Hybrid TEVAR FIRST
- Aortic Arch Aneurysm

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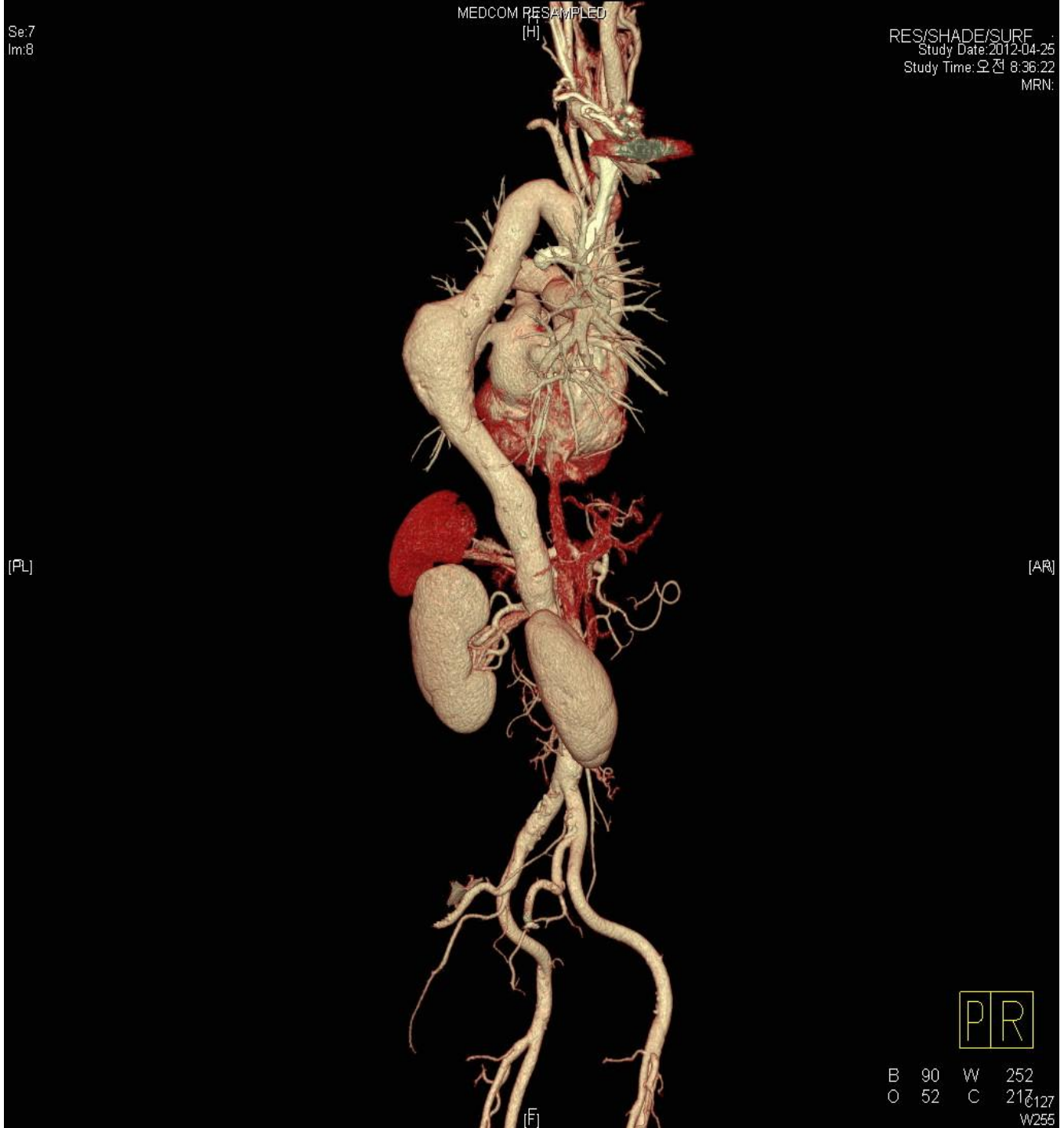
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P R
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O 52 C 217
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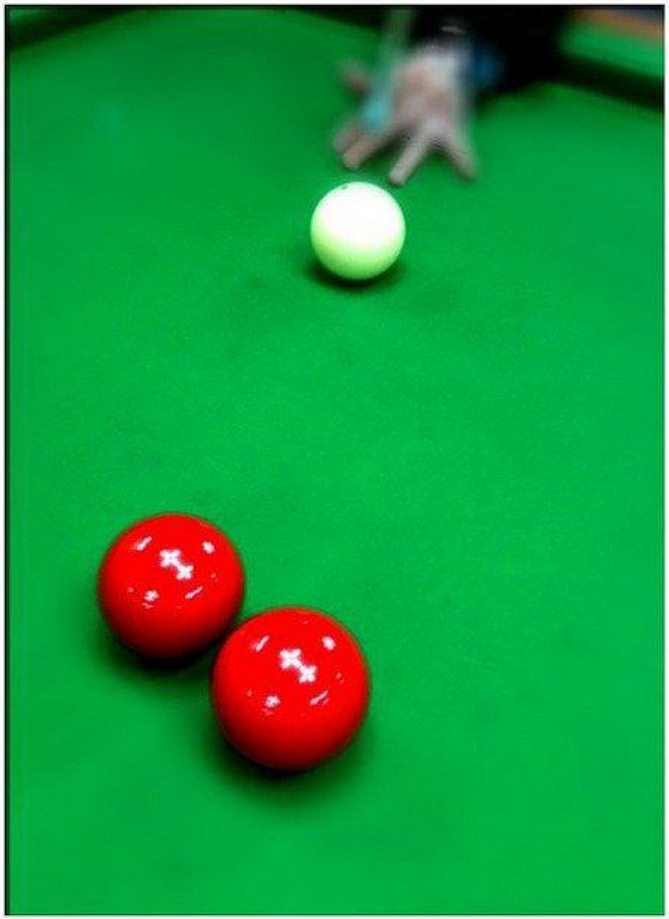
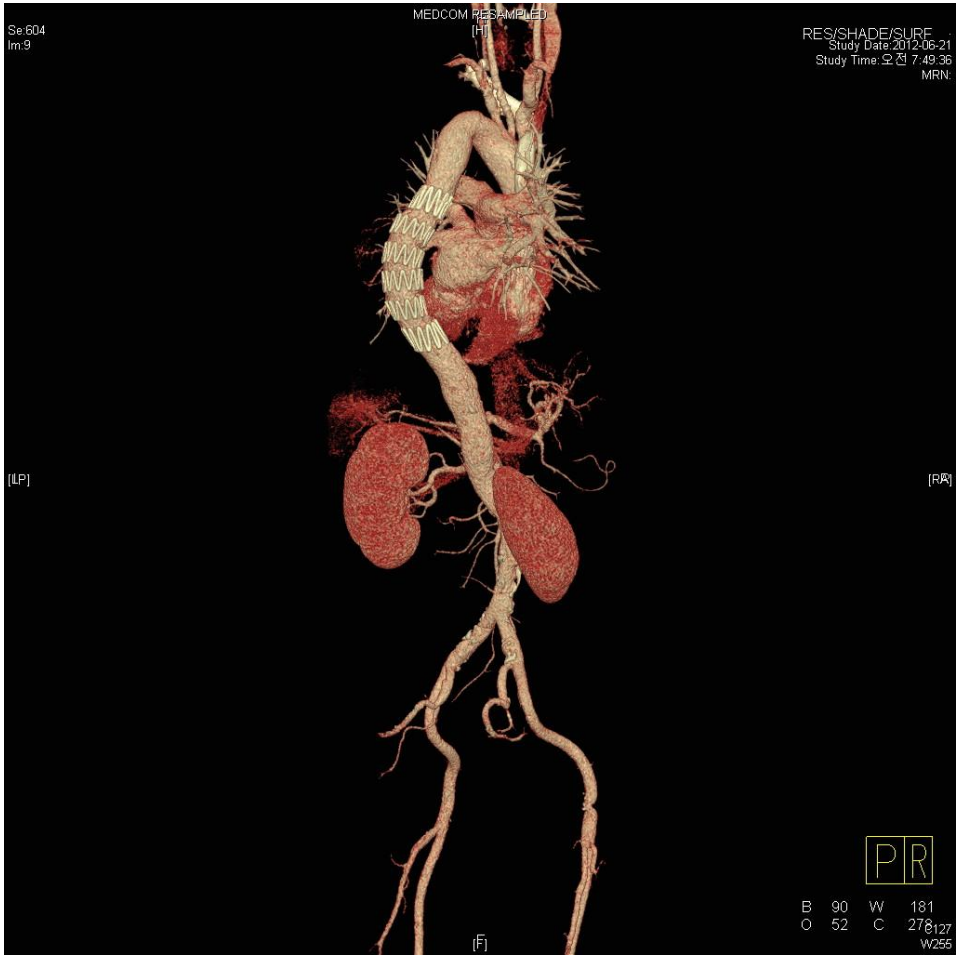
꽃다마!



Zone 4 TEVAR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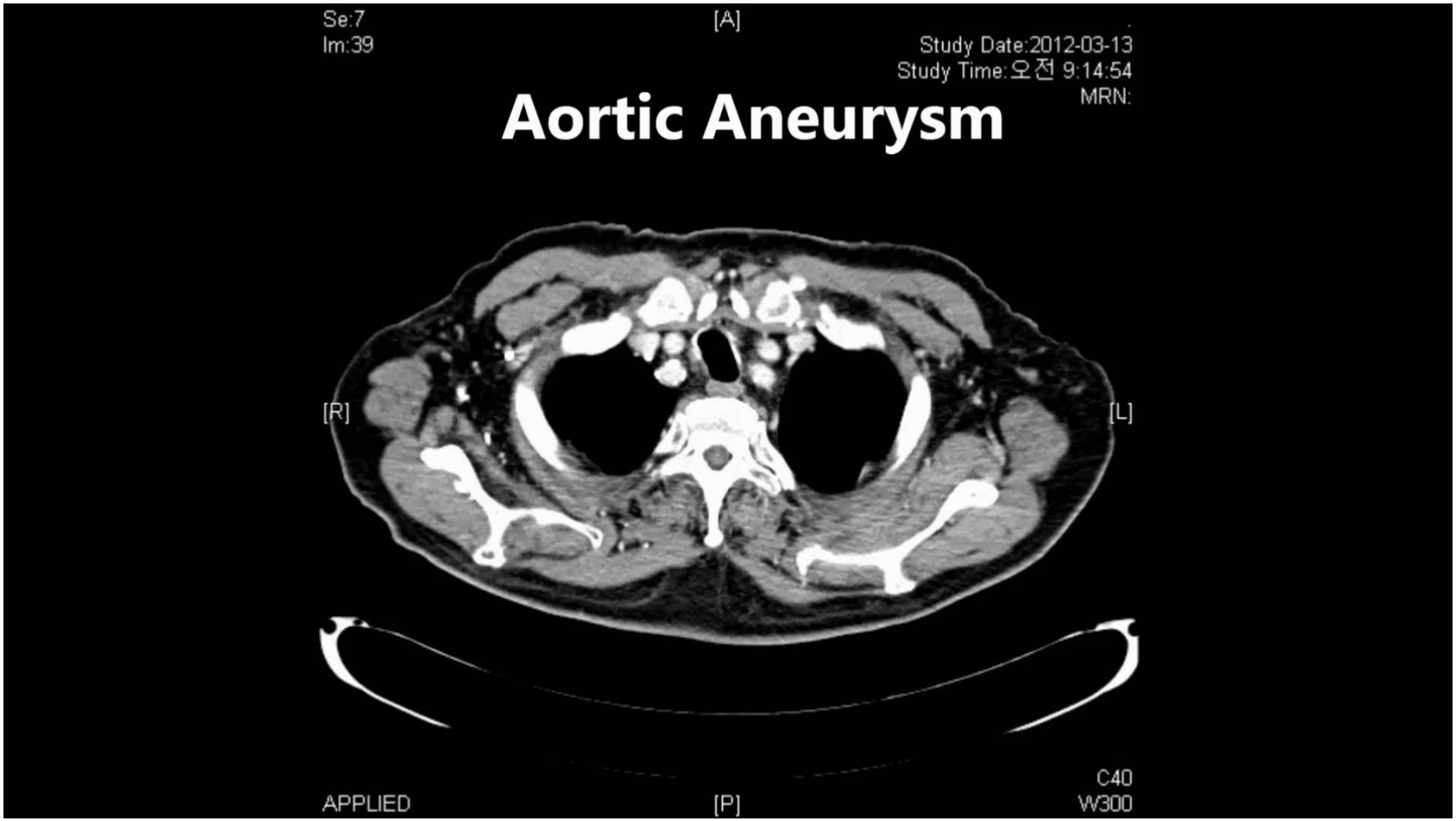
Extensive aortic pathologies



Reality ?

현재의 환자상태

CT상 28.6 × 44.0mm 소견

♣ 한글 병명 : 대동맥류 (대동맥 궁부 (좌쇄골하동맥 기시부 바로 원위부), 튀어나온 양상)

♣ 한글 수술/시술/검사명 : 대동맥수술 (시행(예정)일 [redacted]) 확인 ☑

상행대동맥 및 대동맥궁치환술

수술 소요 시간 : 10 - 12시간 + 회복 마취

* 기 왕 력 : ☐ 없다 ☑ 있다
* 특이체질 및 질병 : ☐ 알레르기 ☑ 고혈압 ☑ 당뇨병 ☐ 심장병 ☐ 출혈소인 ☐ 약으로 인한 사고

확인 ☑

시행하고자 하는 수술/시술/검사 내용 및 예상되는 위험 (합병증) .....

⊙ 목적 및 효과

정중흉골절개술로 접근 예정. 좌측 겨드랑동맥 부분 절개 및 좌측 대동맥 치환목적으로 시도시 뇌경색 가능성 매우 높아 수술후 증대한 합병증 및 사망 가능성 증가

대동맥 치환술이란?
손상된 대동맥을 인조혈관을 이용하여 부분 혹은 전체를 치환하는 수술.

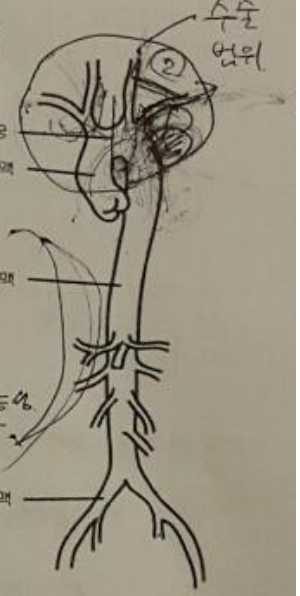
⊙ 수술/시술/검사 과정 및 방법 (부위와 침습정도, 추정 소요시간, 범위추가 가능성 포함)

☑ 수술의 응급성 유무 튀어나온 양상, 소위 주머니 모양 (saccular) 인 경우 혈류가 그부위로 집중되어 파열 및 출사 가능성 높아 빠른 시일내 수술 필요

☑ 대동맥 판막 폐쇄 부전 유무 (경도의 대동맥 판막 폐쇄부전 포함)
중도판막 및 삼첨판막도 경도의 폐쇄부전 동반

☐ 타장기로의 관류장애 유무

수술 범위



순환정지 : 본토 신장 수술의 경우 체외순환기를 사용하면서 혈류를 유지하면서 수술하나, 이 수술의 경우 수술 기법상 저체온을 다른 수술에 비해 훨씬 더 낮게 하여 일시적으로 체외순환기계 정지시키는 상황 필요. 일반 심장에서 뇌손상 수분만에 진행되는 데 비해 저체온 안전 시간이 늘게는 하나. (뇌경색 가능성 타 수술에 비해 매우 높음. 일반 수술서 의식 손상 가능성 1-5% 이나, 이 수술의 경우 뇌경색 및 뇌출혈로 의식 손상 가능성 20% 내외로 상당히 높아짐. 수술 중 모니터링 지속하며 학인하면서 수술 진행.

⊙ 다른 치료방법 및 제한점
없음, 수술 권유.

< 수술 순서 >
정중 흉골 절개술 → 체외순환 → 순환정지 → 대동맥궁 치환 (좌쇄골동맥 대동맥류 제거 및 정체온 → 순환정지 푸는 중 → 상행대동맥 치환 → 지혈 (2-3시간 소요).

⊙ 수술/시술/검사 진행 중 혹은 회복 중 예상되는 위험 및 합병증

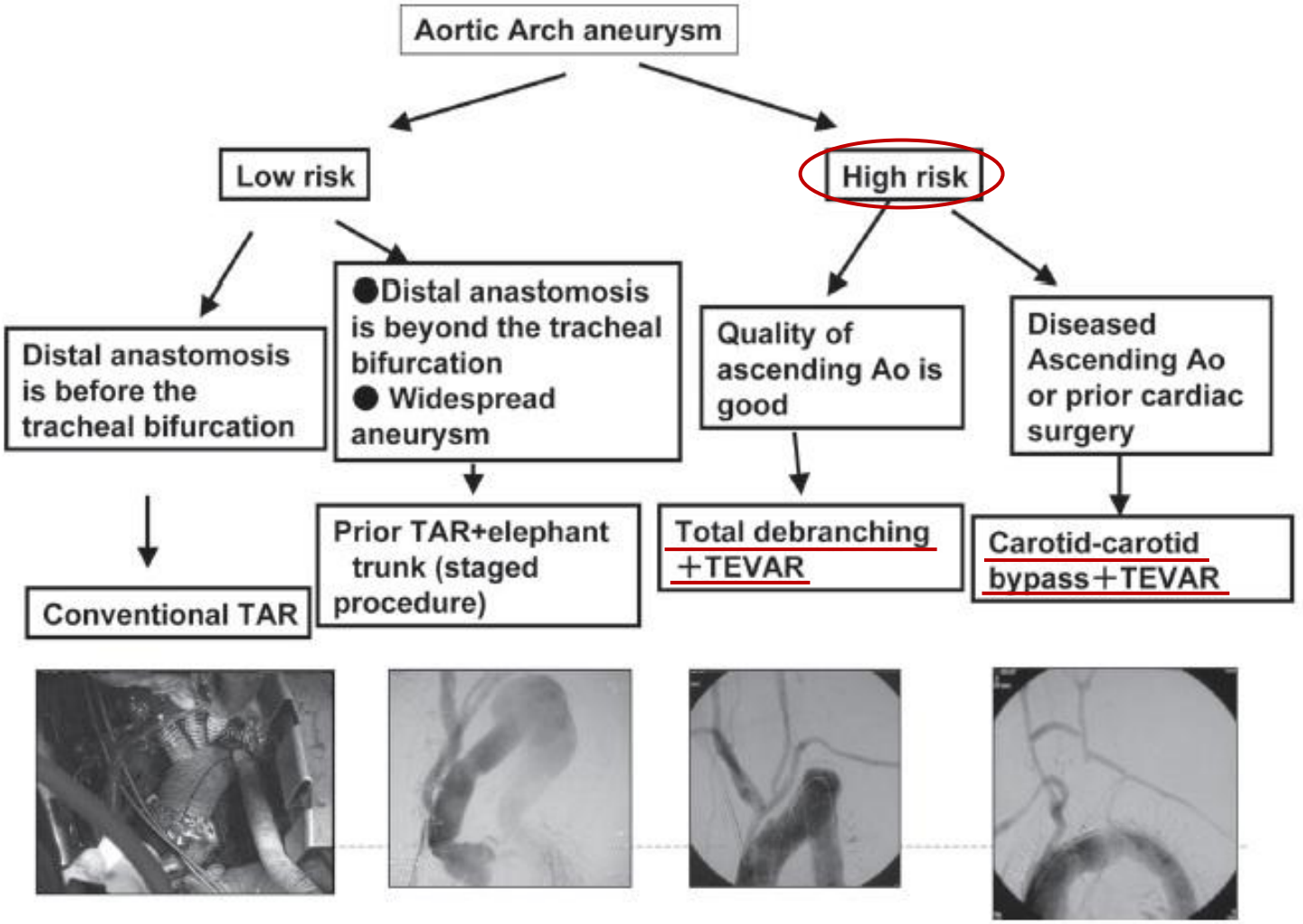
1. 출혈 : 심폐기 및 항응고제 사용 → 저체온, 수혈, 지혈제, 지혈을 위한 재수술 2~3%
2. 신경계 : 순환정지로 인한 허혈성 뇌손상, 뇌출혈, 중추 및 말초신경 손상, 마비 → 항응고제 사용, 신경과 의식 손상 ; 20% 수술적 치료, 항간질약 일시적 정신 착란 증상 10% 하지 마비
3. 순환기계 : 심부전, 부정맥, 심근경색 → 강심제, 혈관이완제, 항부정맥제제, 인공심박동기, 기계보조장치, ECMO
4. 호흡기계 : 무기폐, 폐렴, 급성폐손상, 폐부종 → 적극적인 기침, 심호흡 운동, 항생제 사용 가래, 걸기
5. 소화기계 : 허혈성 장기 손상, 간부전, 신부전, 위염 및 위궤양, 식도천공
6. 감염 : 상처감염, 종격동염, 이식혈관 감염 → 항생제, 상처소독, 상처 재봉합, 재수술
7. 기타 : 유미흉
8. 사망

< 대동맥 수술 합병증 >
1. 뇌경색, 뇌출혈로 인한 의식 손상 20%
2. 지도이후두신경 손상에 의한 쉰목소리

⊙ 예정된 의료행위가 시행되지 않았을 때의 결과

대동맥 질환은 원질환에 따라 수술하지 않는 경우 대동맥의 파열, 박리, 대동맥류 자체에 의한 압박 증상이 발생할 수 있습니다.

Introduction



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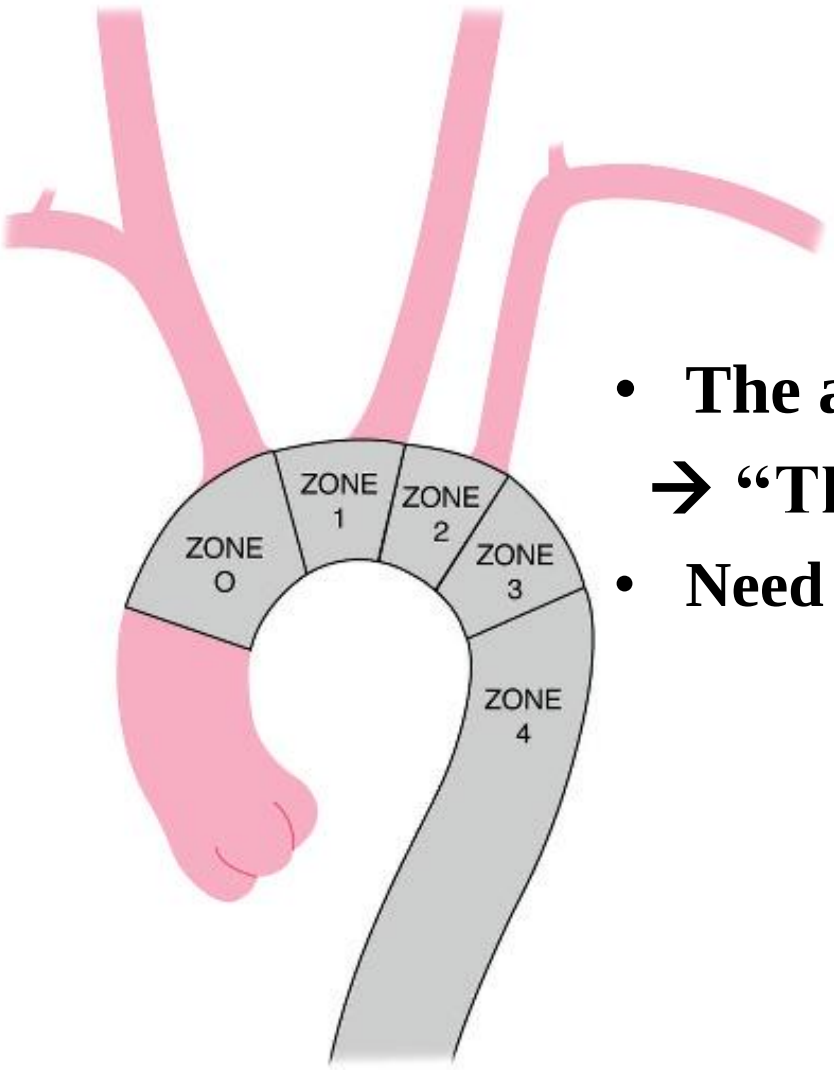
Hybrid TEVAR

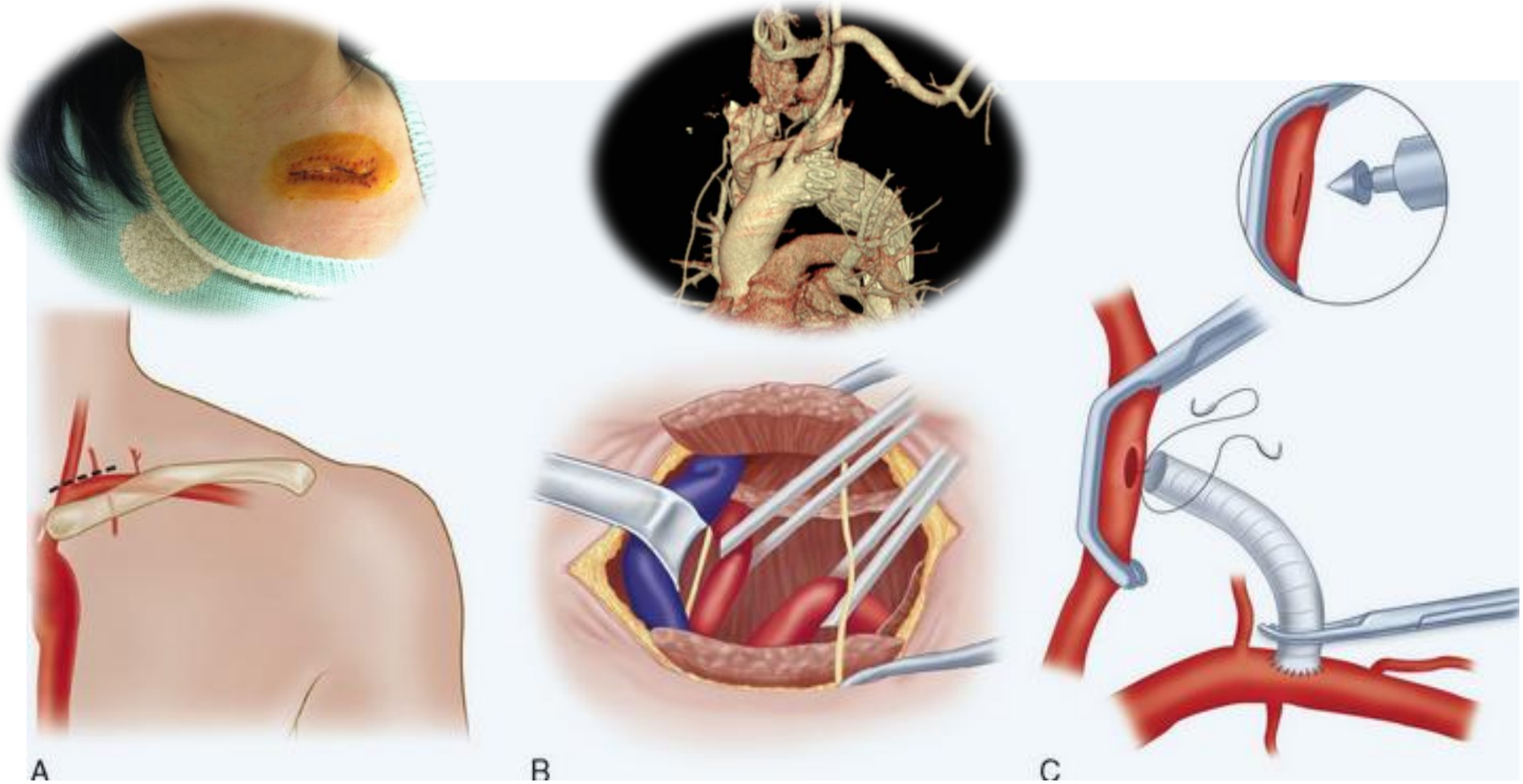


- **The aortic arch**

  → **"The Achilles' heel" of TEVAR**

- **Need to be more safe, lesser invasive**

Hybrid Zone 2 TEVAR



Hybrid Zone 1 TEVAR

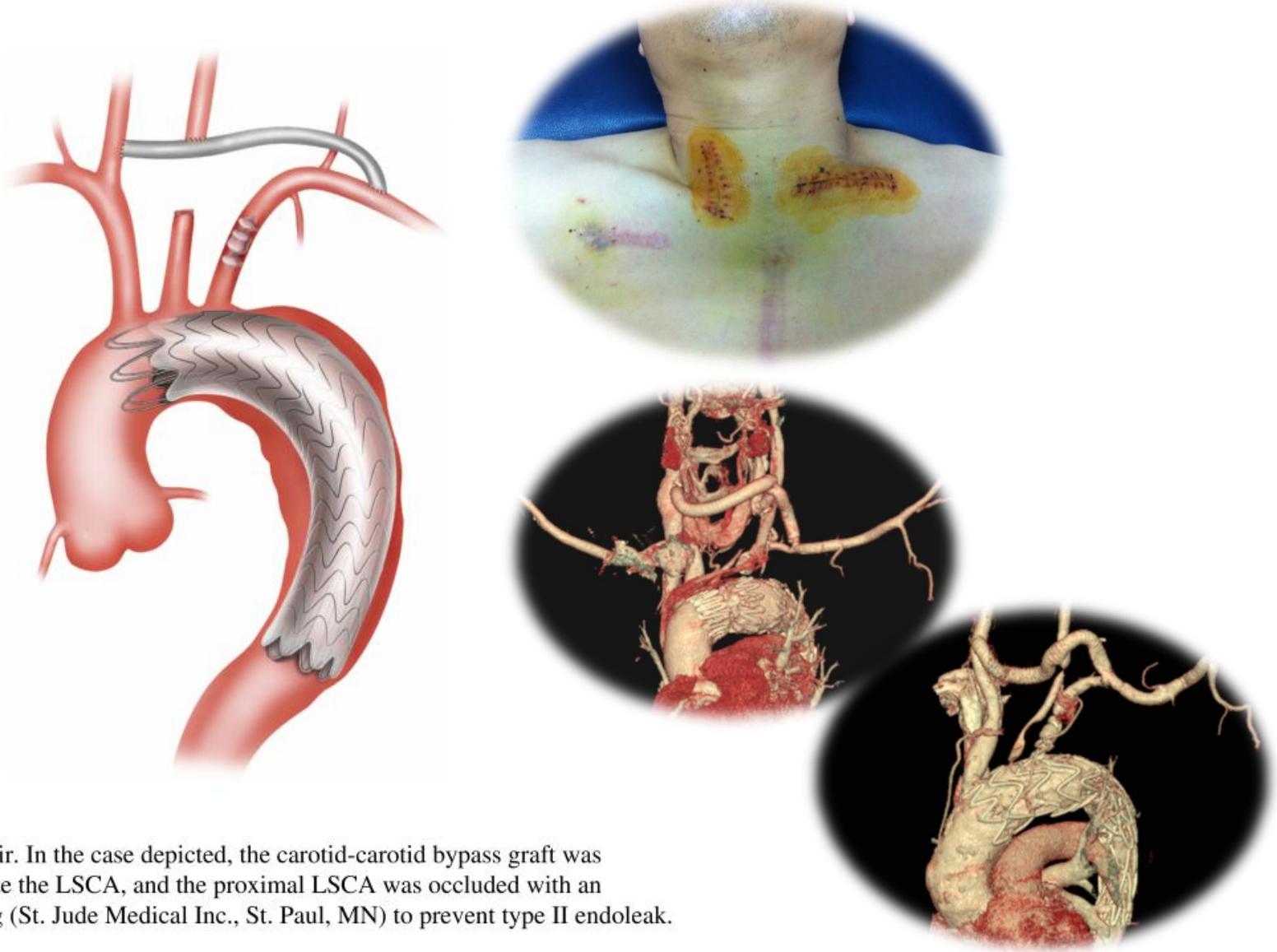


Figure 2.
Zone 1 hybrid arch repair. In the case depicted, the carotid-carotid bypass graft was extended to revascularize the LSCA, and the proximal LSCA was occluded with an Amplatzer vascular plug (St. Jude Medical Inc., St. Paul, MN) to prevent type II endoleak.

Partial debranching

-Carotid to carotid artery bypass

A | B
C | D

Fig. 1 TEVAR with partial debranching (carotid-carotid artery cross-over bypass).
A: Preoperative angiography shows a distal arch aneurysm located just distal to the left subclavian artery.
B: The graft is passed between the esophagus and cervical vertebra.
C: Postoperative angiography shows that the aneurysm is excluded from the systemic circulation after partial debranching and TEVAR.
D: Postoperative CT angiography reveals that the aneurysm is completely excluded from the systemic circulation.

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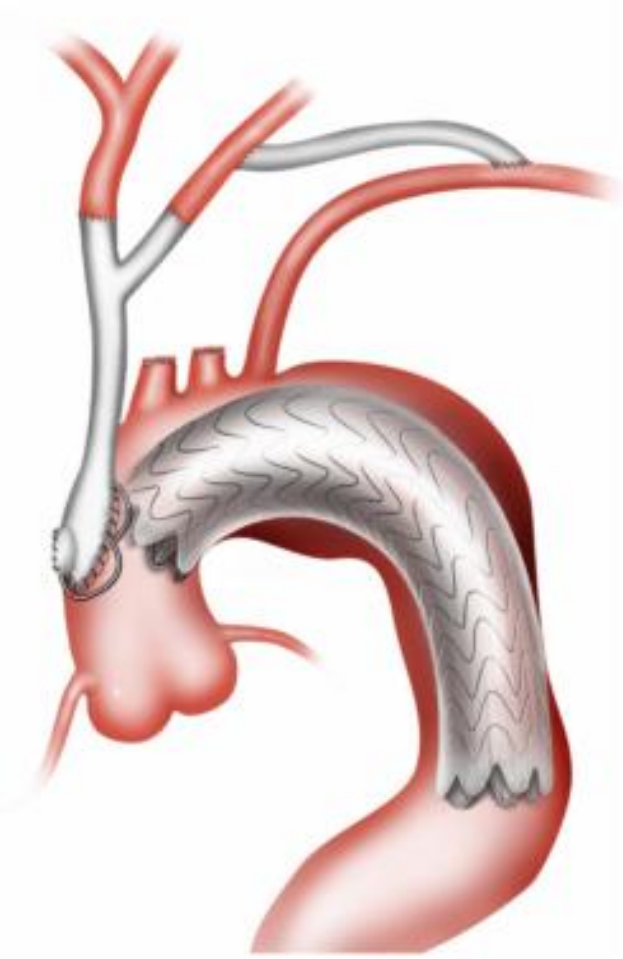
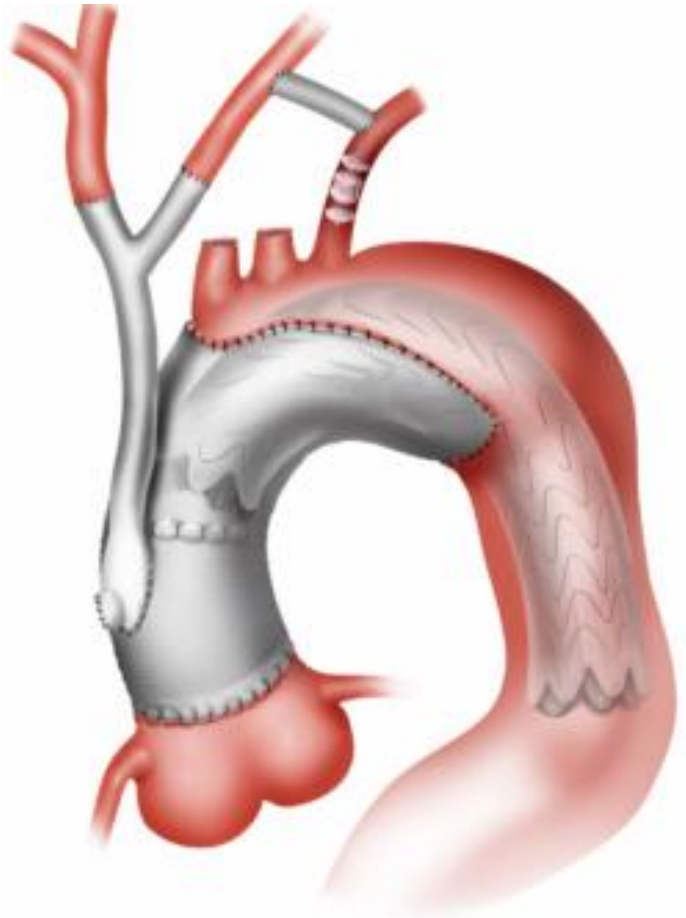
Hybrid Zone 0 TEVAR





Total debranching

-Debranching of all arch branches

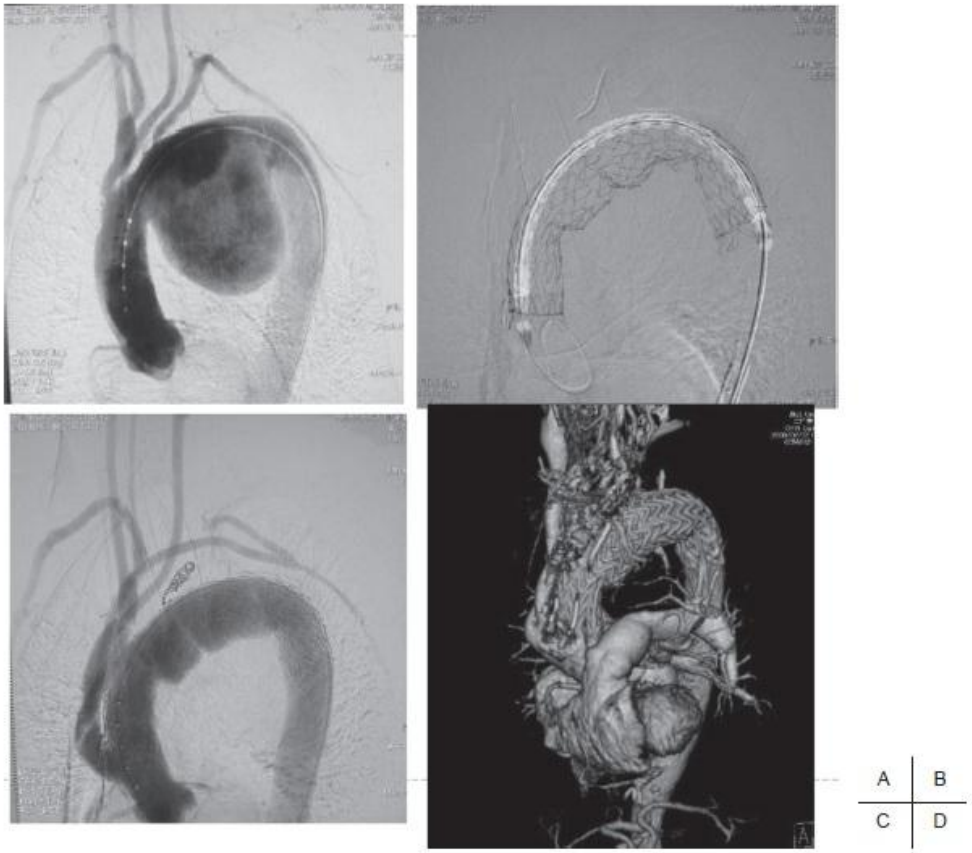


Fig. 2 TEVAR with total debranching.
A: Preoperative angiography shows that neck branches are involved with a huge arch aneurysm.
B: The TAG stent graft is deployed from the ascending aorta after total debranching of the neck vessels with a median sternotomy.
C: Postoperative angiography shows that the aneurysm is excluded from the systemic circulation after total debranching and TEVAR.
D: Postoperative CT angiography reveals that the aneurysm is completely excluded from the systemic circulation.

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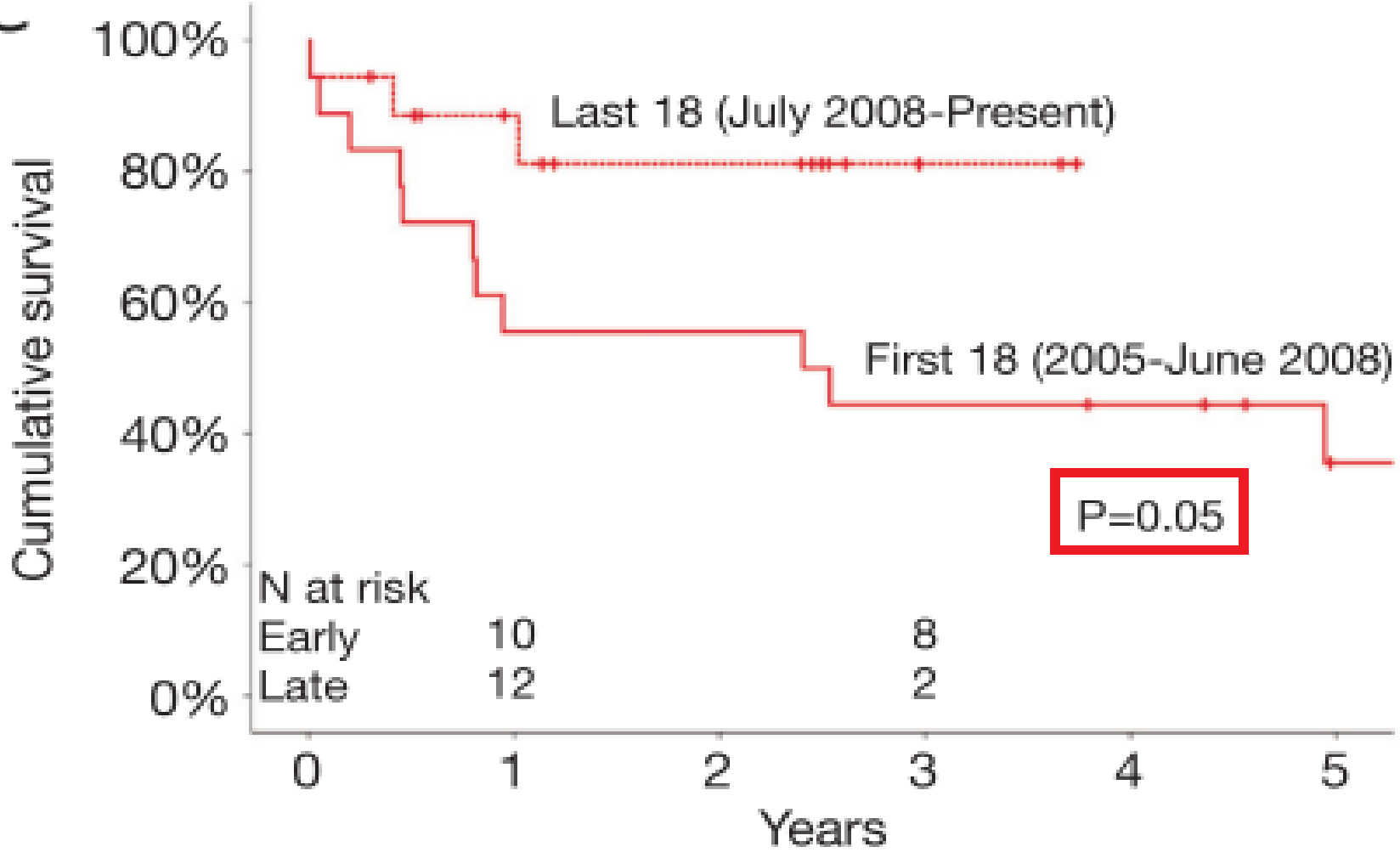
Outcomes of Hybrid TEVAR

Reinterventions and graft patency

Variable	Total (N=87)	Zone 1 (n=19)	Zone 0 (n=48)	Total Arch + SET (n=20)	P Value
Duration of follow-up (mos)	28.5 ± 22.2	33.7 ± 23.0	28.4 ± 21.5	23.4 ± 23.3	0.33
Reintervention for endoleak	11 (13%)	2 (11%)	8 (17%)	1 (5%)	0.40
- TypeIA	4 (5%)	0	4 (8%)	0	0.18
- Type IB	0	0	0	0	1
- Type II	6 (7%)	2 (11%)	4 (8%)	0	0.36
- Type III	1 (1%)	0	0	1 (5%)	0.18
Arch vessel bypass graft revision	1 (1%)	1 (5%)	0	0	0.16
Patency of bypassed arch vessels	204/207 (99%)	28/29 (97%)	122/123 (99%)	54/55 (98%)	1
Aortic reintervention for new disease	5 (6%)	0	3 (6%)	2 (10%)	0.40

C


100%
80%
60%
40%
20%
0%
Cumulative survival
Last 18 (July 2008-Present)
First 18 (2005-June 2008)
P=0.05
N at risk
Early 10 8
Late 12 2
0
1
2
3
4
5
Years

Targeting Landing Zone 0 by Total Arch Rerouting and TEVAR: Midterm Results of a Transcontinental Registry

Martin Czerny, MD,* Ernst Weigang, MD,* Gottfried Sodeck, MD, Juerg Schmidli, MD, Carlo Antona, MD, Guido Gelpi, MD, Tanja Friess, MD, Josef Klocker, MD, Wilson Y. Szeto, MD, Patrick Moeller, MS, Alberto Pochettino, MD, and Joseph E. Bavaria, MD

Department of Cardiovascular Surgery, University Hospital Berne, Berne, Switzerland; Department of Cardiothoracic and Vascular Surgery, University Medical Center Mainz, Germany; Department of Emergency Medicine, Medical University of Vienna, Vienna, Austria; Cardiovascular Surgery Division, L. Sacco Hospital, University of Milan, Milan, Italy; Department of Vascular Surgery, Medical University of Innsbruck, Innsbruck, Austria; and Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania

Background. Landing zone 0, defined as a proximal landing zone in the ascending aorta, remains the last frontier to be taken. Midterm results of total arch rerouting and thoracic endovascular aortic repair (TEVAR) extending into landing zone 0 remain to be determined.

Methods. From 2003 to 2011, 66 patients (mean age, 70 years; 68% men) presenting with pathologic conditions affecting the aortic arch (atherosclerotic aneurysms [n = 48], penetrating ulcers [n = 6], type B dissections [n = 6], type B after type A dissections [n = 5], and anastomotic aneurysm [n = 1]) were treated in 5 participating centers. Of these 66 patients, only 12% would have been deemed suitable for any kind of conventional surgical repair because of multisegmental aortic disease or comorbidities.

Results. In-hospital mortality was 9%. Retrograde type A dissection was observed in 3% of patients. The assisted type I and type III endoleak rate was 0%. Stroke was seen in 5% of patients. Permanent paraplegia was observed in 3% of those studied. Median follow-up was 25 months (8–41 months). There was 1 late type Ib endoleak, which was followed by watchful waiting. Five-year survival was 72%. Five-year aorta-related survival was 96%. No aorta-related reintervention had to be performed in the segments treated.

Conclusions. Midterm results of total arch rerouting and TEVAR extending into landing zone 0 are excellent in regard to aorta-related survival and freedom from aorta-related reintervention. Retrograde type A dissection, potentially related to compliance mismatch between the ascending aorta and the stent-graft, warrants further attention. Extended application of this strategy augments therapeutic options in a group of patients who are not suitable candidates for conventional therapy.

(Ann Thorac Surg 2012;94:84–9)

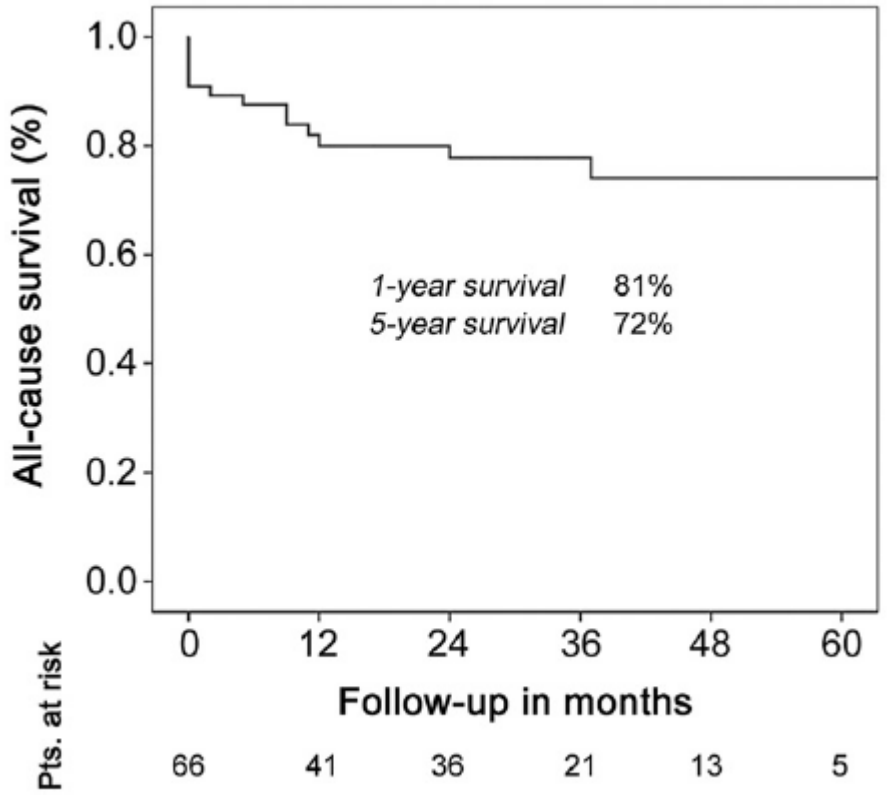


Fig 4. One- and 5-year survival rates.

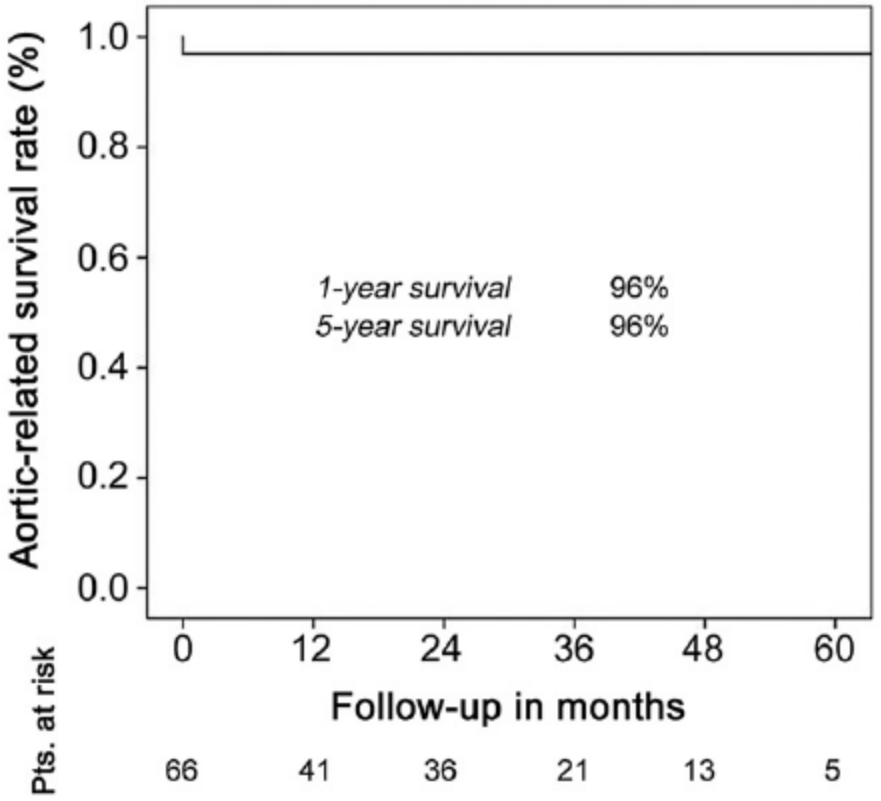


Fig 5. One- and 5-year aorta-related survival rates.

How should aortic arch aneurysms be treated in the endovascular aortic repair era? A risk-adjusted comparison between open and hybrid arch repair using propensity score-matching analysis†

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Department of Cardiovascular Surgery, National Cerebral and Cardiovascular Center, Suita, Osaka, Japan

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Received 12 September 2013; received in revised form 15 November 2013; accepted 21 November 2013

Abstract

OBJECTIVES: Recent advances in endovascular aortic repair have changed the treatment of aortic arch aneurysms. The purpose of this study was to compare the early and mid-term outcomes of open repair and hybrid arch repair for aortic arch aneurysms.

METHODS: This study included 143 and 50 patients who underwent open aortic repair and hybrid thoracic endovascular aortic repair (TEVAR), respectively, for non-dissecting aortic arch aneurysms from 2008 to 2013. The European System for Cardiac Operative Risk Evaluation II scores were 4.35 ± 3.65% and 7.78 ± 5.49% for the open and hybrid TEVAR groups, respectively ($P < 0.001$). Furthermore, 35 patients from each group were matched using propensity scores to adjust for differences in patient characteristics.

RESULTS: There was no significant difference in early mortality between the open and hybrid groups (3 vs 2%, $P = 0.76$). Early morbidity was equivalent in both groups, but intensive care unit (ICU) lengths of stay were shorter in members of the hybrid group (4.7 vs 1.6 days, $P = 0.018$). During the follow-up, survival rates were not significantly different (87 vs 81% at 3 years, $P = 0.13$), but reinterventions for the aortic arch were required in 1 patient (pseudoaneurysm) in the open group and 5 (endoleak in 4, brachiocephalic artery stenosis in 1) in the hybrid group. The rates of freedom from reintervention at 3 years were 99% in the open group and 80% in the hybrid group ($P < 0.001$). Propensity score matching yielded similar results for shorter ICU and hospital lengths of stay and more frequent reintervention in the hybrid group.

CONCLUSIONS: Surgical outcomes in both groups were satisfactory. Hybrid TEVAR was superior in terms of early recovery from surgery; however, open arch repair showed more reliable long-term outcomes. When properly selected according to patient risk, these two strategies improve the surgical results in all patients with aortic arch aneurysms.

Keywords: Aortic arch aneurysms • Hybrid arch repair • Open arch repair • Endovascular procedures • Propensity score matching

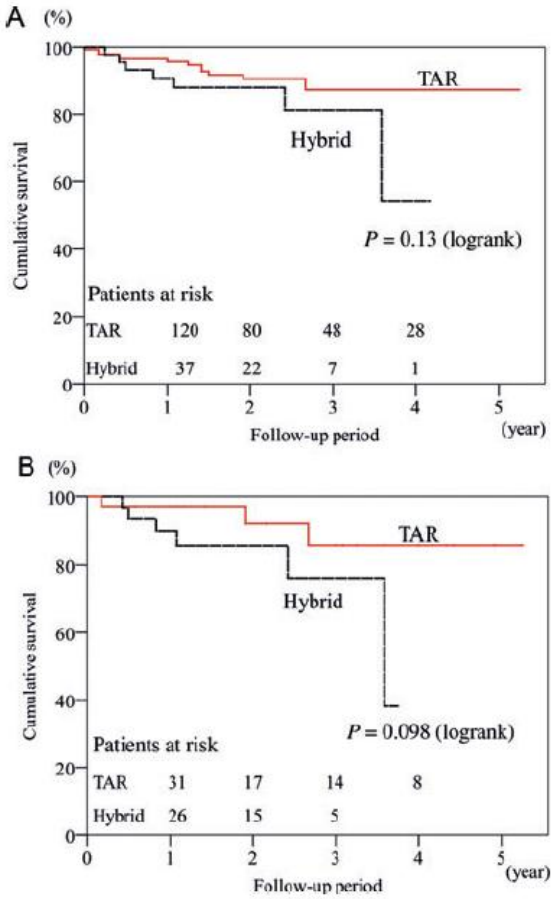


Figure 1: Cumulative survival curve. (A) All patients. (B) Propensity score-matched cohorts of the TAR and hybrid groups.

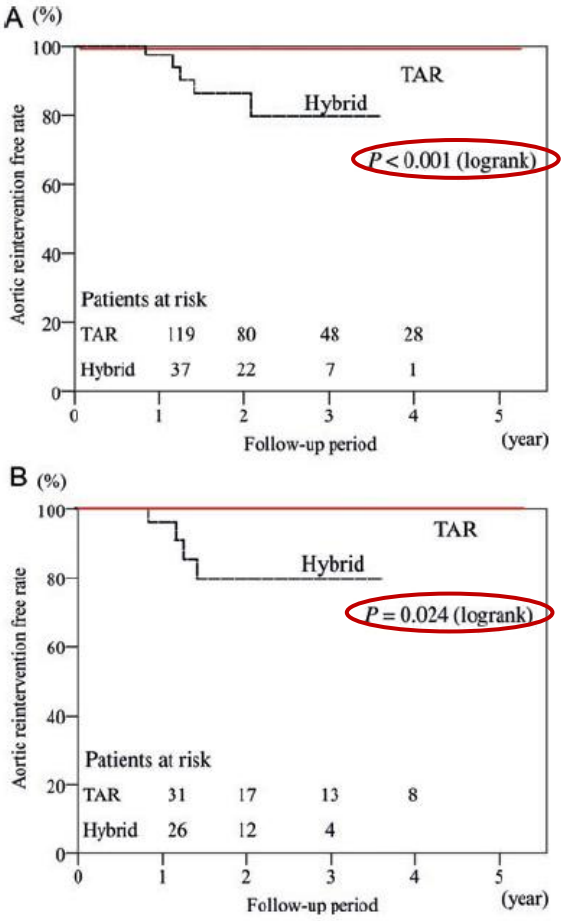
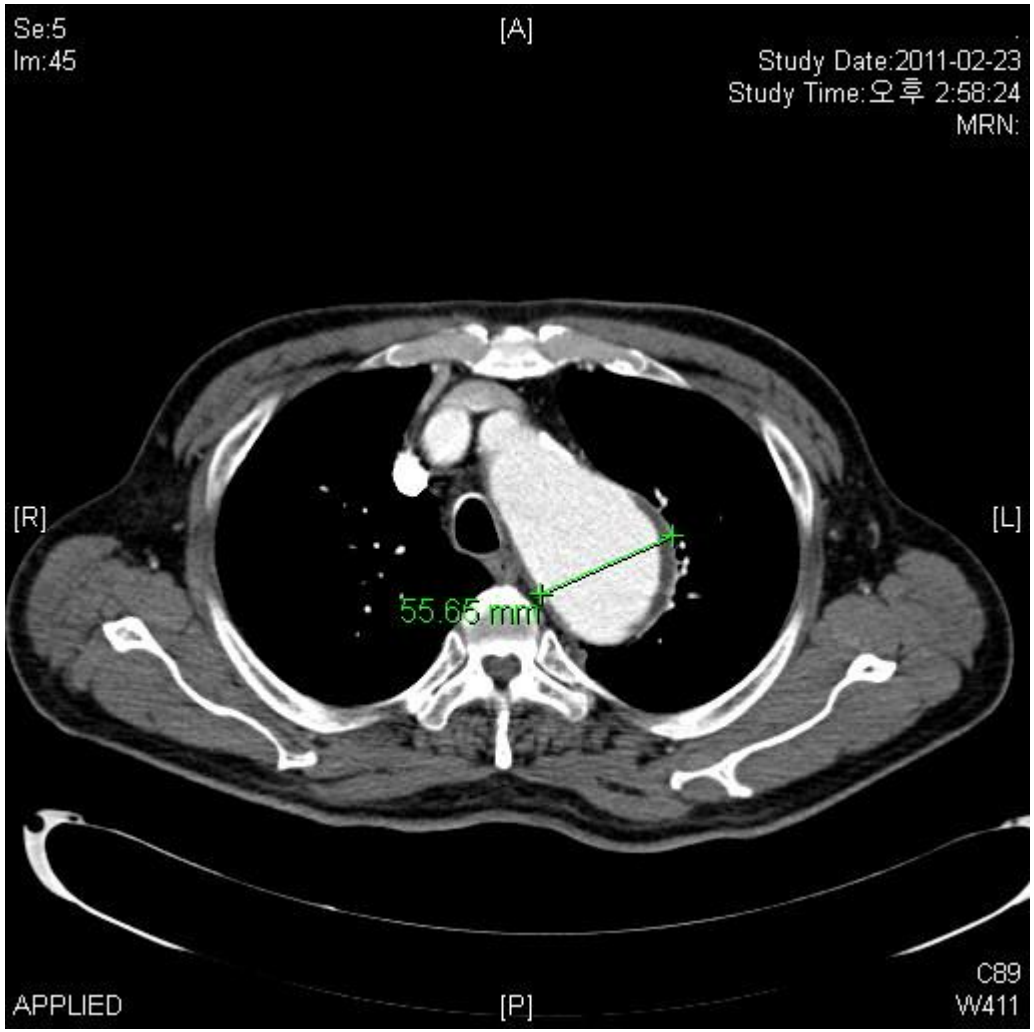
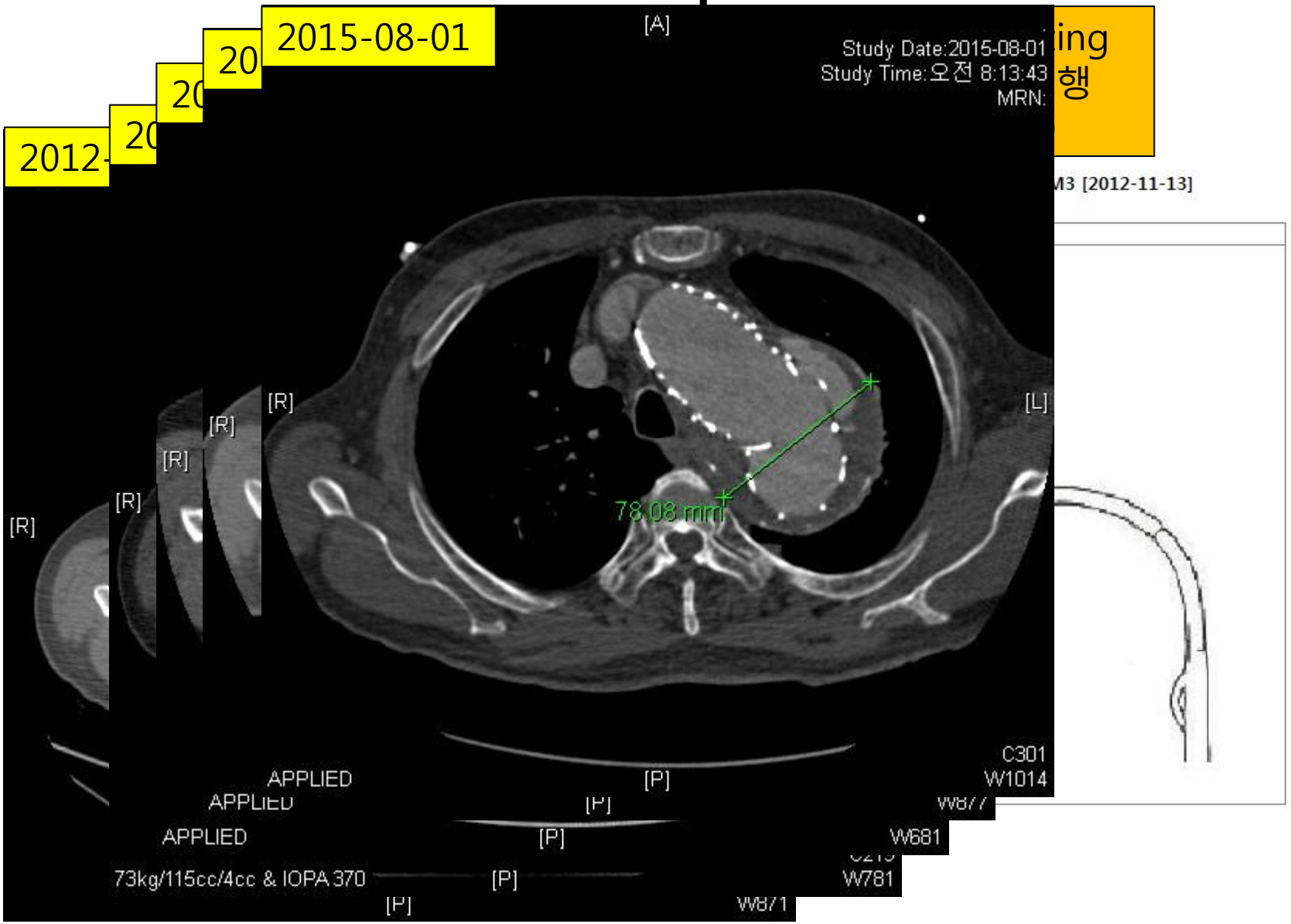


Figure 2: Freedom from late aortic reintervention for previous arch repair. (A) All patients. (B) Propensity score-matched cohorts of the TAR and hybrid groups.

Case 1. M/74
Pre-op CT (2011-02-23)



Post-op CT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Study Date:2015-08-01
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APPLIED
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APPLIED
73kg/115cc/4cc & IOPA 370
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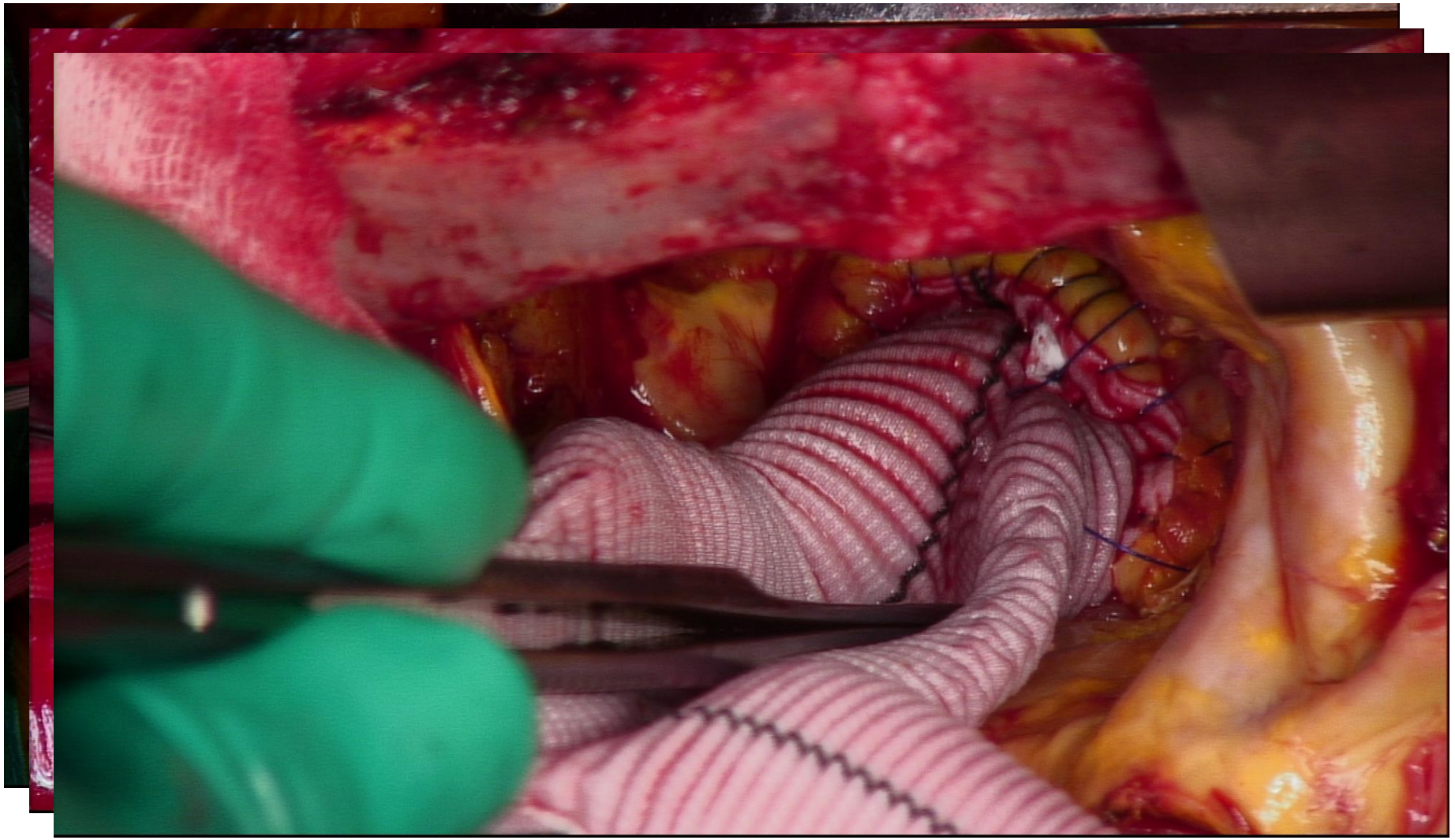
C301
W1014
W681
W781
W871

type Ia endoleak s/p
TEVAR(2011-04-07)

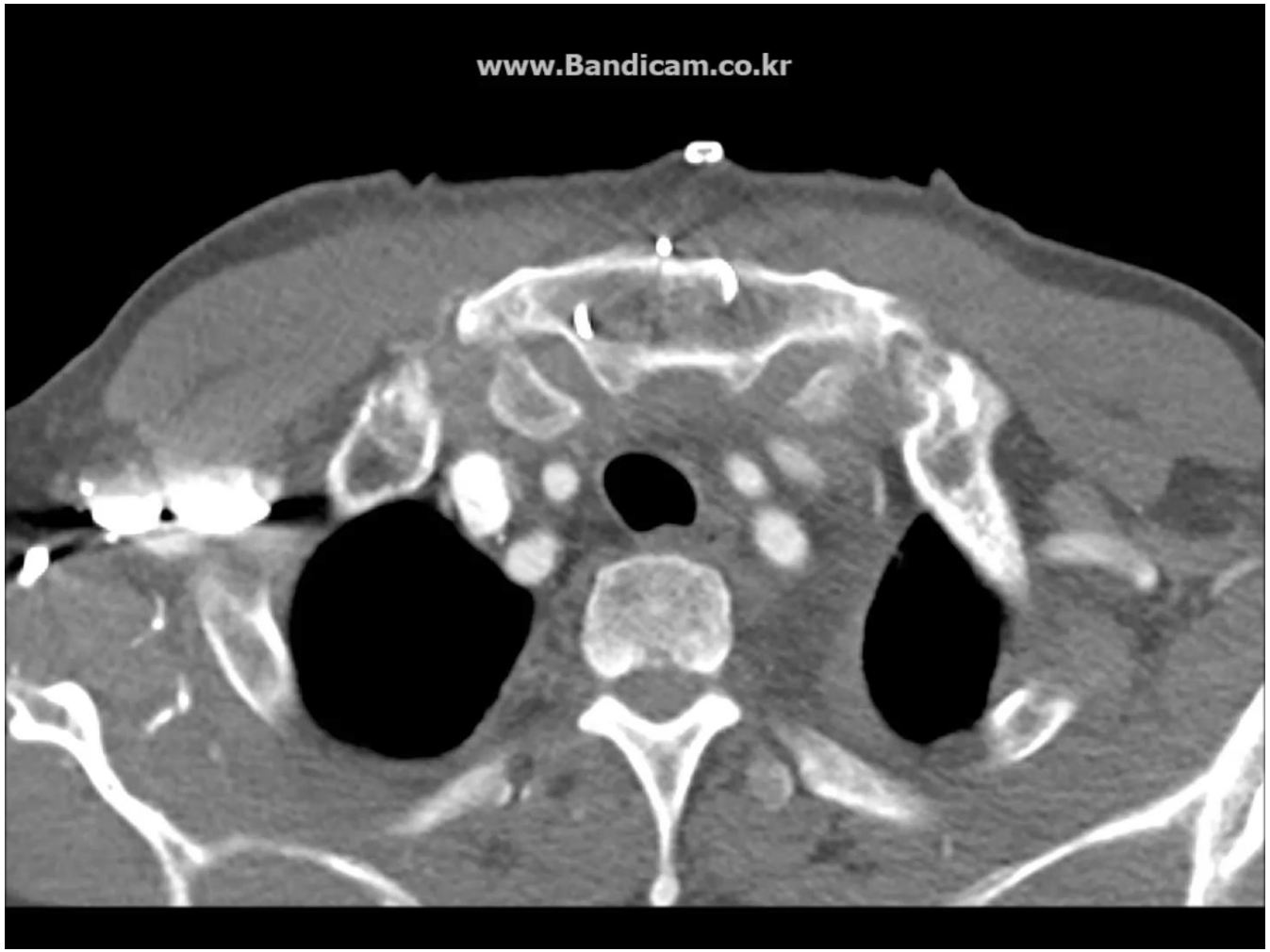
CT: 2012-01-11

Case 2. M/67
Preop CT

Operation Photo



Postop CT



Case 3. M/68

Summary

- **TEVAR for aortic arch aneurysm**
  - **Zone 1, 0 Hybrid TEVAR**
  - **Risk**
  - **Proximal landing zone**
  - **Aortic arch curvature**
  - **Branched TEVAR**

  - **Open repair**

Summary

- Hybrid TEVAR has the potential to be an alternative for conventional total arch replacement for high risk patients

- Careful selection of treatment strategies of aortic arch aneurysm is very important