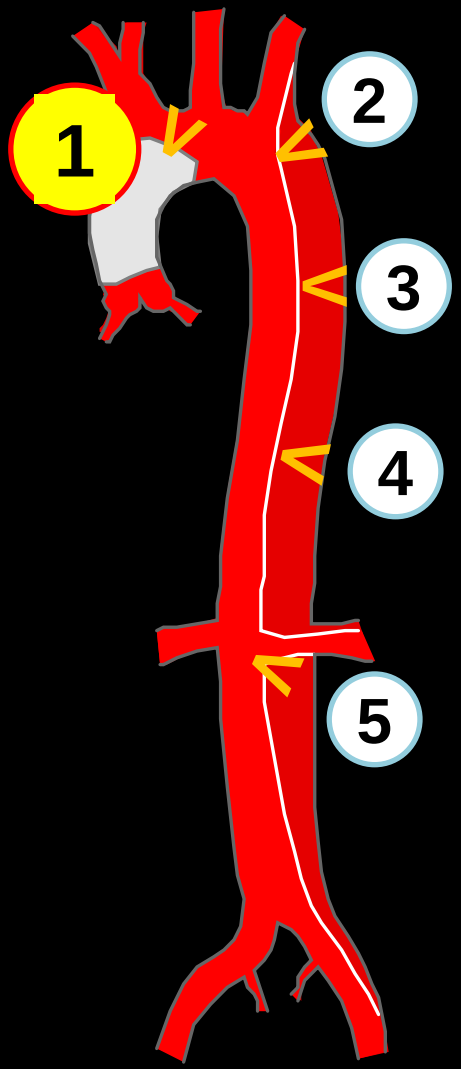


M / 64, total arch replacement with short elephant trunk

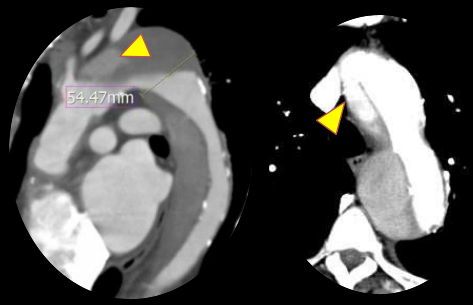
preoperative | 6 days | 8 months | 38 months



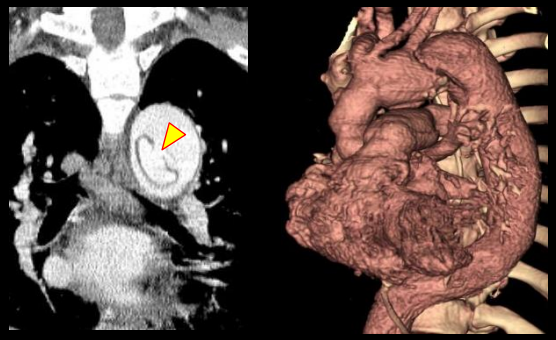
Causes of persistent descending FL patency



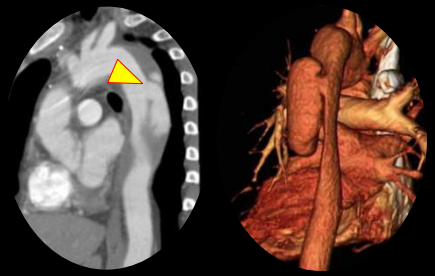
1. new, iatrogenic tear (anastomotic line)



2. arch tear left alone

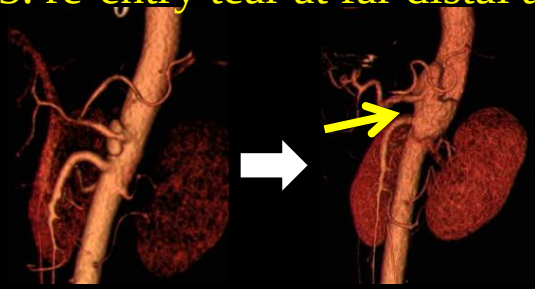


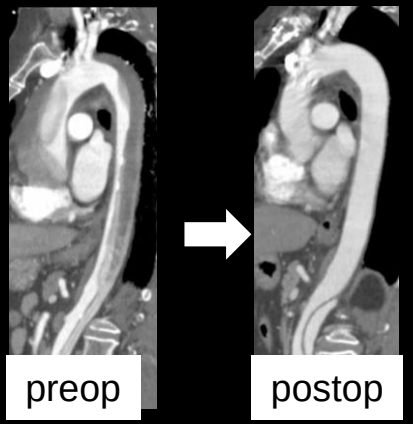
3. tear at descending thoracic aorta



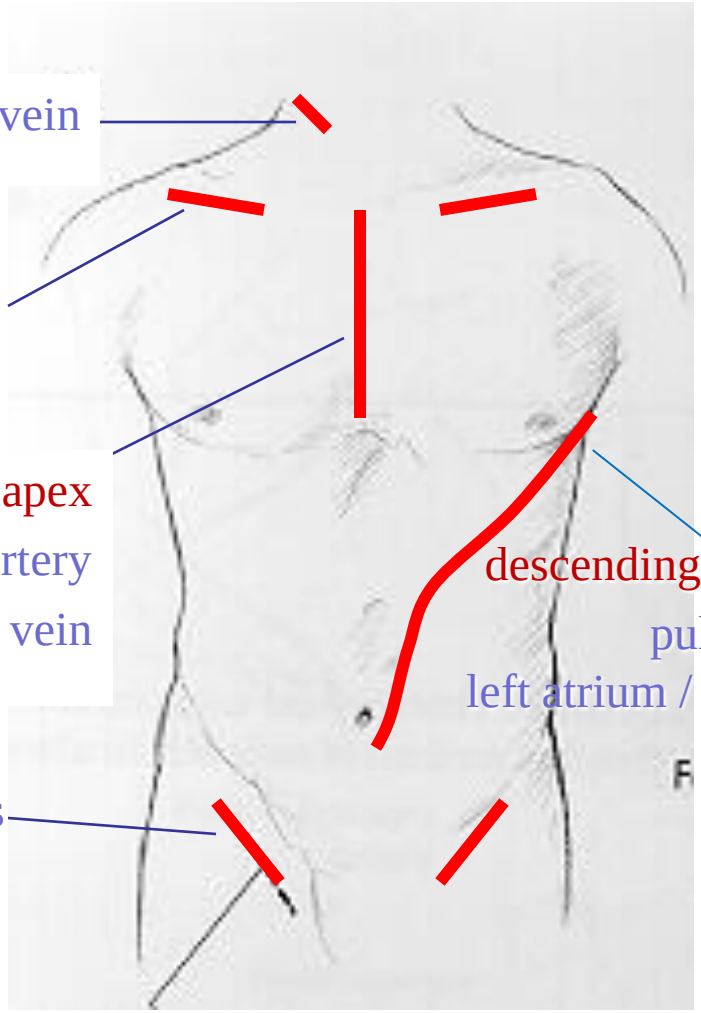
4. primary tear at far distal aorta
(retrograde type A dissection)

5. re-entry tear at far distal aorta





Access for cannulation



internal jugular vein

axillary artery

ascending aorta / innominate artery / LV apex

right atrium / venae cavae / pulmonary artery

left atrium / pulmonary vein

descending aorta / LV apex

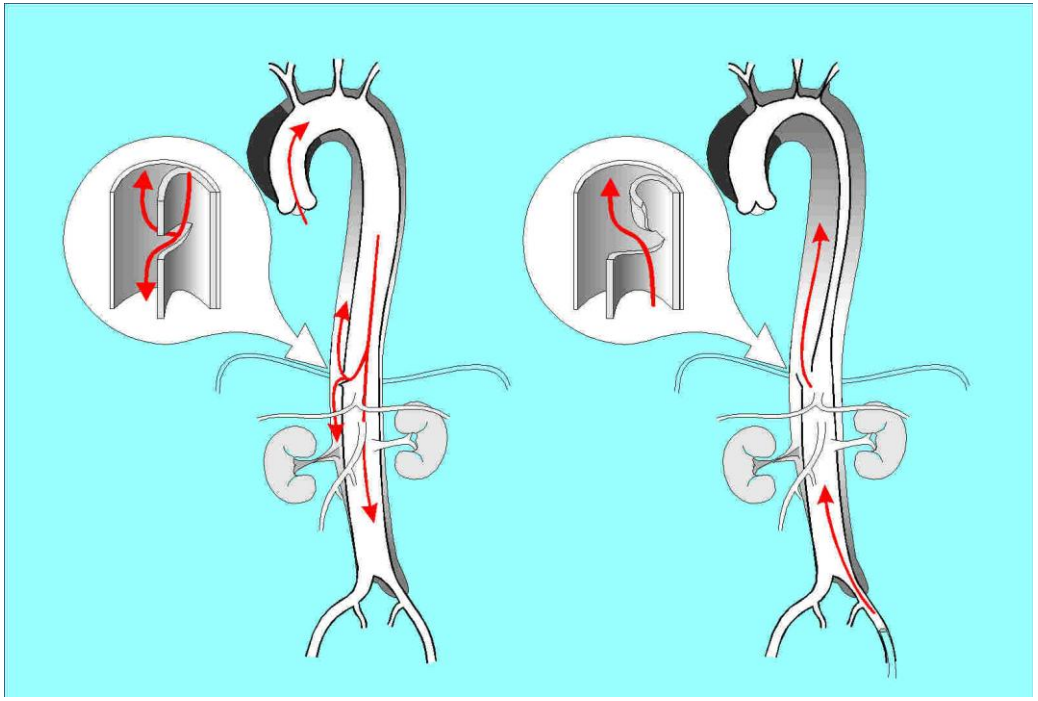
pulmonary artery /

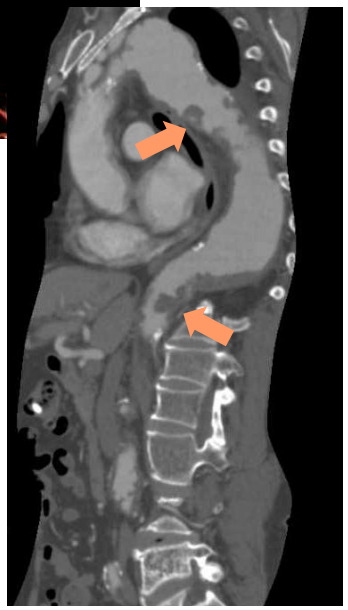
left atrium / pulmonary vein

femoral arteries & veins

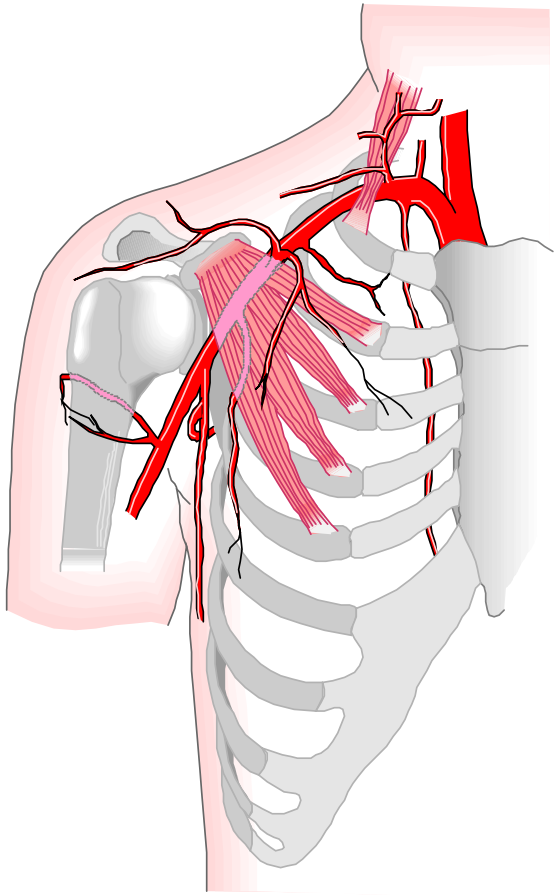
Problems of femoral artery cannulation

- Malperfusion in dissection
- Embolism of atheroma from the aorta
- Impossible, if iliofemoral occlusion/stenosis is present.





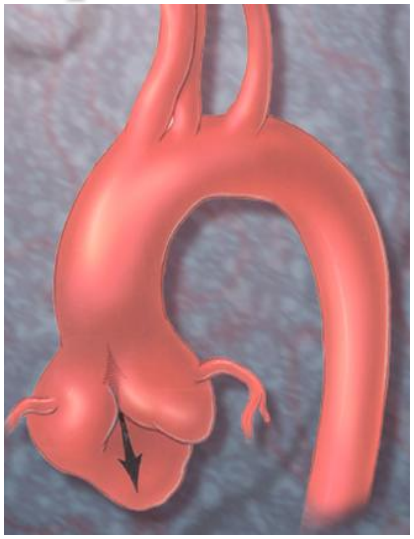
Right axillary artery cannulation

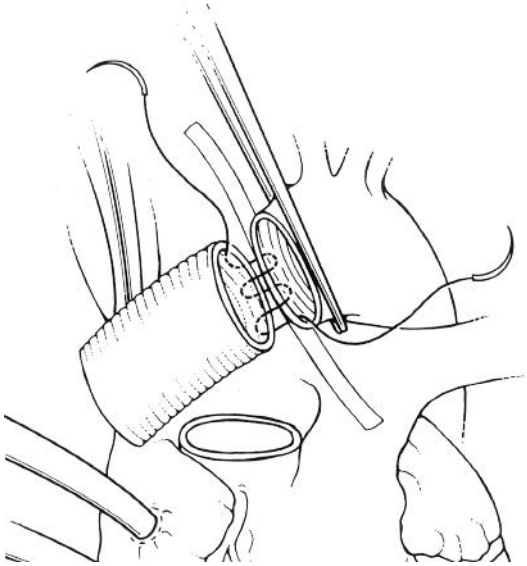


- Rarely involved by atherosclerosis / dissection
- Detour aortic atherosclerosis
  → much less risk of cerebral embolism
- Enables & simplifies selective cerebral perfusion

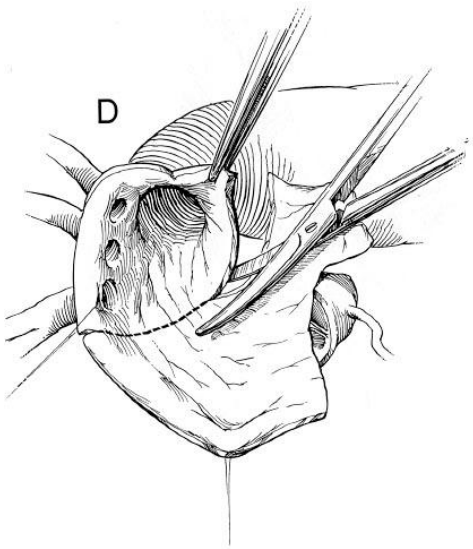
- Time for exposure
- Anatomic variation
- Nerve injury – brachial plexus
- Lower body perfusion ↓ / cerebral blood flow ↑ (?)
  - in case of small axillary/subclavian/innominate a.

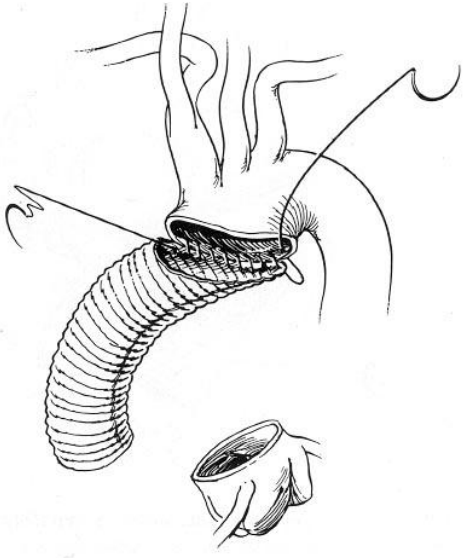
Anastomosis under clamp

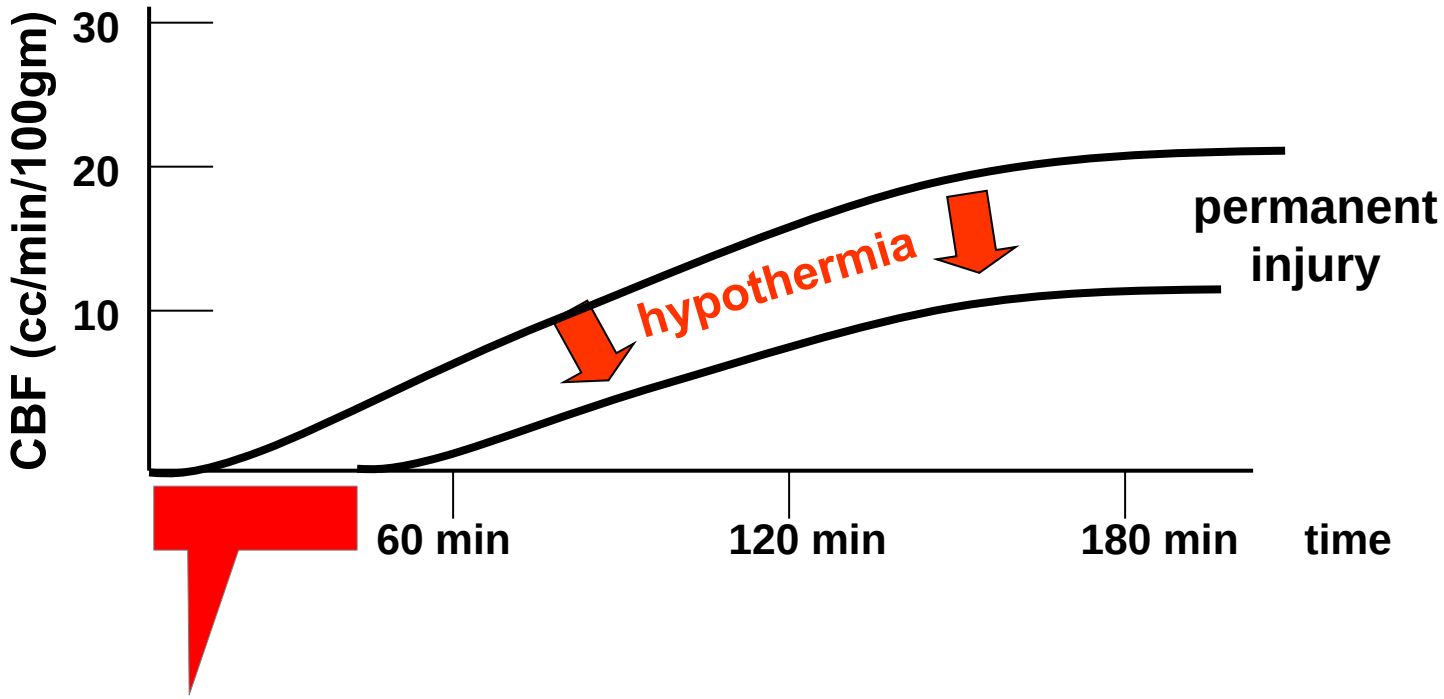




Open technique







40 ~ 50 minutes at brain temperature of 10 ~ 15 ºC

20 ~ 30 minutes at 20 ºC

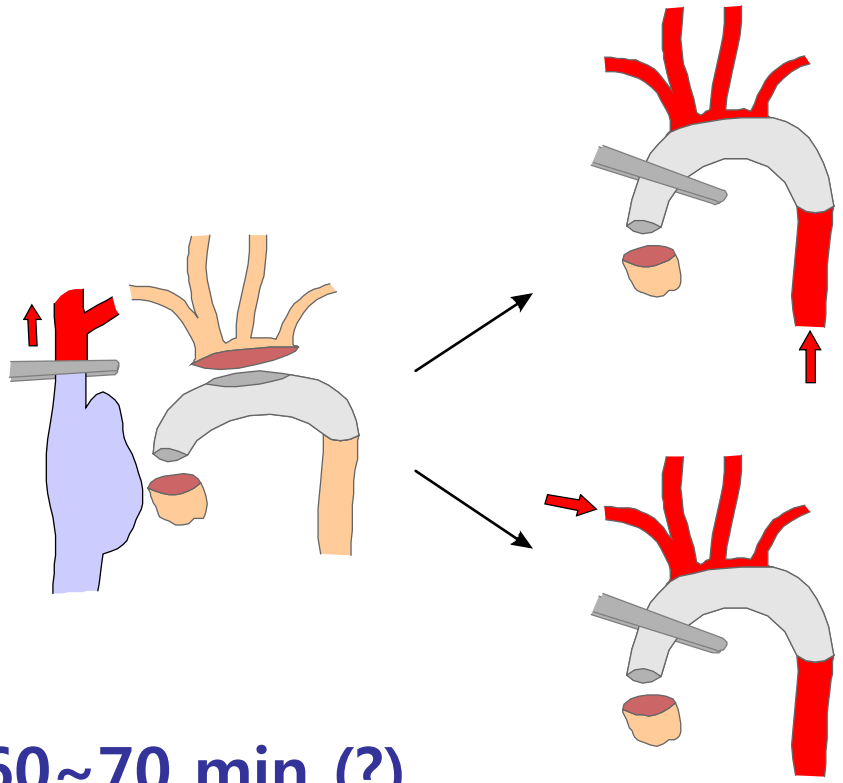
10 ~ 20 minutes at 25°C

5 ~ 10 minutes at 28°C

Conventional technique for cerebral protection

- hypothermic circulatory arrest ± retrograde cerebral perfusion (RCP) -

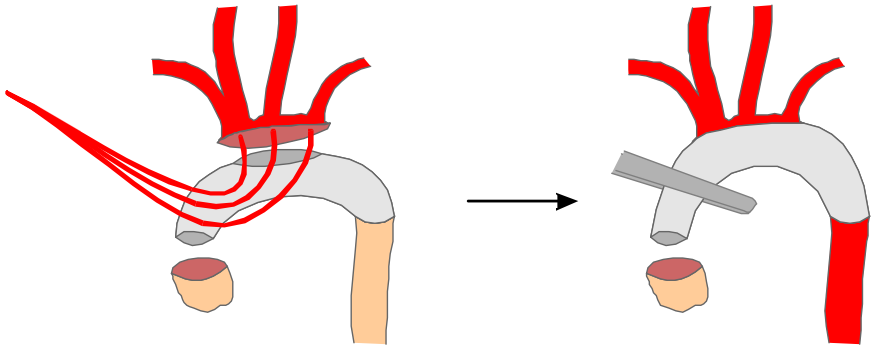
100~300ml/min
CVP ≤ 20~25mmHg

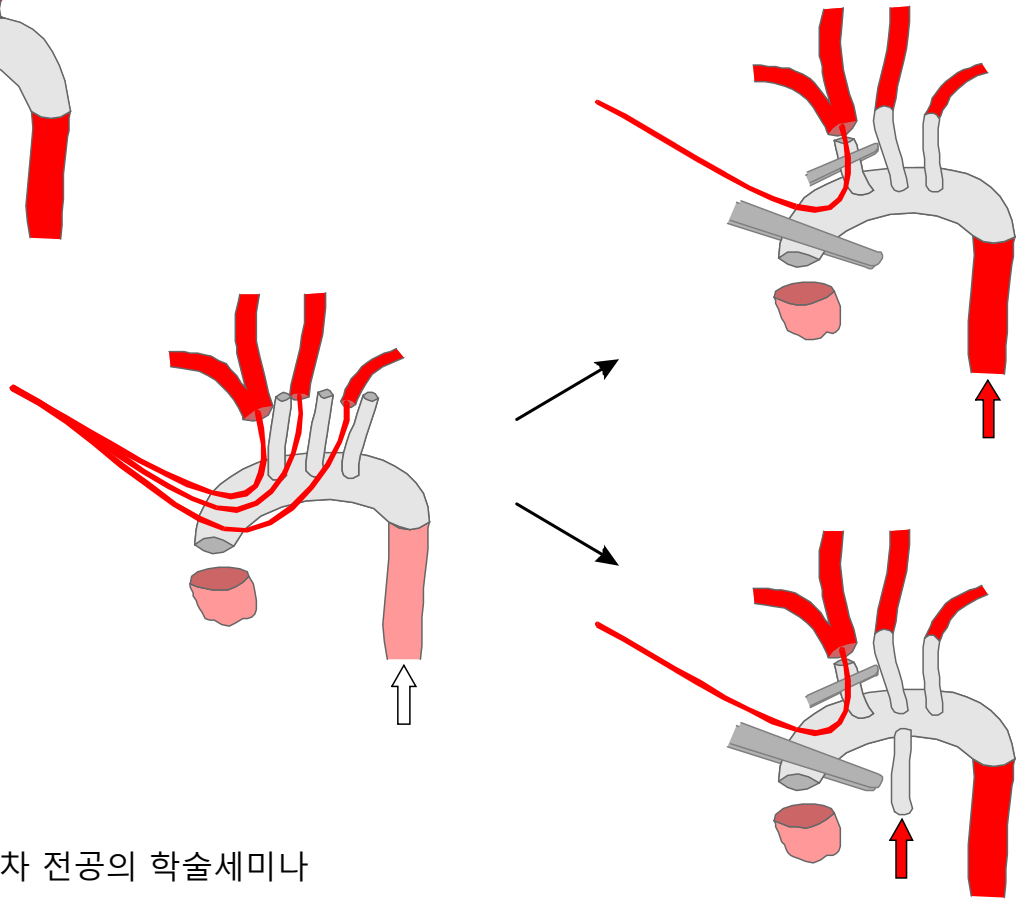


- **40~50 min →→ 60~70 min (?)**
- **Back-flushing of air, debris, harmful metabolites**

- **Brain edema**
- **Fluid overload**

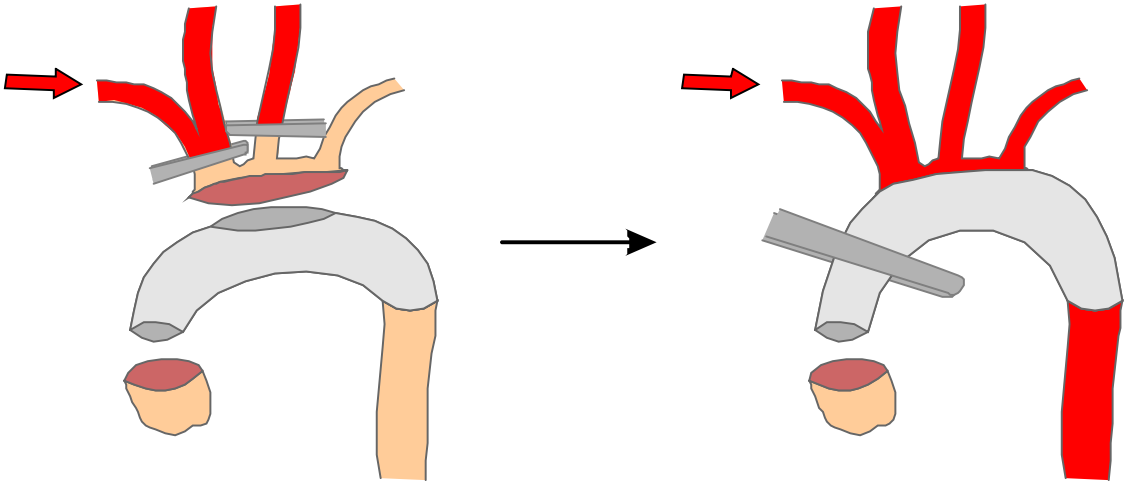
Selective antegrade cerebral perfusion
(SACP, ACP)



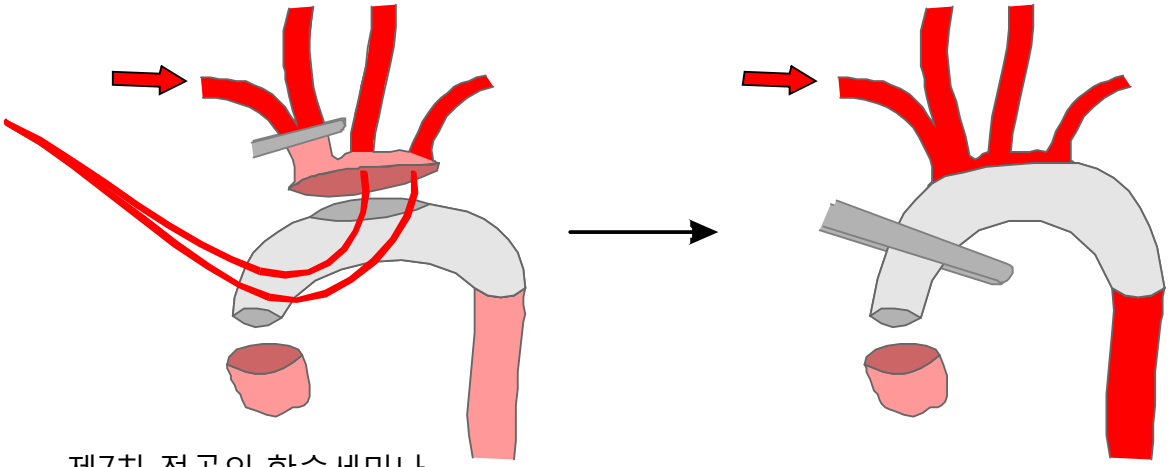


5~10ml/kg/min
Pressure 50~60mmHg

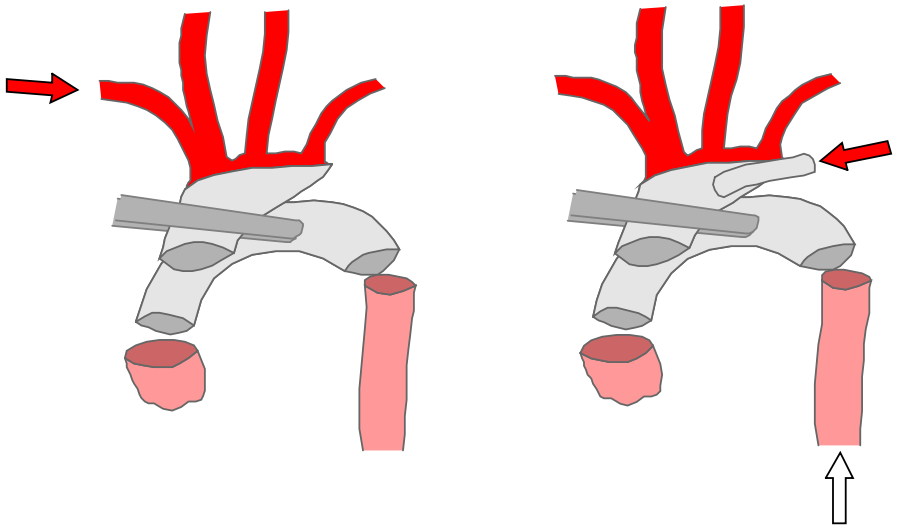
ACP using right axillary artery



Anatomy
Back-flow
Brain oximetry

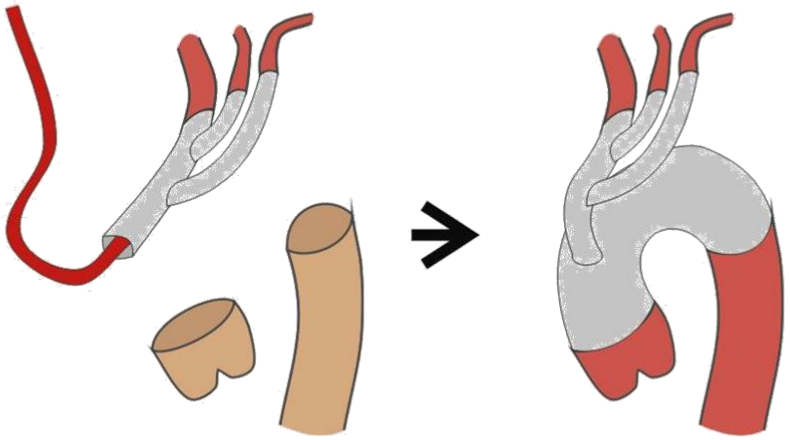


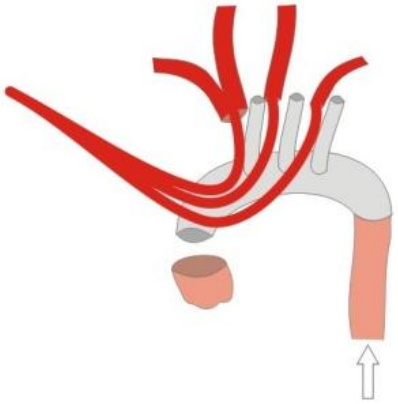
Shortening of brain ischemia
- arch-first technique -



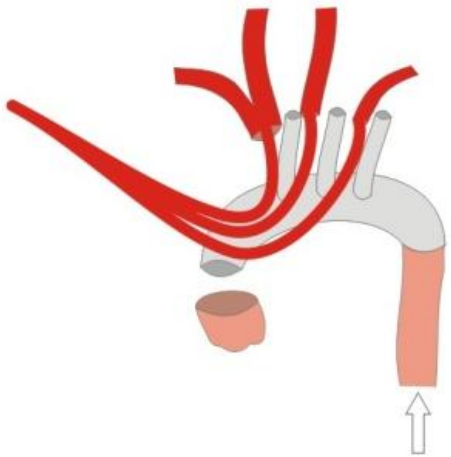
- less crowded field during distal anastomosis
- no need of clamping or ballooning of arch branches

- Need of additional anastom (graft-to-graft)



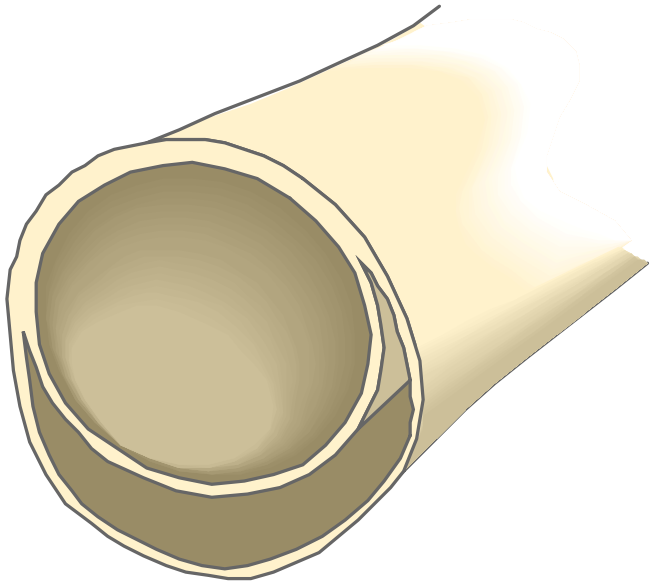


Options in selective cerebral perfusion



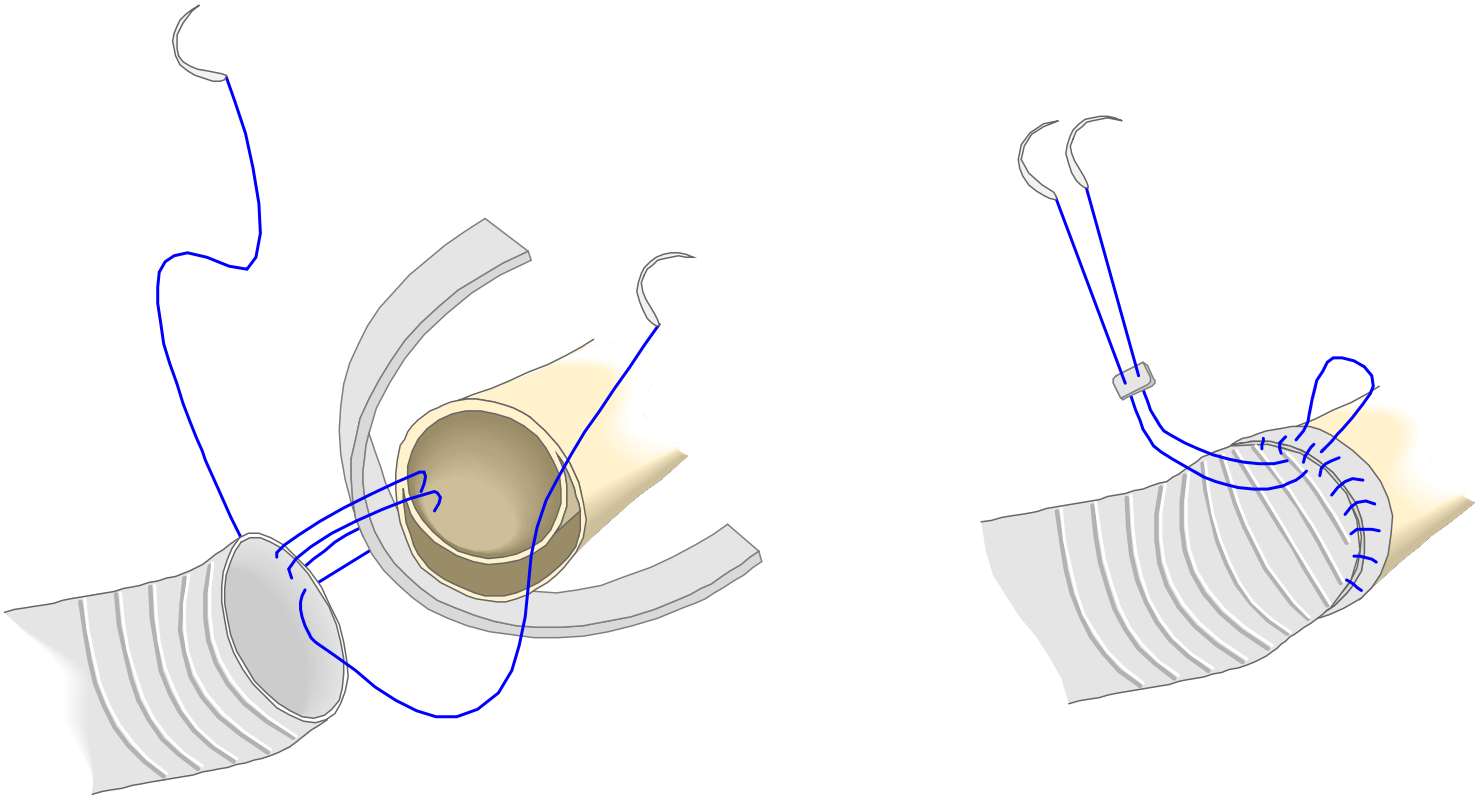
- Routine for ascending / hemiarch replacement
  vs. only for total arch replacement
- Deep vs. moderate / mild hypothermia (25~30°C)
- Unilateral vs. bilateral perfusion
- Temporary vs. continuous selective perfusion

Anastomosis & stump re-enforcement

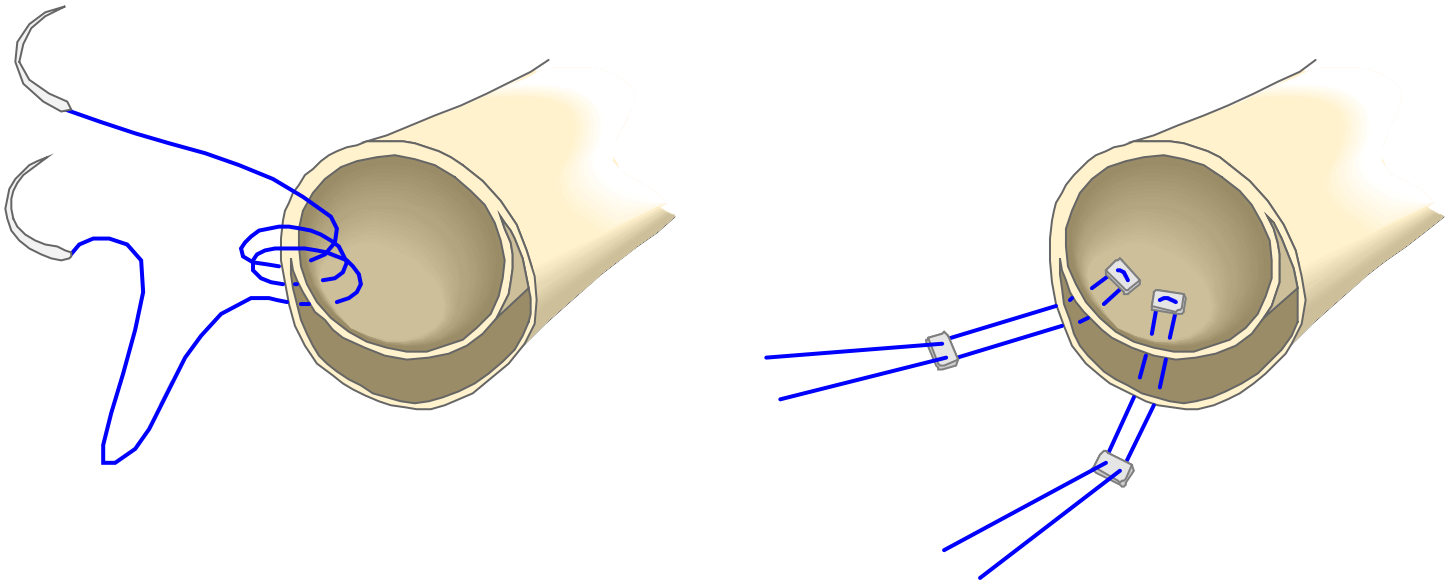


- Hemostasis
- Prevention of pseudoaneurysm
- Obliteration of adjacent false lumen

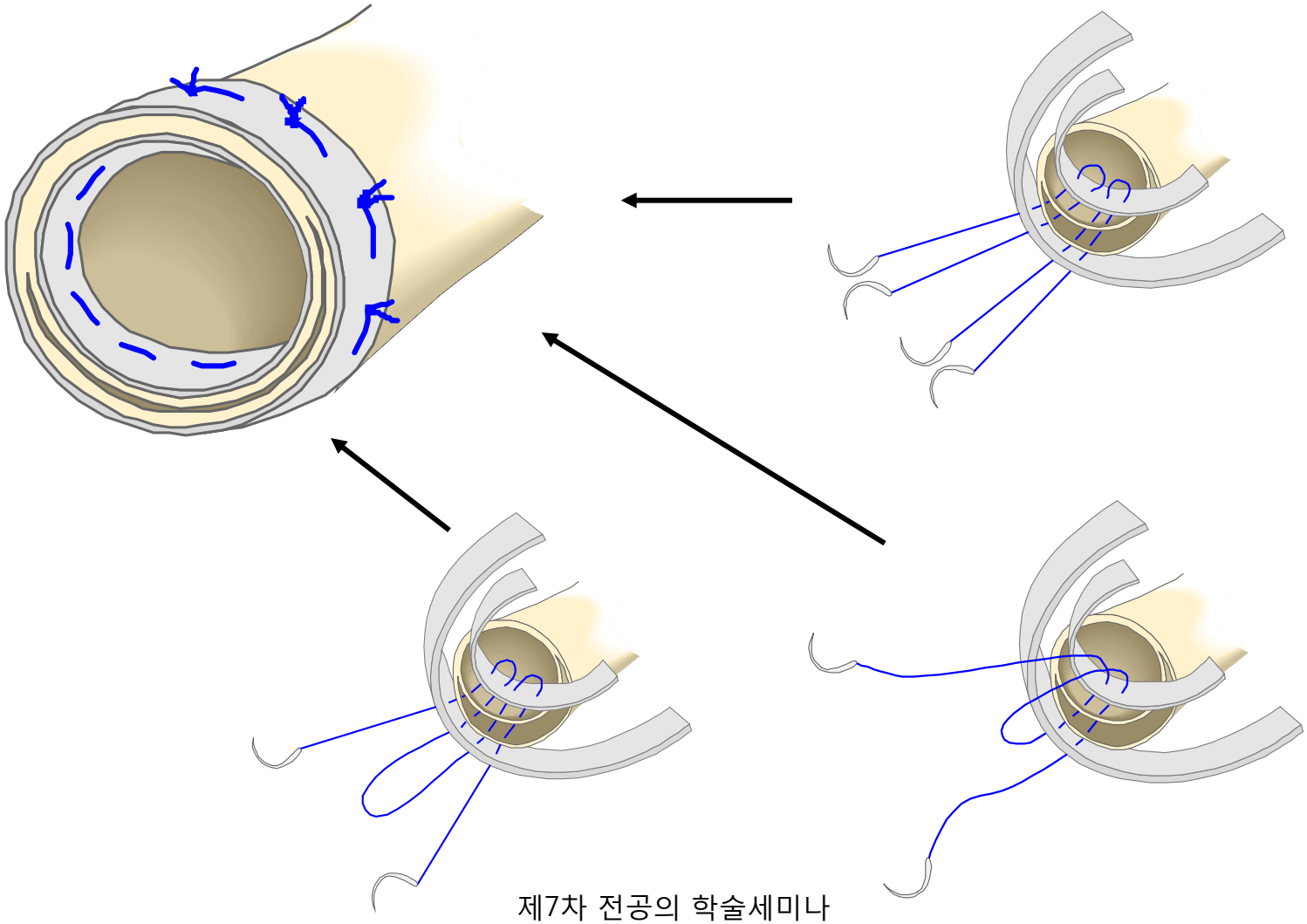
nothing or outside felt only
→ multiple re-enforcement



Simple re-attachment with suture

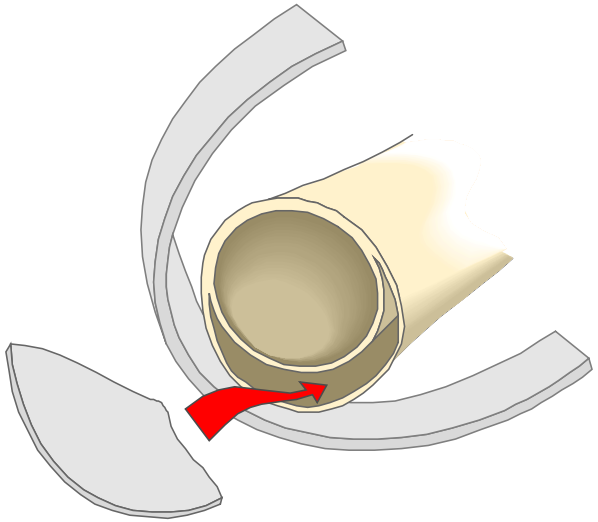


Sandwich

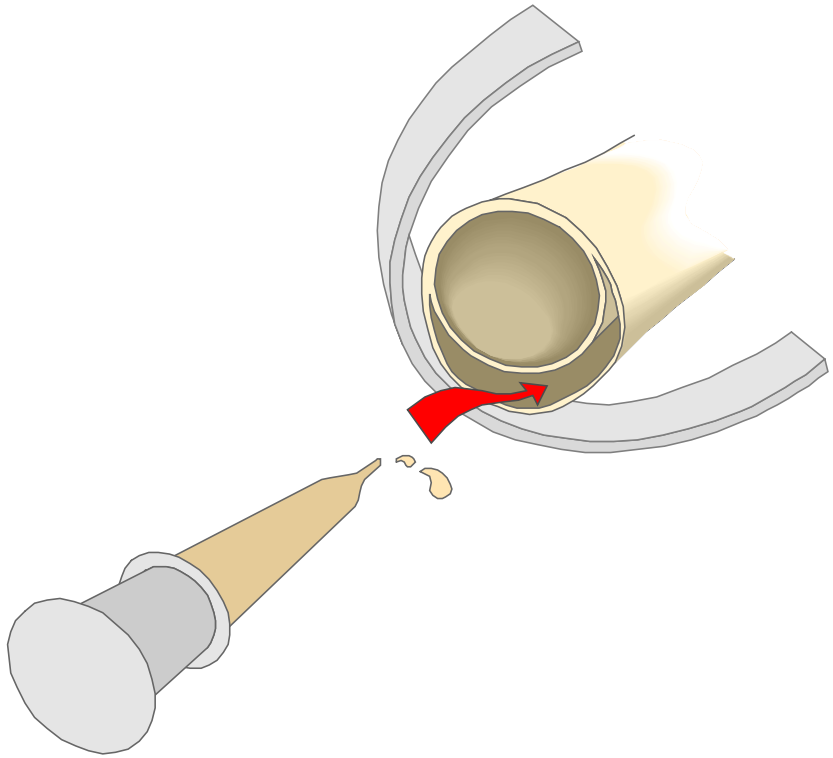


Neo-media

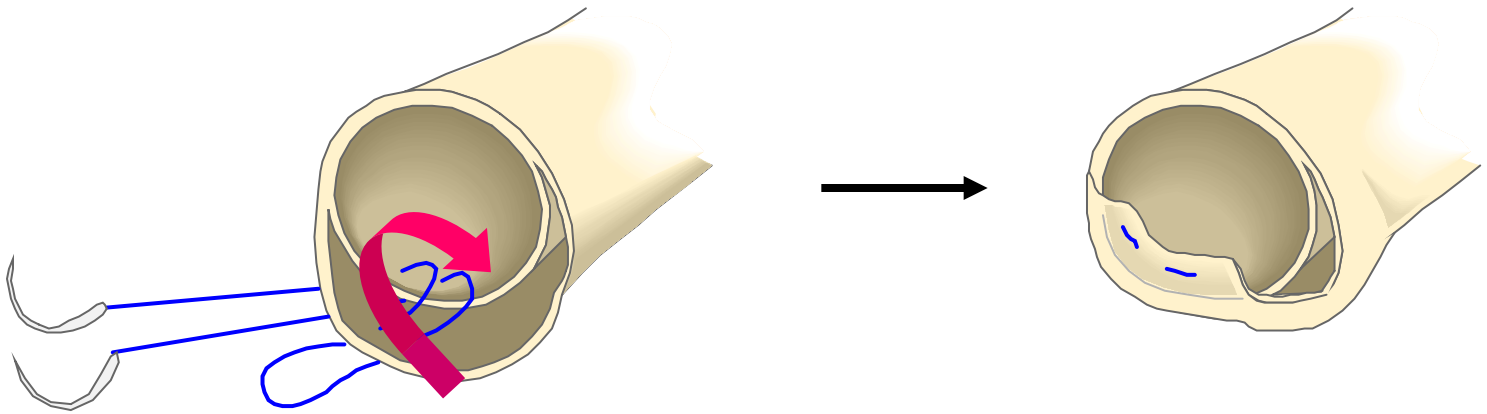
Teflon felt patch



glue



Adventitial inversion



Controversies regarding IMH

- Is the prognosis as bad as that of the overt dissection?

- Is it really a "dissection without intimal tear"

  caused by rupture vasa vasorum,

  or a "thrombosed dissection without a visible tear"?

Different Clinical Features of Aortic Intramural Hematoma Versus Dissection Involving the Ascending Aorta

Jae-Kwan Song, MD, FACC,* Hyun-Sook Kim, MD,* Duk-Hyun Kang, MD,* Tae-Hwan Lim, MD,†

the mortality rate with medical treatment was much lower in patients with AIH than it was in patients with AD (6% vs. 58%, p = 0.003). In follow-up imaging studies of 13 patients who survived AIH without surgical repair, seven patients showed complete resolution. Typical AD developed in three patients, and the other three patients showed focal AD only in the descending aorta. The two-year survival rate did not show significant difference (84% ± 6% in AIH vs. 76% ± 17% in AD, p = 0.47).

CONCLUSIONS Absence of continuous flow communication can explain a more favorable clinical course of AIH than for AD, and medical treatment with frequent imaging follow-up and timed elective surgery in cases with complications can be a rational option for patients with proximal AIH.
(J Am Coll Cardiol 2001;37:1604–10)

Acute Aortic Intramural Hematoma

An Analysis From the International Registry of Acute Aortic Dissection

Kevin M. Harris, MD; Alan C. Braverman, MD; Kim A. Eagle, MD; Elise M. Woznicki, BS;

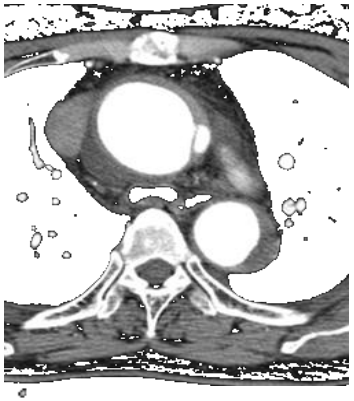
in-hospital mortality was not statistically different for type A IMH compared to AD (26.6% versus 26.5%; P=0.998); type A IMH managed medically had significant mortality (40.0%), although less than classic AD (61.8%; P=0.195). Patients with type B IMH had a hospital mortality that was less but did not differ significantly (4.4% versus 11.1%; P=0.062) from classic AD. One-year mortality was not significantly different between AD and IMH.

Conclusions—Acute IMH has similar presentation to classic AD but is more frequently complicated with pericardial effusions and periaortic hematoma. Patients with IMH have a mortality that does not differ statistically from those with classic AD. A small subgroup of type A IMH patients are managed medically and have a significant in-hospital mortality. (***Circulation*. 2012;126[suppl 1]:S91–S96.**)

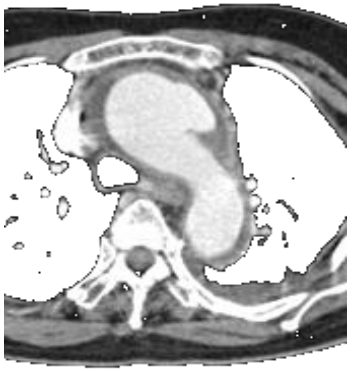
Prevalence of Aortic Intimal Defect in Surgically Treated Acute Type A Intramural Hematoma

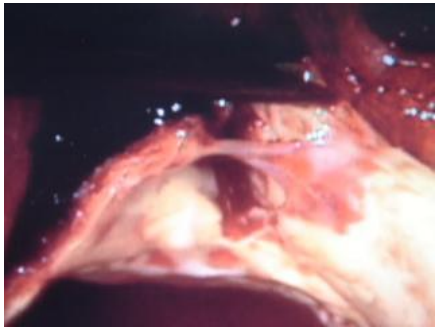
Kay-Hyun Park, MD, PhD, Cheong Lim, MD, PhD, Jin Ho Choi, MD, Kiick Sung, MD, Kwhanmien Kim, MD, PhD, Young Tak Lee, MD, PhD, and Pyo Won Park, MD, PhD

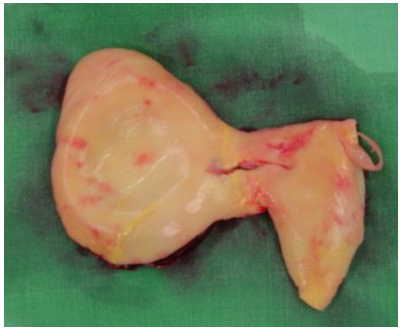
Department of Thoracic and Cardiovascular Surgery, Seoul National University Bundang Hospital, Gyeonggi-do, and Department of Thoracic and Cardiovascular Surgery, Sungkyunkwan University School of Medicine, Samsung Medical Center, Seoul, Korea

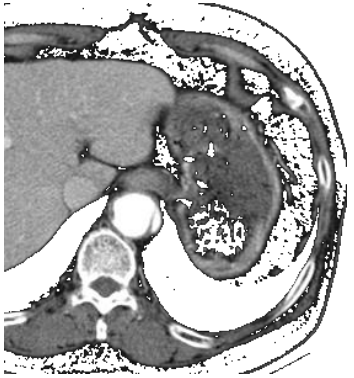


Results. In 18 patients (48.6%), intimal defects were suggested in preoperative computed tomography (CT). During surgery, 27 patients (73.0%) had small intimal defects in the ascending aorta or arch, while 14 of them (51.9%) did not have preoperative CT findings suggestive









Acute aortic syndrome

- conventional principle -

	complicated	uncomplicated
● Dissection		
■ Type A		
■ Type B		
● IMH		
■ Type A		
■ Type B		
● PAU		

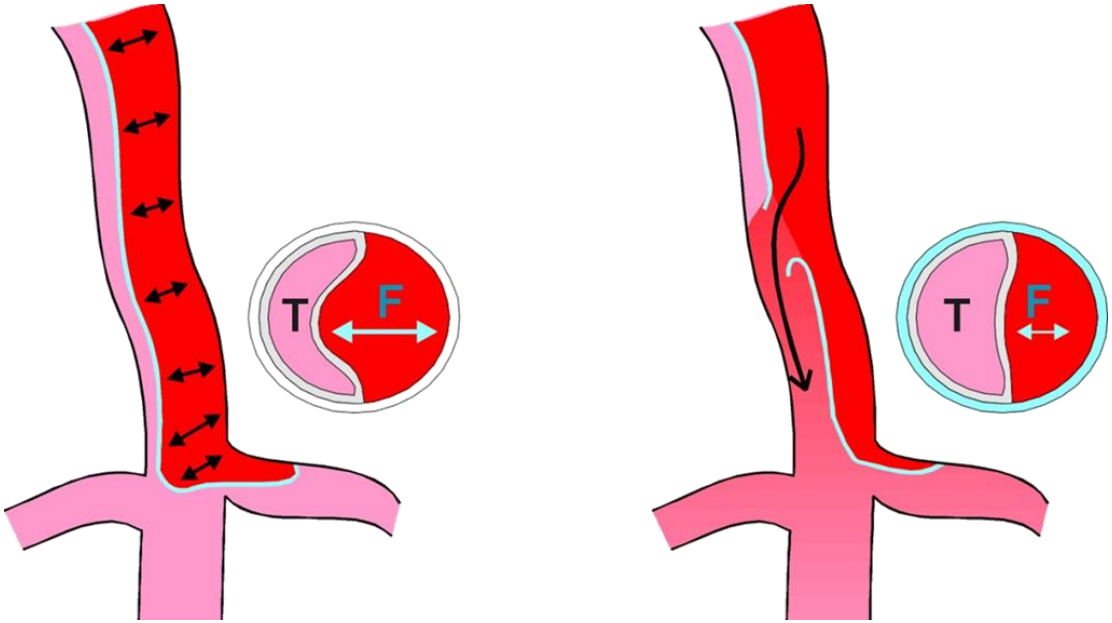
Acute aortic syndrome
- "complicated" -

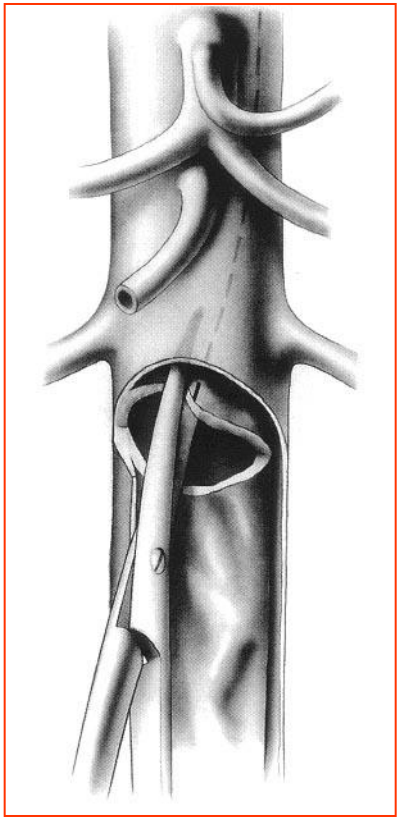
- **(Impending) rupture**
  - periaortic hematoma / sanguineous effusion
- **Branch vessel obstruction/compromise**

- Resistant hypertension
- Persistent pain

- Aortic growth ≥ 5mm within 3 months
- Total aortic diameter ≥ 40mm

Fenestration

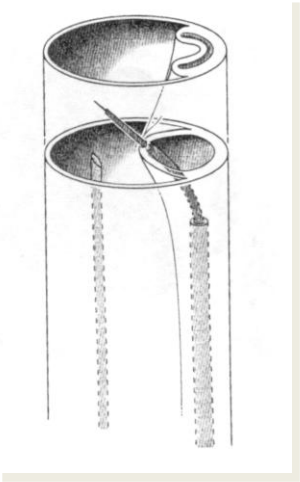


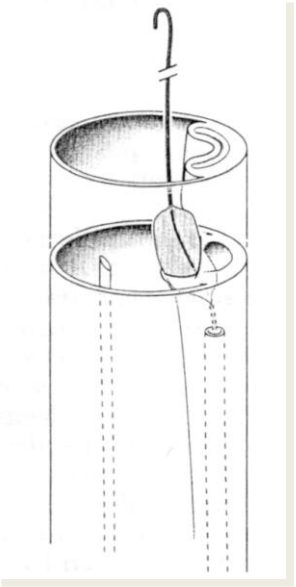


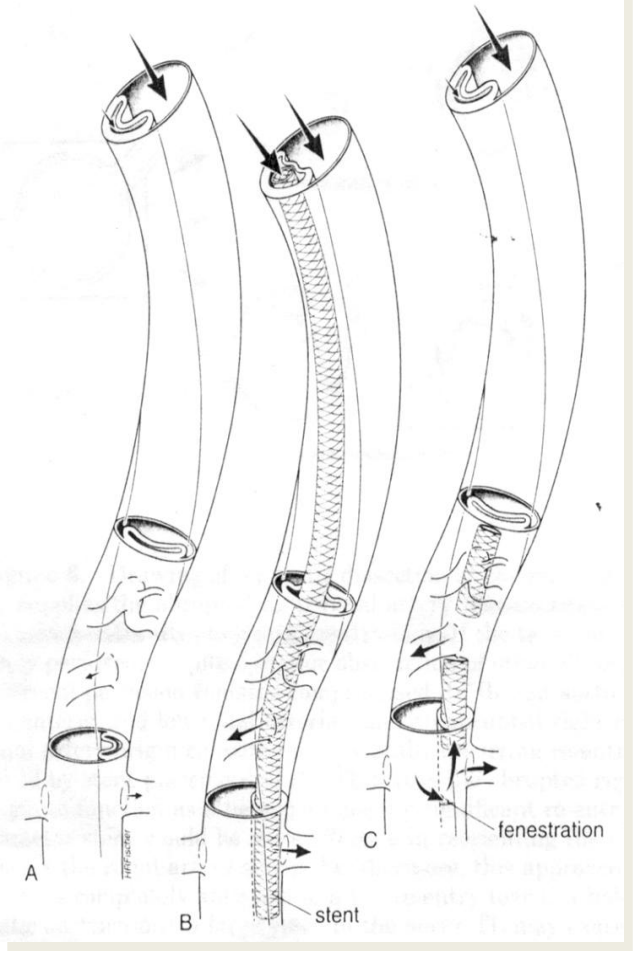
- Decompression of false lumen
  - halt distal progression of dissection
  - prevent rupture
- Re-establishment of flow to distal aorta & branches

Stenting of true lumen

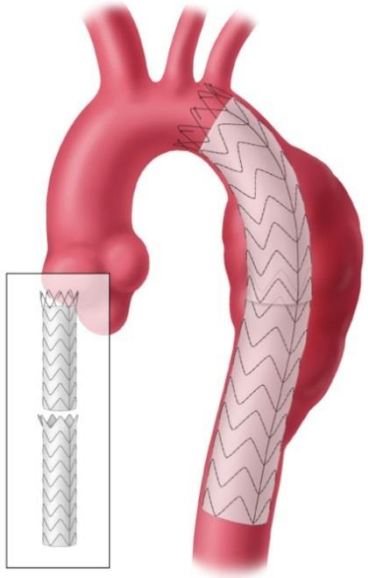
Endovascular fenestration

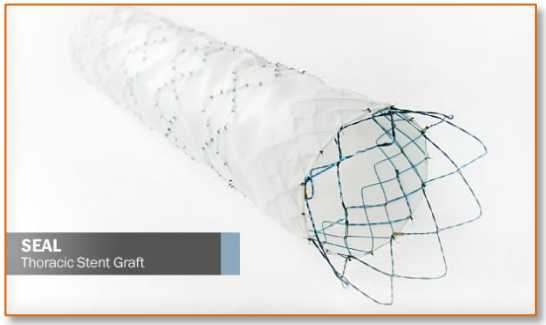






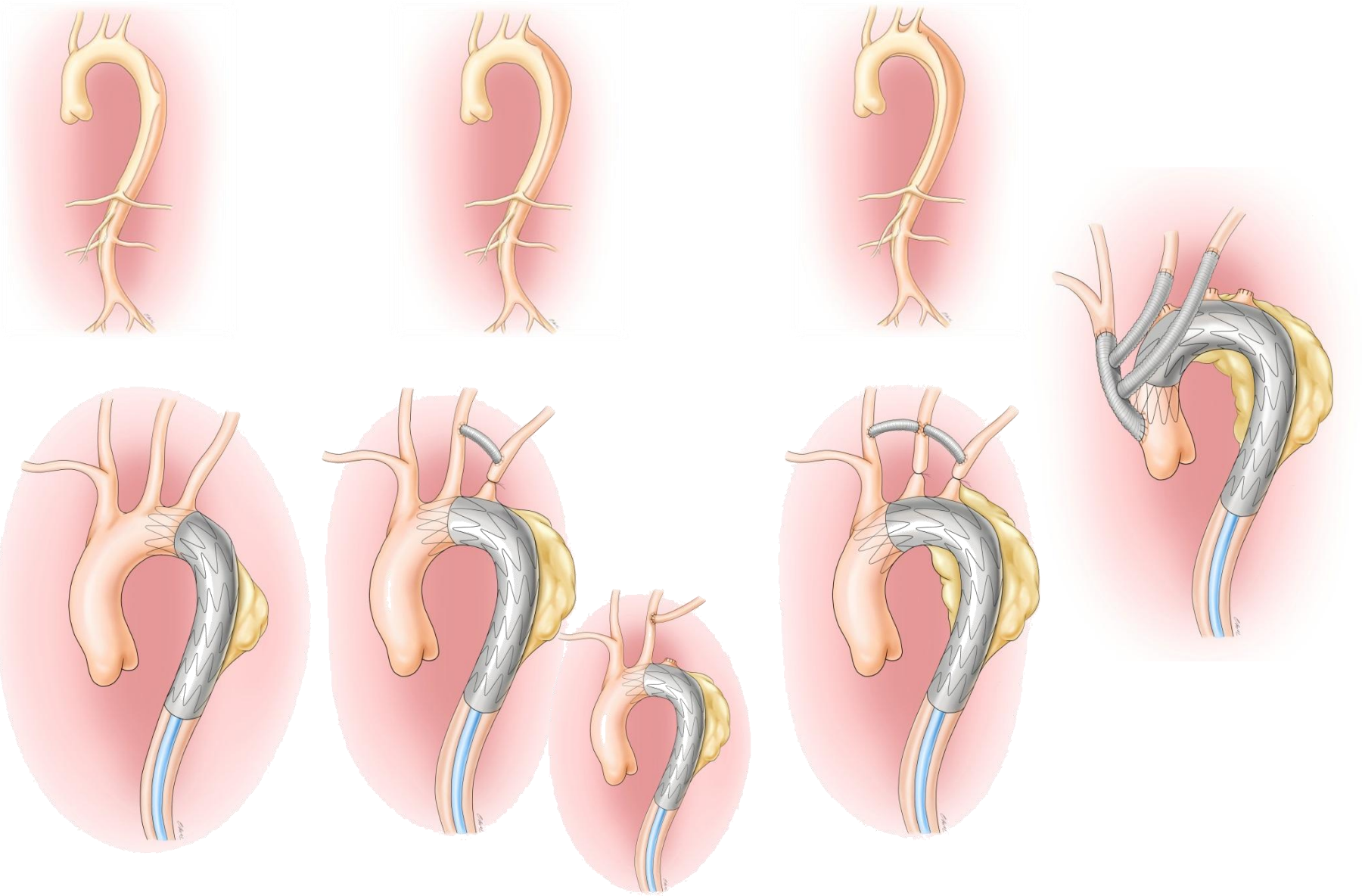
Thoracic EndoVascular Aortic Repair





제7차 전공의 학술세미나

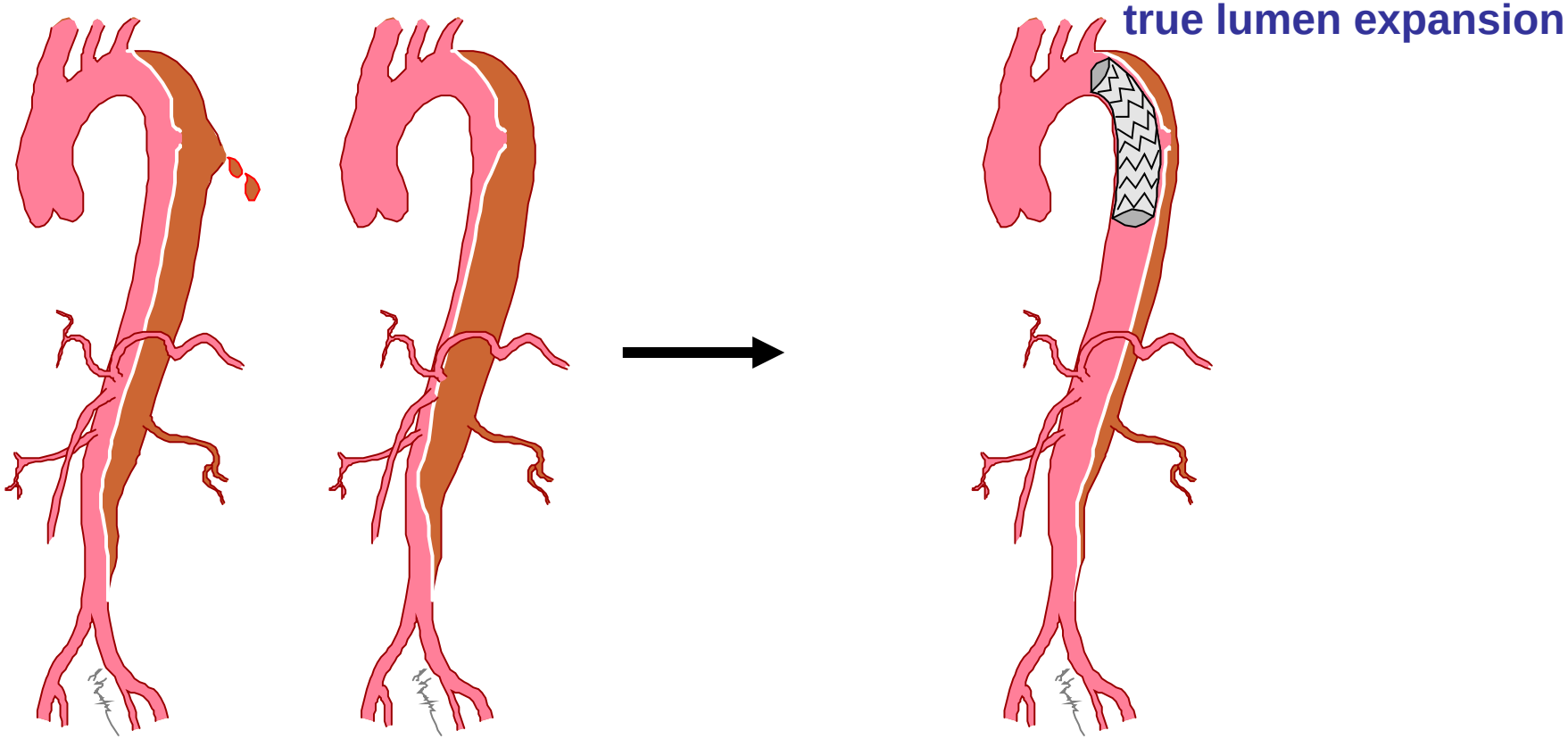
Hybrid TEVAR with arch debranching



TEVAR in type B dissection

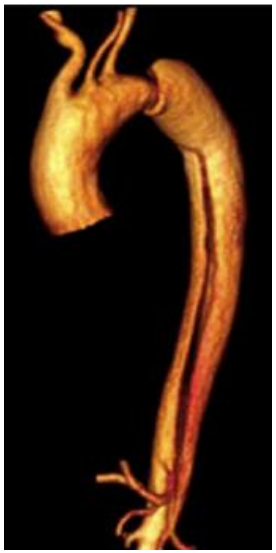
complicated **acute dissection**

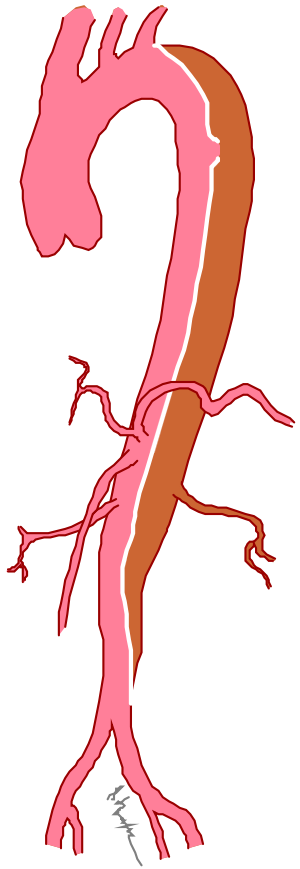
exclusion of intimal tear → **prevention of rupture & true lumen expansion**

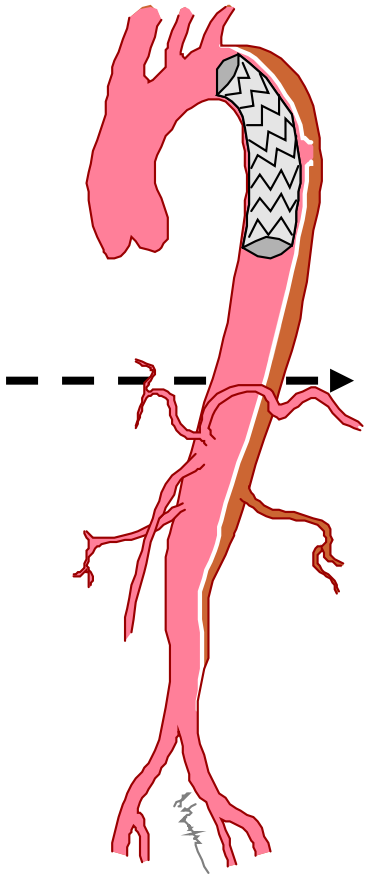


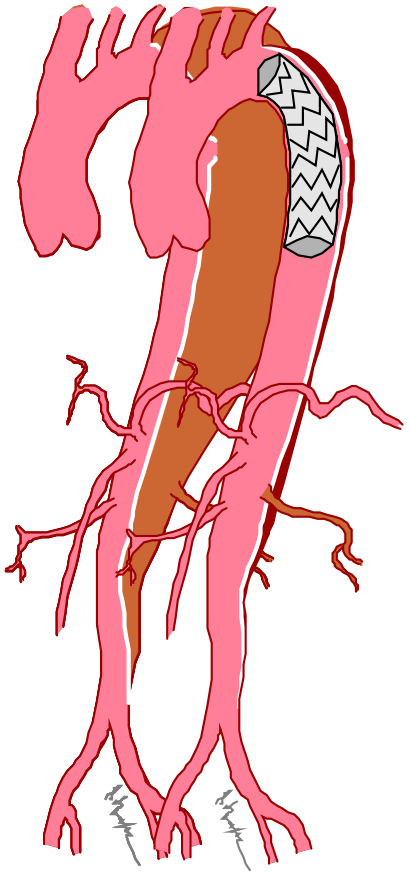
rupture *malperfusion*

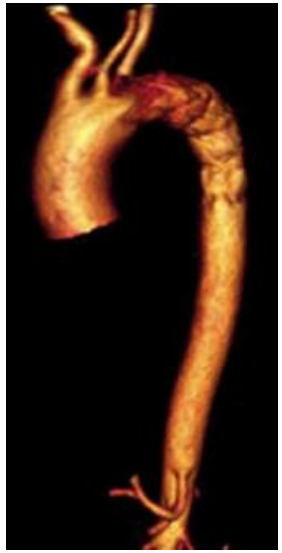
Rationale of TEVAR in uncomplicated dissection









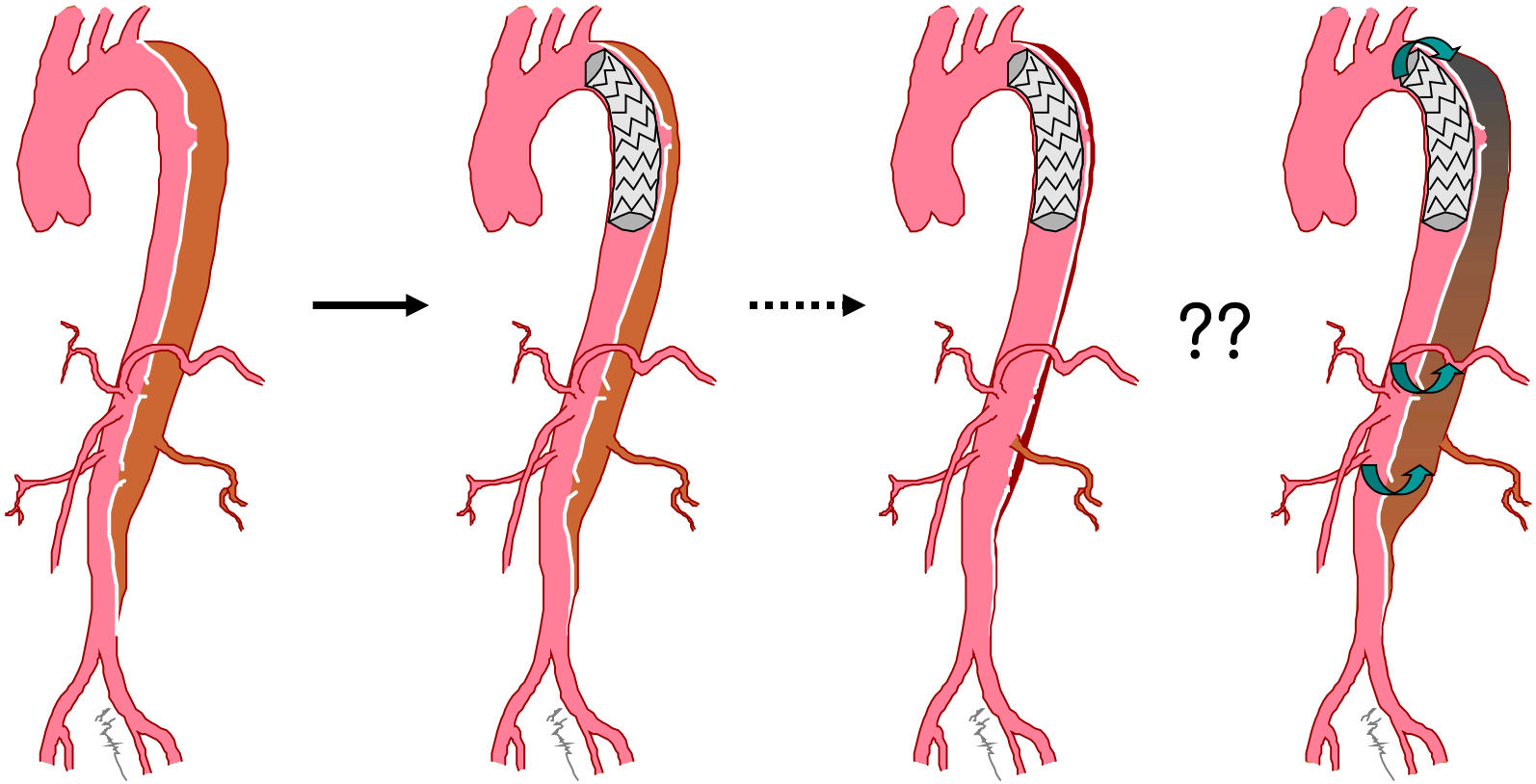


However, the reality is that

TEVAR

≤ 80% in acute
≤ 50% in chronic

Type I endoleak
Distal re-entry tears

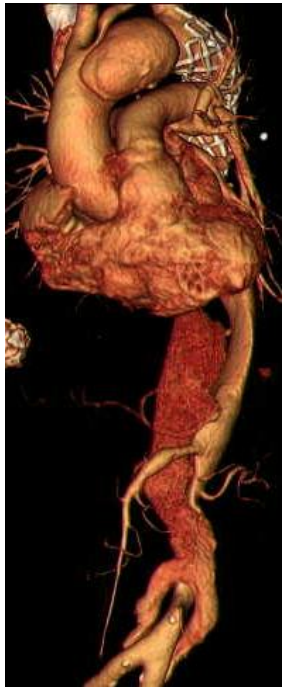


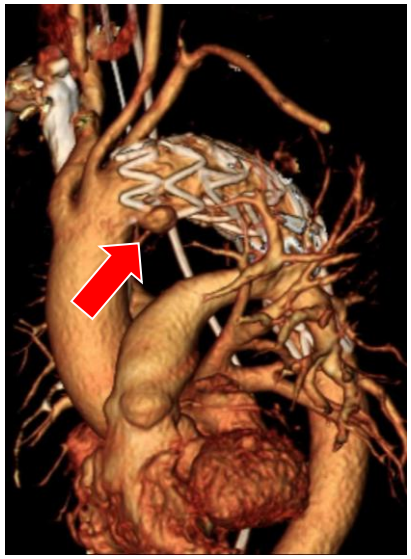
Problems/complications of TEVAR

- Mortality 1.5~6.5%
- Procedural failure 1~5%
- Conversion to open surgery up to 5%
- Retrograde type A dissection 1.9~2.5%
- Endoleak 0~45%
- Late mechanical failure (fracture/breakage/wear) up to 9%
- Renal failure 5.2~13%
- Vascular access problems
  - need of iliac conduit up to 40%
  - serious injury to iliofemoral arteries 1.4~14%
- Neurological complications
  - stroke 2.9~11%
  - paraplegia 2~5%

Post-TEVAR surgery

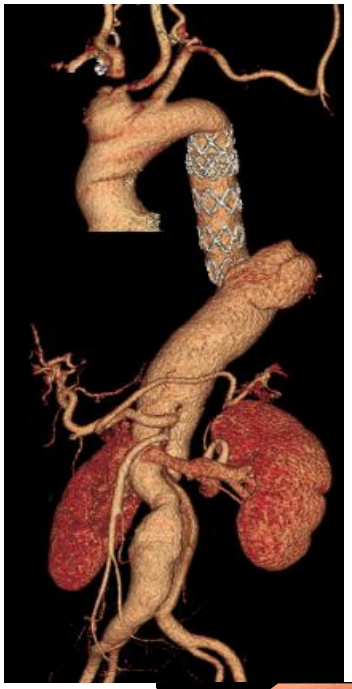
retrograde dissection



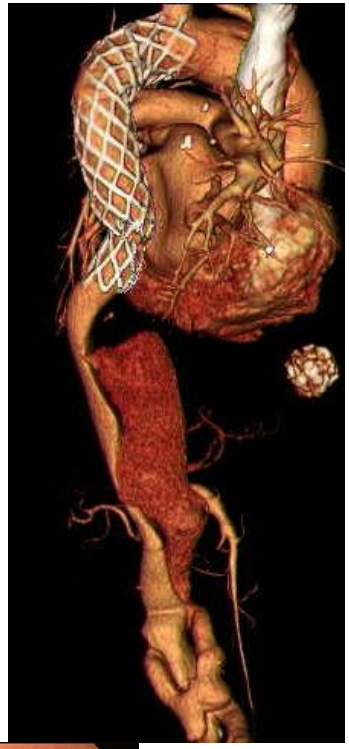


pseudoaneurysm

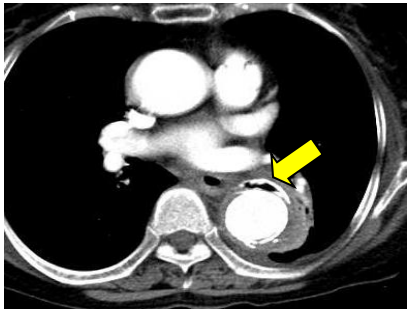
distal erosion – aneurysm / rupture

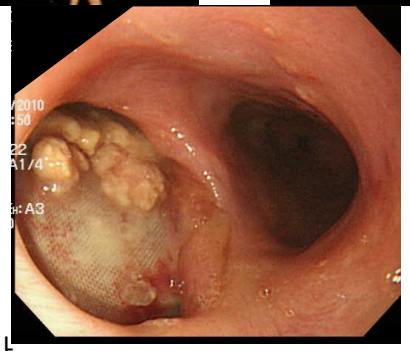


residual aneurysm



aortoesophageal fistula





Secondary surgical procedures after TEVAR

- Talent registry (*J Thorac Cardiovasc Surg 2006;132:332-9*)
  - 457 patients, freedom from 2nd procedure = 81% / 3 years, 70% / 5 years
- Talent registry (*J Thorac Cardiovasc Surg 2008;135:1322-6*)
  - 422 patients, median F/U 17 months
  - Conversion to surgery in 3.8%, hospital mortality 6.2%
- Heidelberg (*J Vasc Surg 2011*)
  - 47 patients of hybrid TEVAR (1997~2009)
  - 19% in-hospital mortality, 27.6% 2nd procedure, 6.3% open conversion
- U Penn (*J Thorac Cardiovasc Surg 2013;145:S165-70*)
  - 680 TEVAR (2000~2011) → 60 2nd TEVAR + 20 surgery
  - 8.7% 30-day mortality
- Kobe (*Ann Thorac Surg 2013;95:1584-90*)
  - 147 TEVAR (2000~2011) → 10 2nd TEVAR + 9 surgery
  - 11.5% in-hospital mortality

Surgery after (T)EVAR

- 2nd procedure is not rare after TEVAR, ≥20% of them should be open surgery. In most cases, they are more challenging than primary surgery.
- Causative factors
  - *Heroic TEVAR for marginal anatomy and/or debatable indication*
  - *Procedural / early success ≠ clinical / long-lasting stabilization*

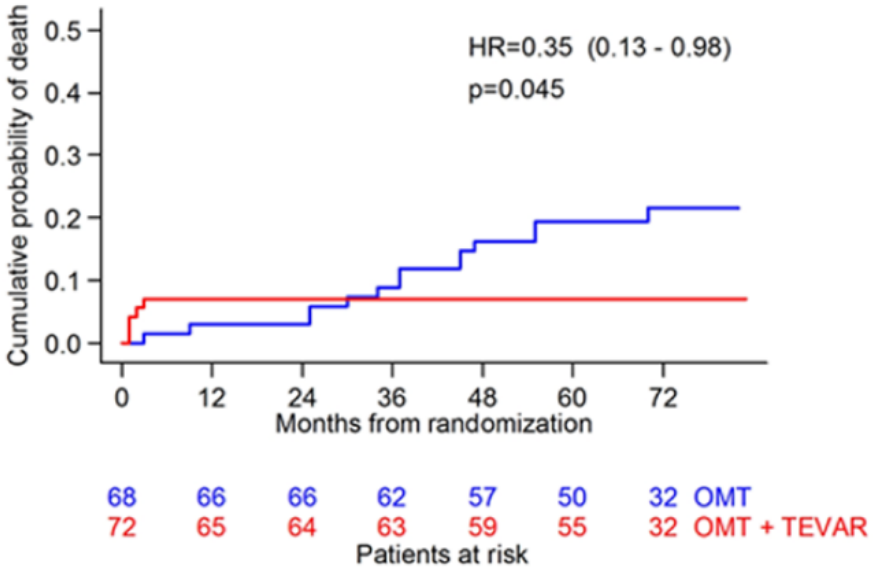
    e.g., late endoleak, adjacent aneurysm, infection, erosion (fistula)

INSTEAD trial

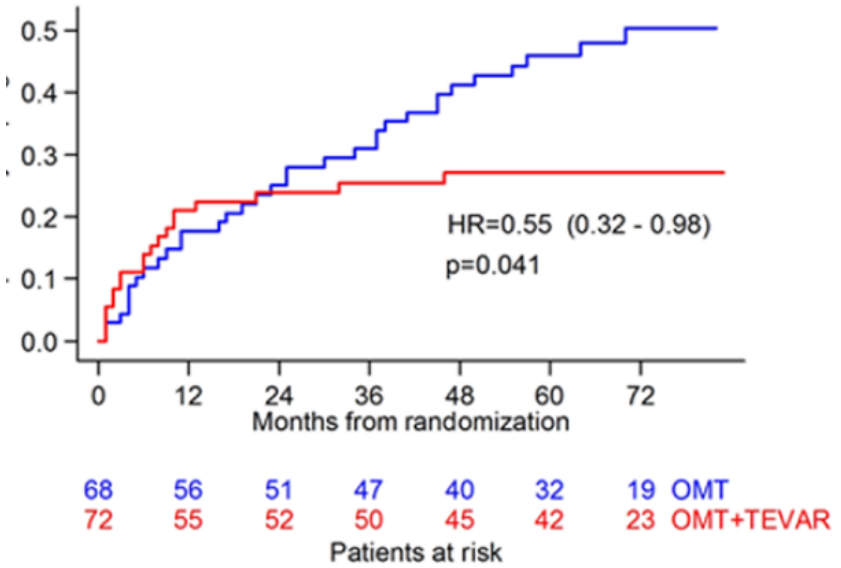
Endovascular Repair of Type B Aortic Dissection

Long-term Results of the Randomized Investigation of Stent Grafts in Aortic Dissection Trial

Aorta-specific mortality

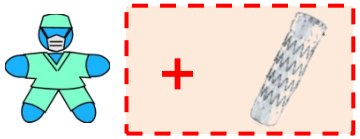
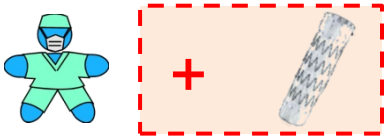
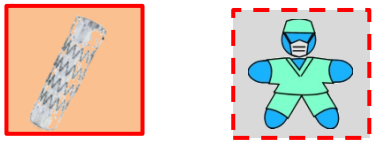
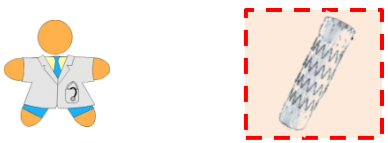
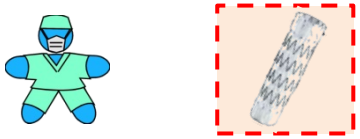
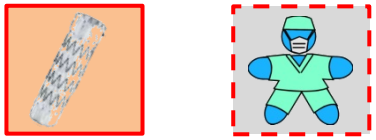


Adverse events



Acute aortic syndrome

- standard in endovascular era -

	complicated	uncomplicated
Dissection		
Type A		
Type B		
IMH		
Type A		
Type B		
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