

State of Art Hybrid Approach **for Complex Aorta Diseases**

Won Ho Kim, MD

Division of Cardiology, Eulji University Hospital

Eulji University School of Medicine, Daejeon, Korea

Introduction

.Hybrid procedure in the modern era :

.Combination of surgery & percutaneous intervention,
staged by minutes, hours, or at most, days

.Hybrid CABG/PCI, hybrid PCI/valve, hybrid AF procedure

.Hybrid approach for complex aorta Dz

Hybrid procedure for complex aorta Dz

.Thoracic aortic aneurysm / dissection (TAA-D)

.Thoraco-abdominal aneurysm / dissection

.Abdominal aortic aneurysm / dissection

Hybrid approach in TAA & TAD

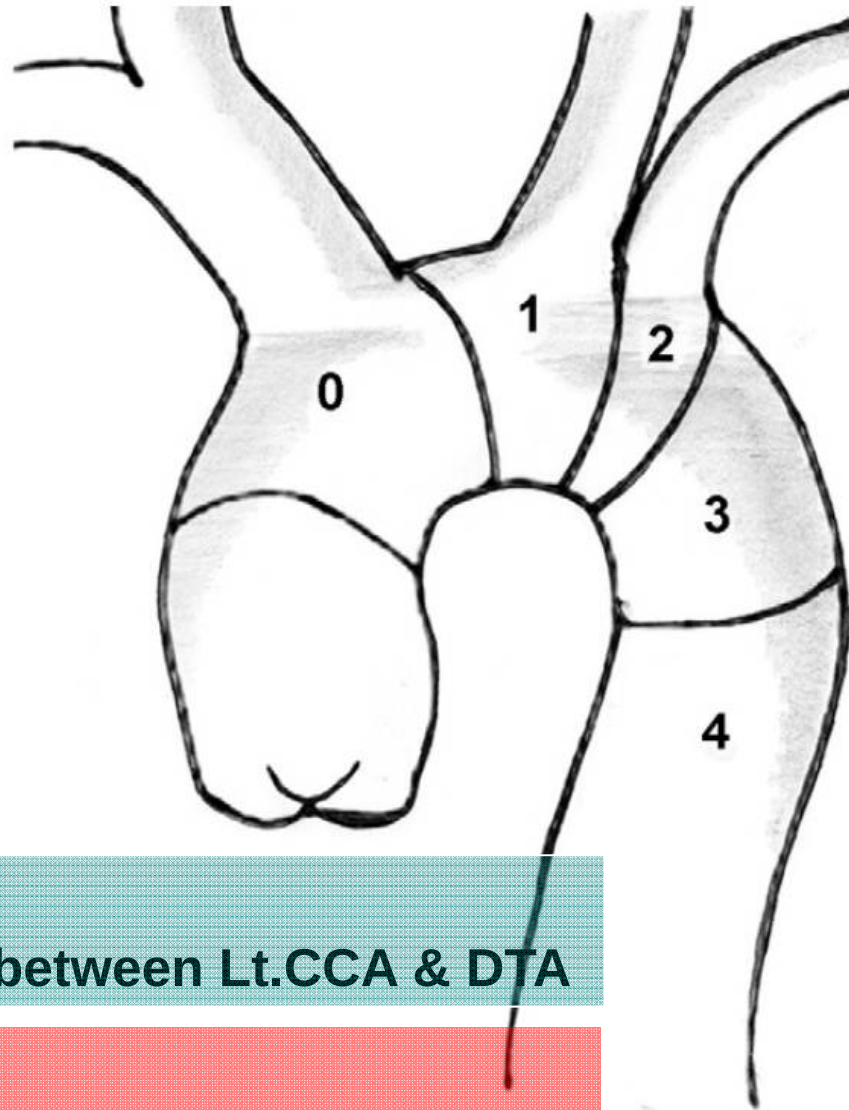
.Limitation of endovascular stent grafting

.Goal of hybrid approach :

.Maintain flow to supra aortic trunk (prevent stroke)

**.Prevent the significant morbidity, mortality associated
with these complex arch pathology & surgery**

Anatomic landing zone map



.Zone 0 :

- .Confined to the ascending aorta
- .Necessity for achieving a proximal seal in the ascending aorta

.Zone 1 :

- .Region between IA & Lt.CCA

.Zone 2 :

- .Region between Lt.CCA & Lt.SCA

.Zone 3 :

- .Region between Lt.CCA & DTA

.Zone 4 :

- .Confined to DTA

Hybrid Aortic Repair

.2 components :

.Open surgical procedure :

.Based on the extent of the arch that is involved with Dz

.Allows proximal extension of SGs into the aortic arch

.Thoracic endovascular aortic repair (TEVAR)

(or open stent graft)

Various surgical procedures

- .Ascending aorta to innominate artery (IA) & Lt.CCA bypass**
- .Ascending aorta replacement with reimplantation IA & Lt.CCA**
- .Ascending aorta replacement & graft to IA & CCA bypass**
- .Rt.CCA to Lt.CCA bypass with or without Lt.CCA to LSA bypass**
- .Rt.axillofemoral bypass & Rt.CCA to Lt.CCA bypass**
- .Bilateral axilofemoral bypass & Lt.CCA to LSA bypass**

.....

Proposed classification-1 (TAAD)

.Classified based on :

.Anatomy of the lesion (extent of the lesion)

.Suitability of the proximal & distal landing zones

.Type I, type II, & type III hybrid arch repairs

.By Szeto W, et al.

.Type I :

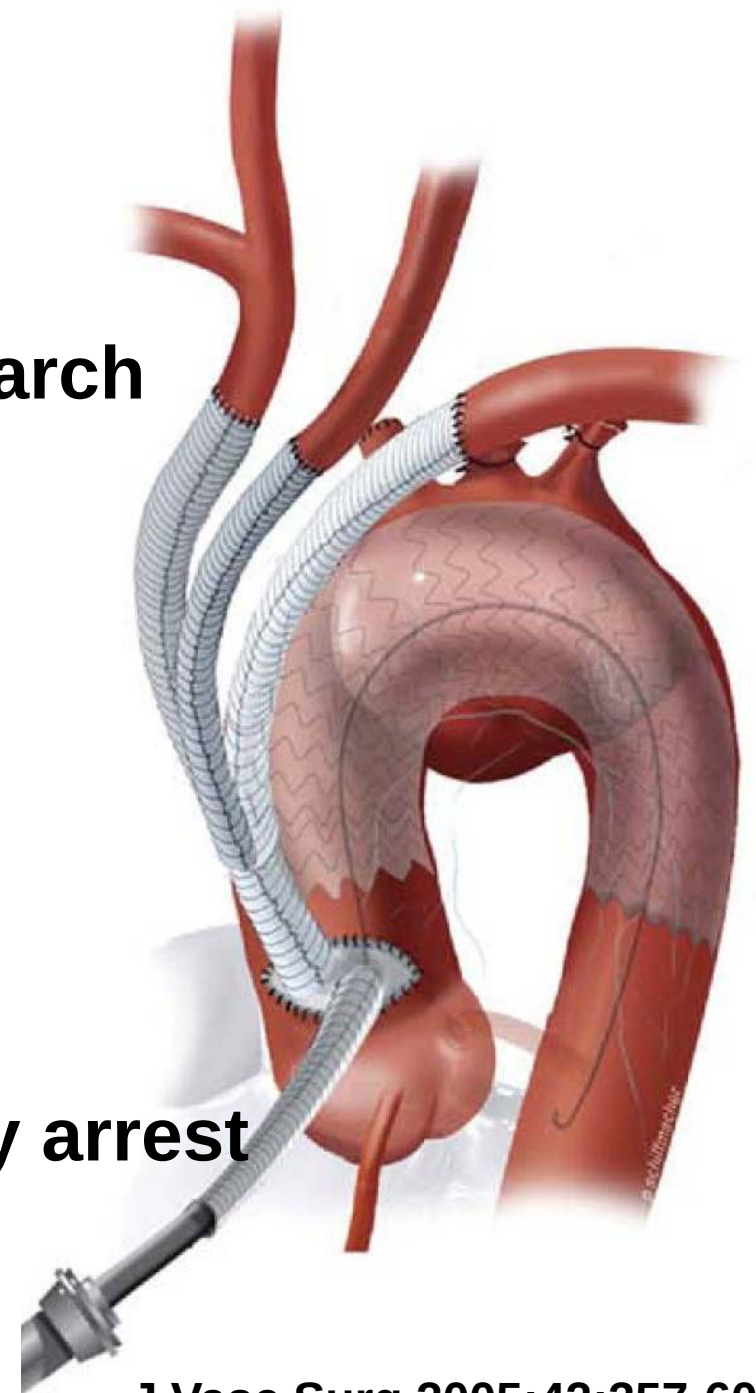
.Isolated aortic arch aneurysm

**.Brachiocephalic bypass with
endovascular repair of the aortic arch**

.Arch debranching procedure :

**.After debranching, exclusion of
the lesion with TEVAR**

**.Eliminating hypothermic circulatory arrest
& potentially CP-bypass**



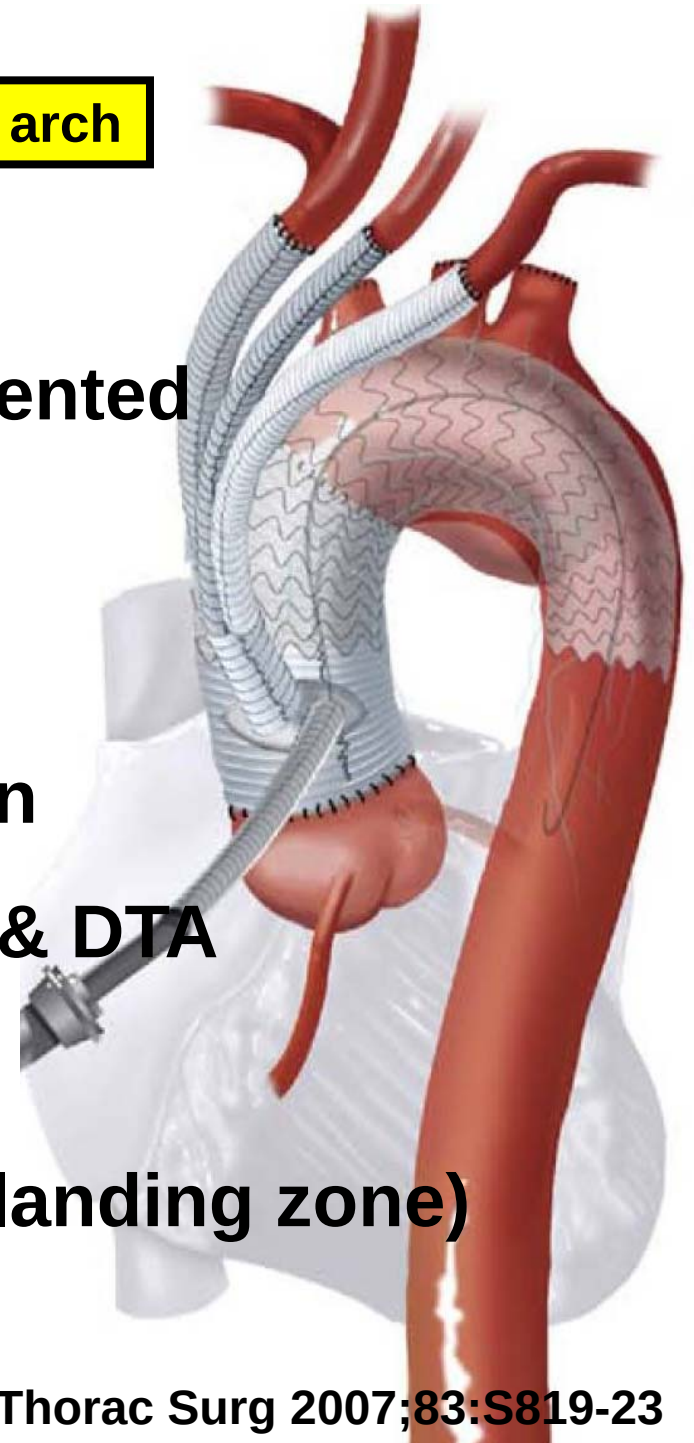
.Ascending aortic aneurysm with extension into distal arch

.Type II :

**.Aortic arch reconstruction with the stented
-elephant trunk**

**.Surgical proximal aortic reconstruction
combined with SG of the distal arch & DTA**

.Not aneurysmal at DTA (normal distal landing zone)



.Typically, SG is deployed during hypothermic arrest :

.Frozen elephant trunk creation

.Antegrade via the open arch into the DTA

.Following SG deployment :

.Repair the ascending aortic aneurysm & arch

.Using a standard Dacron grafts

.Extensive TAAs with involvement of the ascending, arch, & DTA

.Type III :

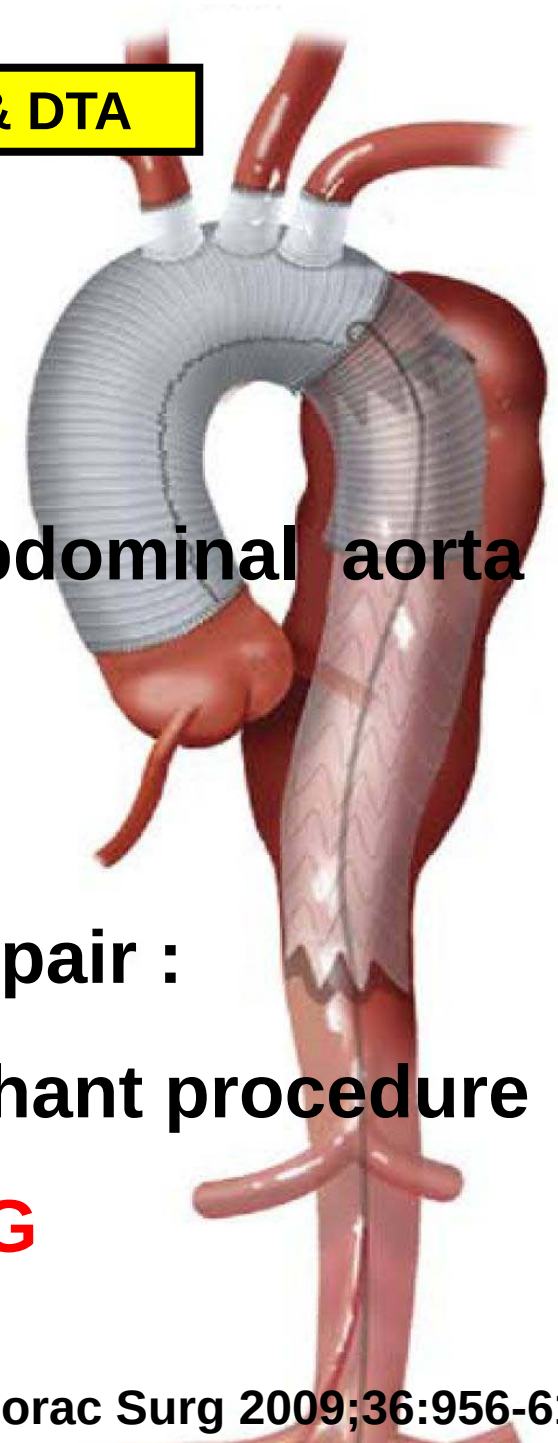
**.Elephant trunk repair with completion
endovascular repair of the thoraco-abdominal aorta**

.Typically, 2 staged procedure :

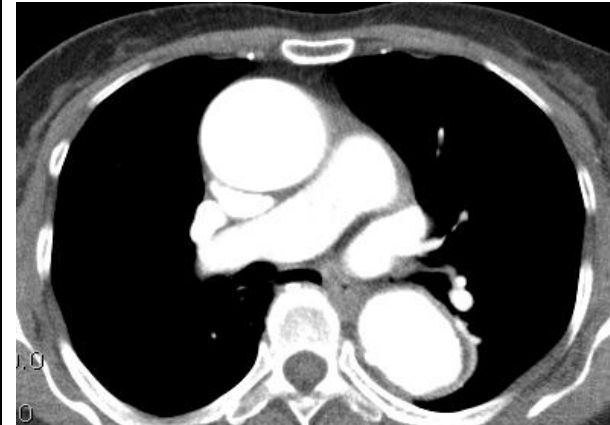
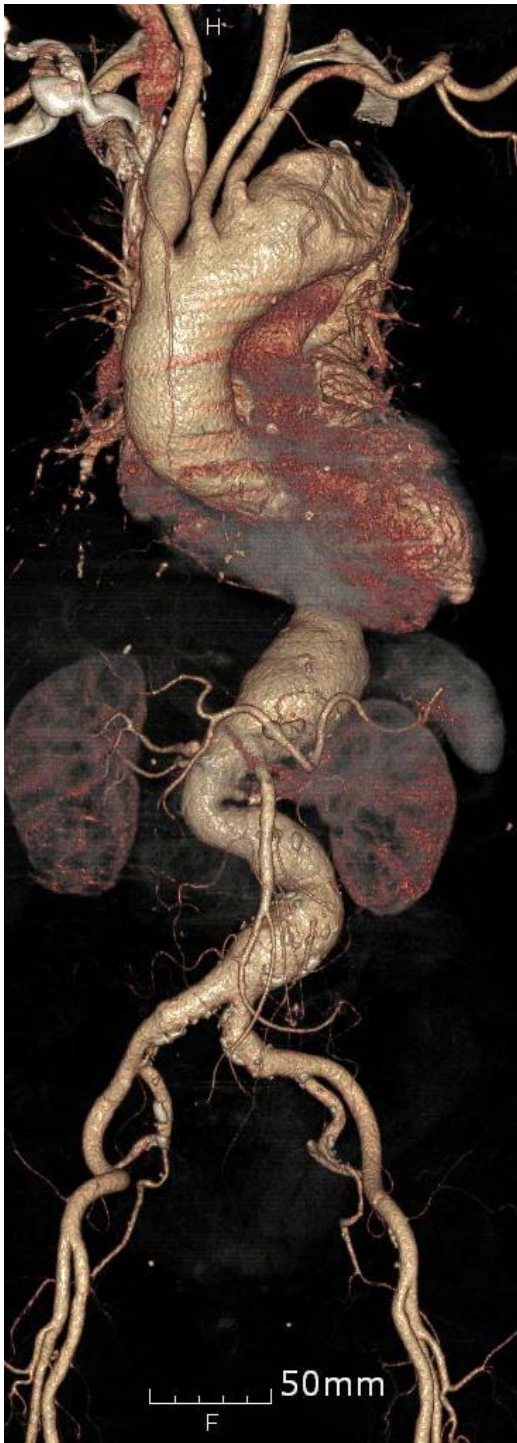
.First stage, similar to that of type II repair :

.Open arch **surgery, or frozen elephant procedure**

.Secondary placement of a thoracic **SG**



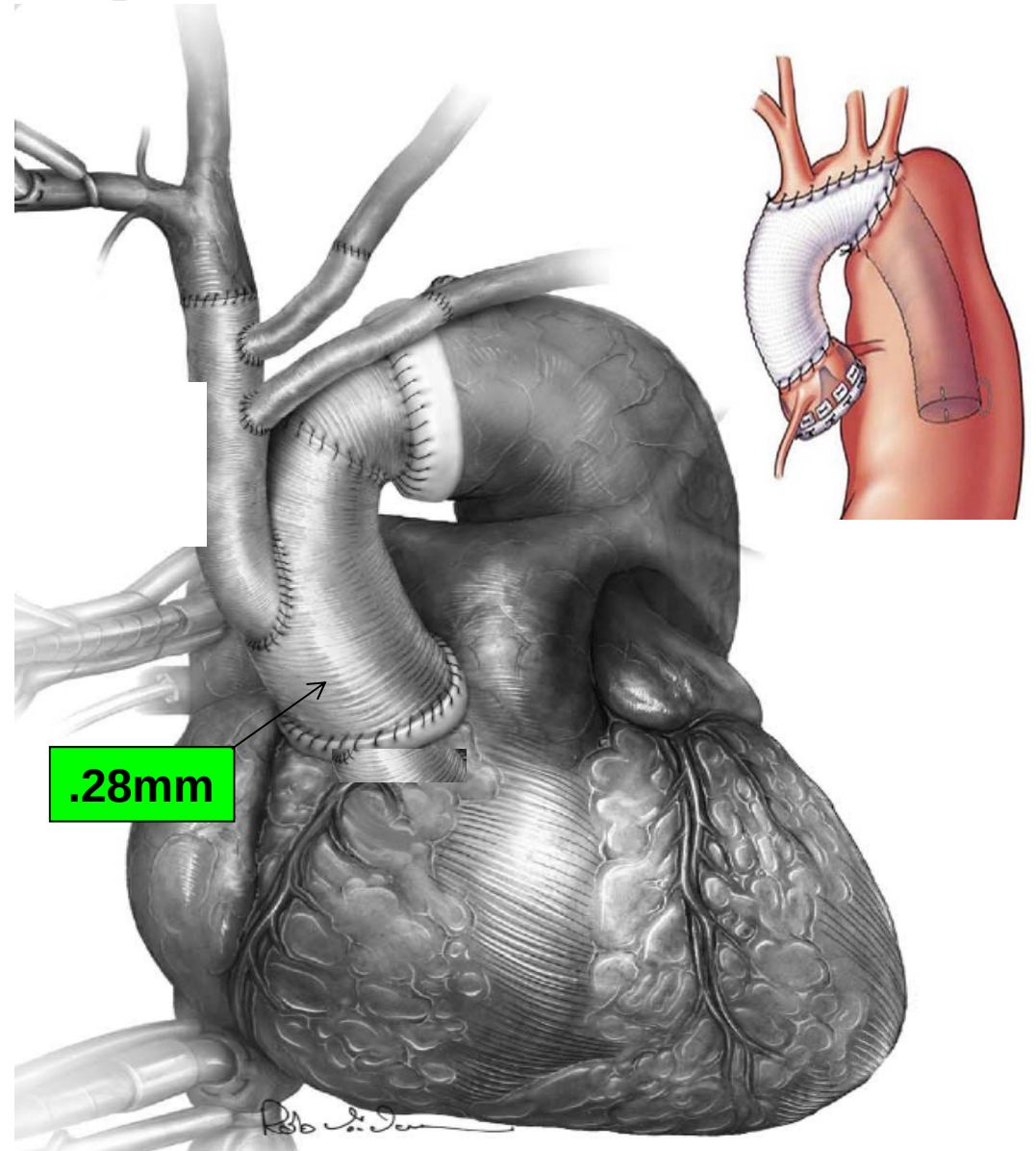
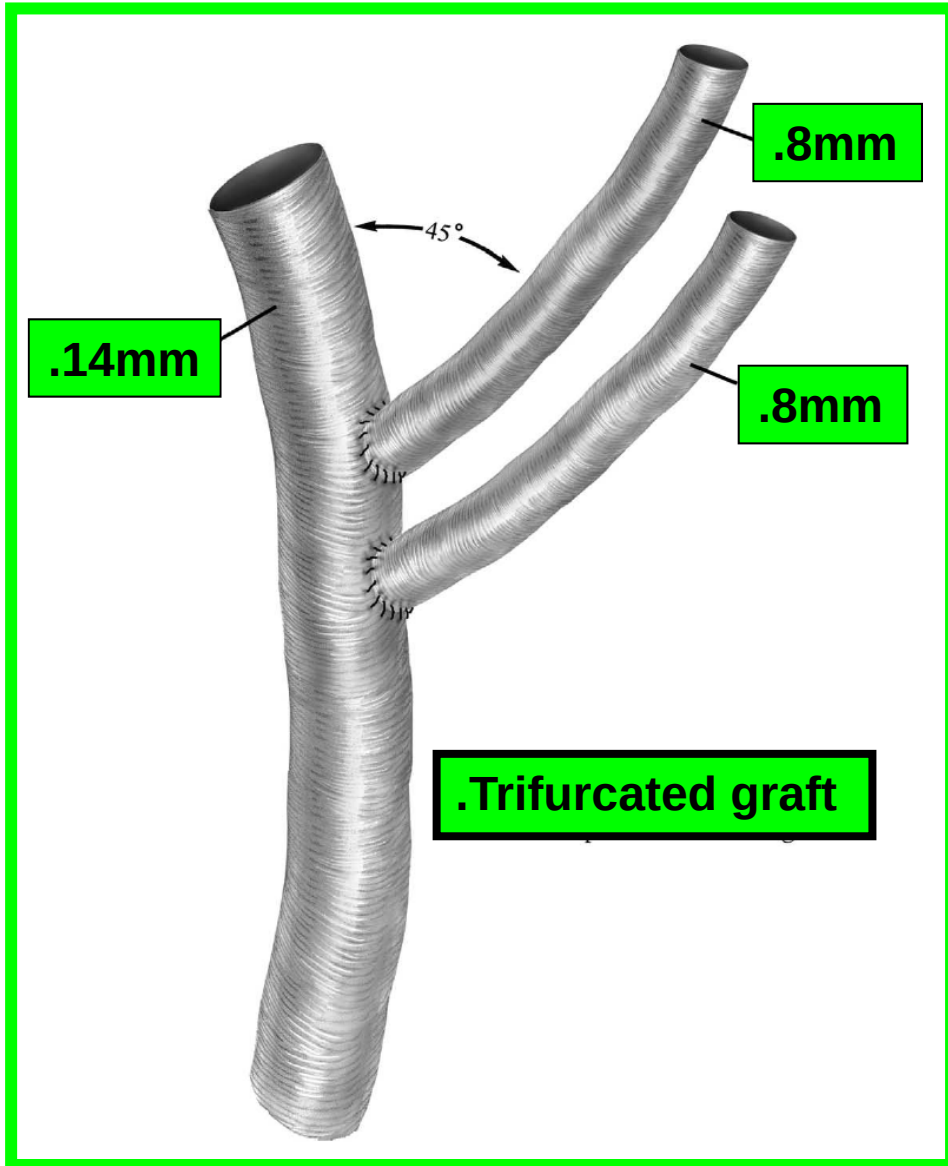
CT-aorta

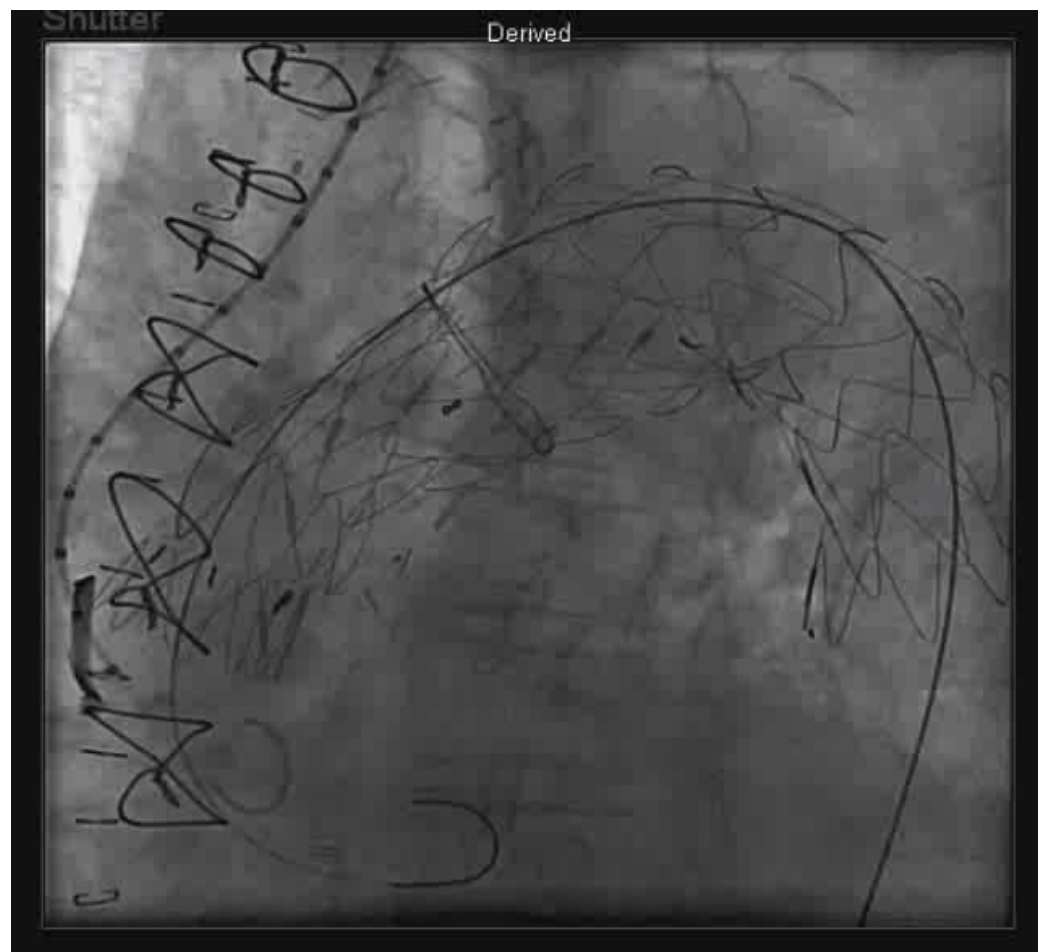
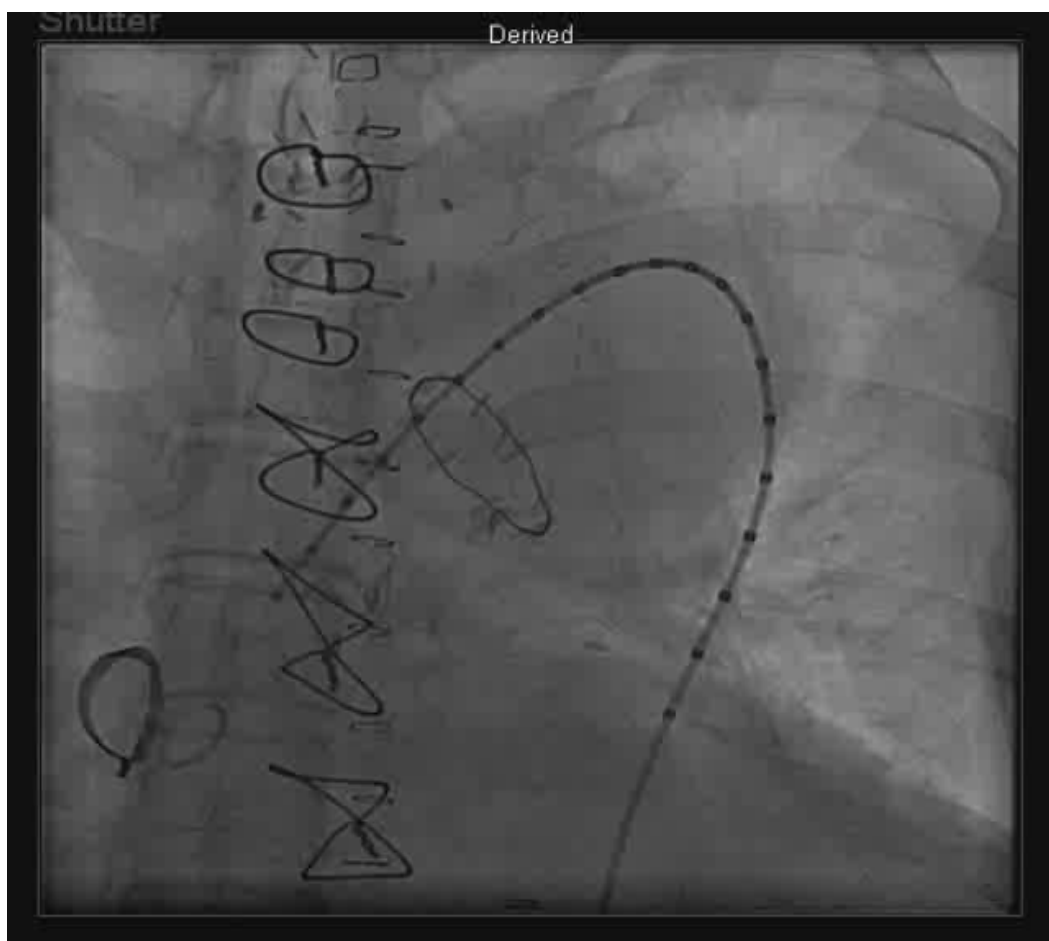


**.Maximal diameter :
.6.3 cm in the aortic arch
.4.6 cm in the ascending aorta
.4.3 cm in the DTA**



Elephant trunk completion & CABG

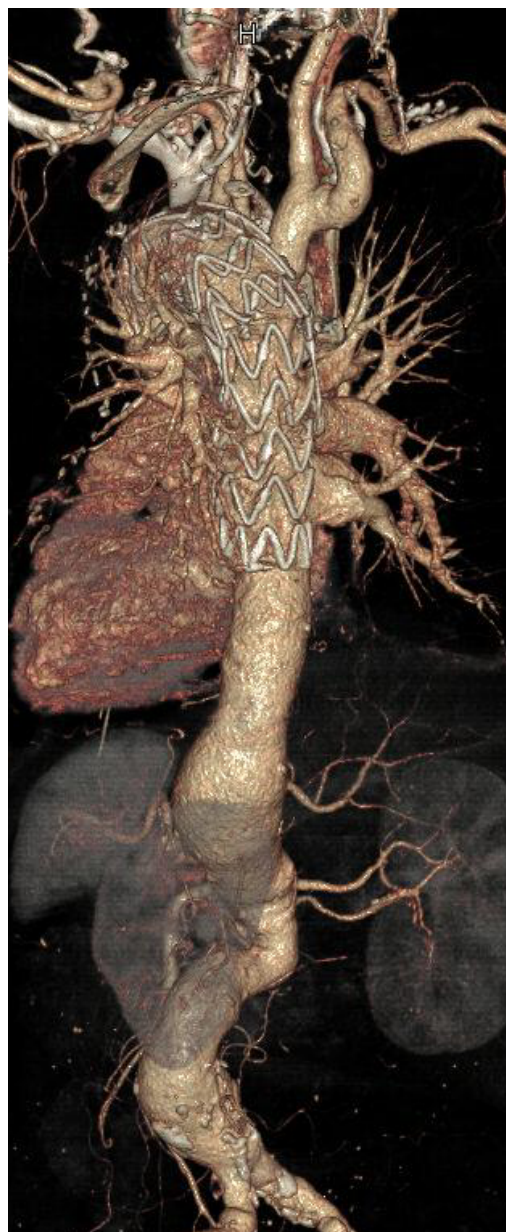
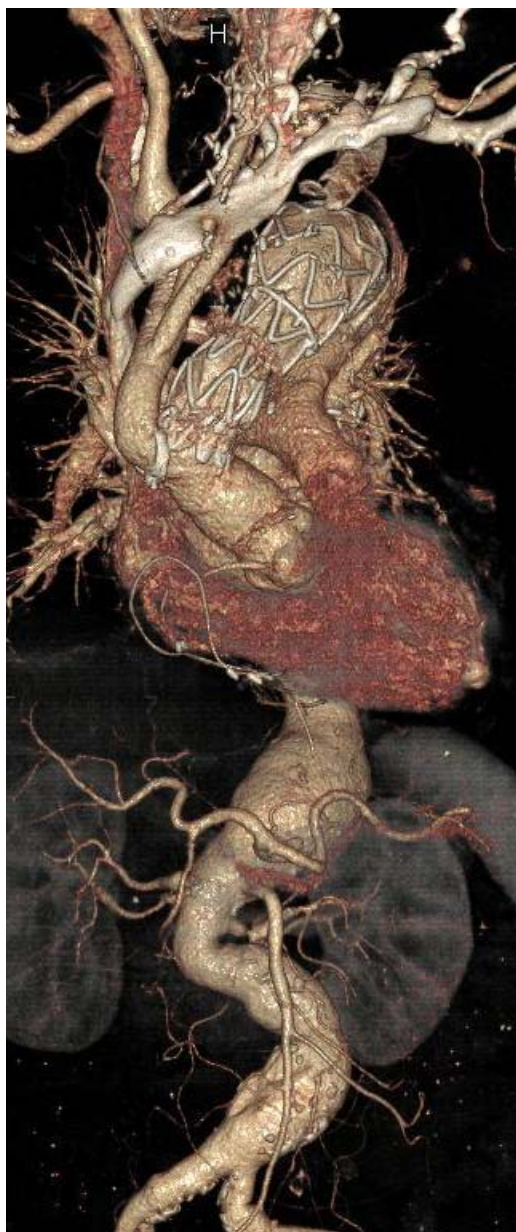






**.Valiant® Thoracic Stentgraft (Medtronic, Santa Rosa, California) :
.Made of 40-36 mm tapered diameter & 150mm length**

Post-stent graft-CT-Aorta



Proposed classification-2 (TAAD)

.Classified based on :

**.Whether the arch is surgically replaced or excluded
with a stent-graft**

.Type I, type II hybrid arch repairs

.By Koullias GJ, et al.

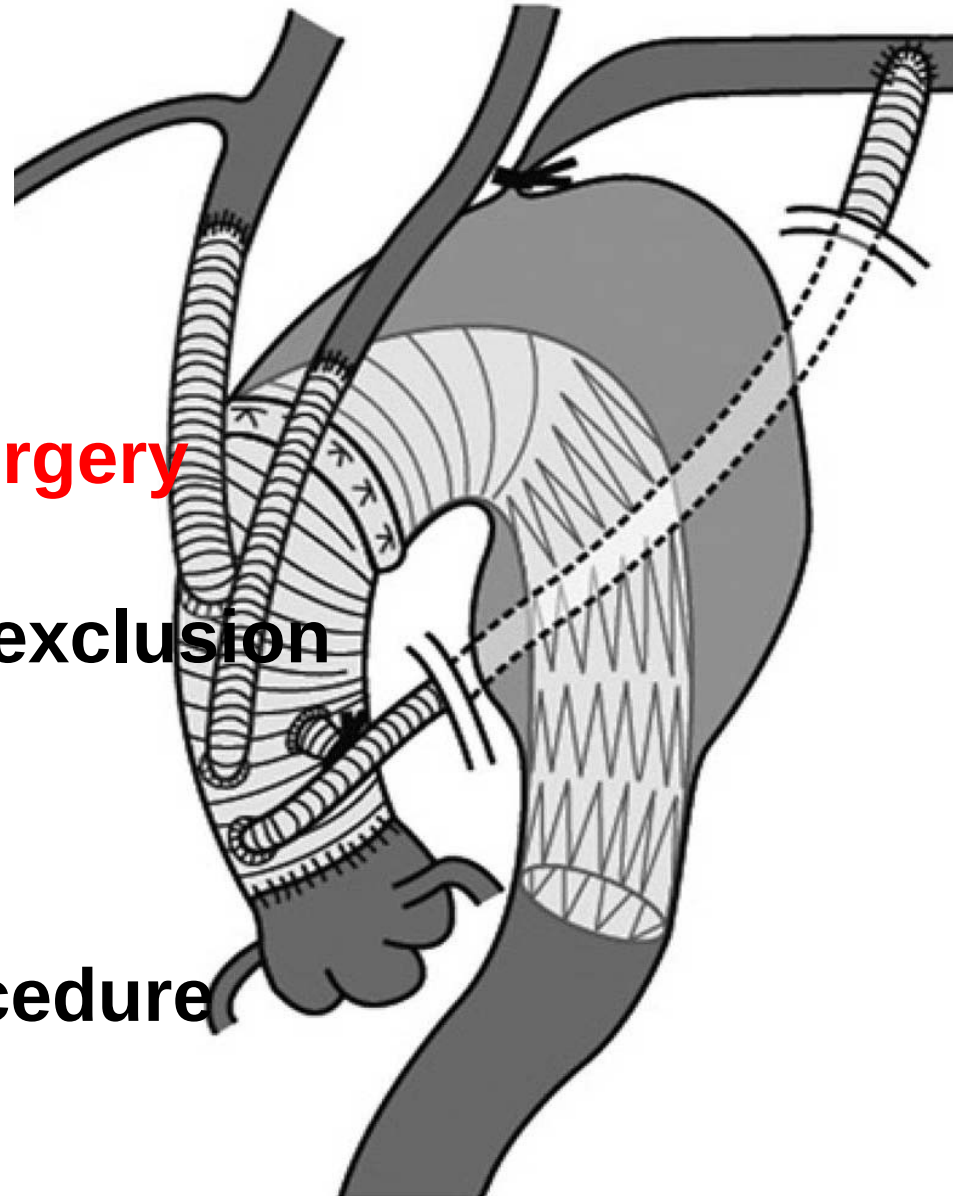
.Type I hybrid repair:

.Arch should be treated with surgery

.SG extends treatment area by exclusion

.Role of TEVAR is secondary

.Ex) Frozen elephant trunk procedure



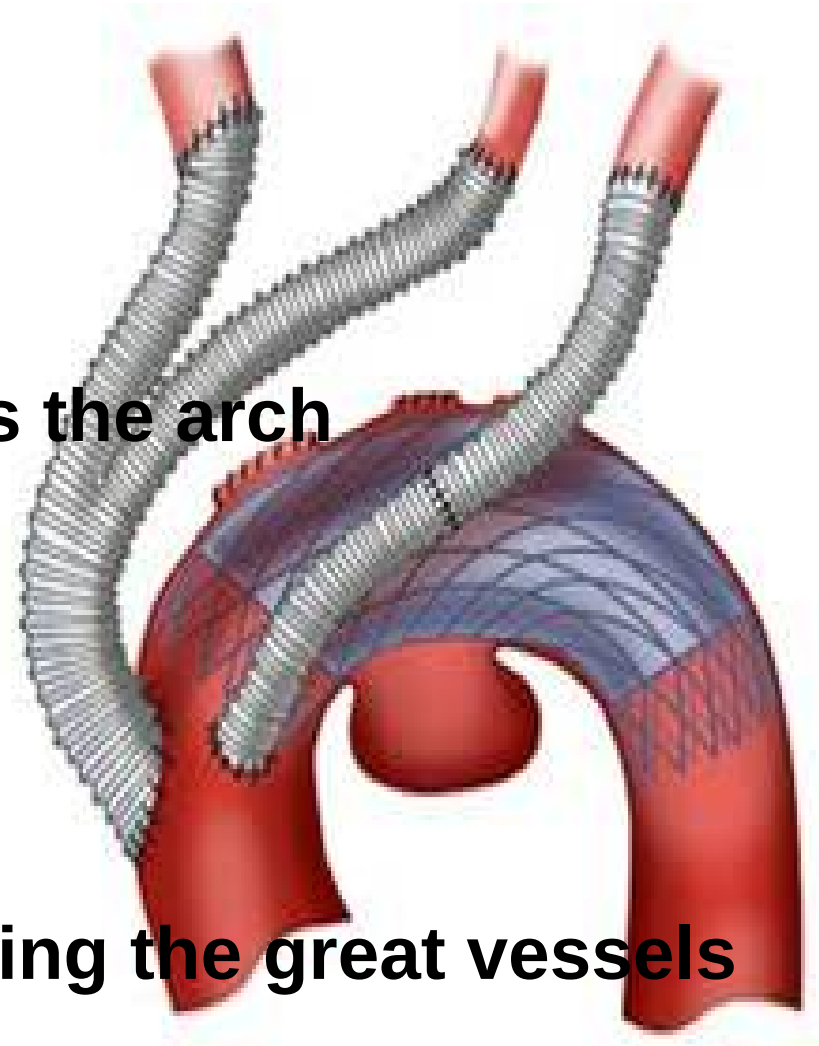
.Type II hybrid repair:

.Arch is retained but SG excludes the arch

.Role of TEVAR is primary

.Open surgical component :

.An adjunctive for revascularizing the great vessels



Safety & efficacy (in TAA / TAD)

- .Acceptable mortality & morbidity**
- .Higher incidence of early endovascular leaks :**
 - .High resolution at 6 months of follow-up (90%)**
- .Long term results are unknown**

State-of-the-Art of Hybrid Procedures for the Aortic Arch: A Meta-Analysis

.15 studies with 463 patients

.Outcomes :

.30-day mortality (8.3%)

.Stroke (4.4%)

.Paraplegia (3.9%)

.Endoleak rates (9.2%)

.Results compare favorably with surgery

Hybrid repair of thoracic aortic lesions for zone 0 and 1 in high-risk patients

.N=38 (Zone 0;n=27, zone 1;n=11), follow-up of 28 months

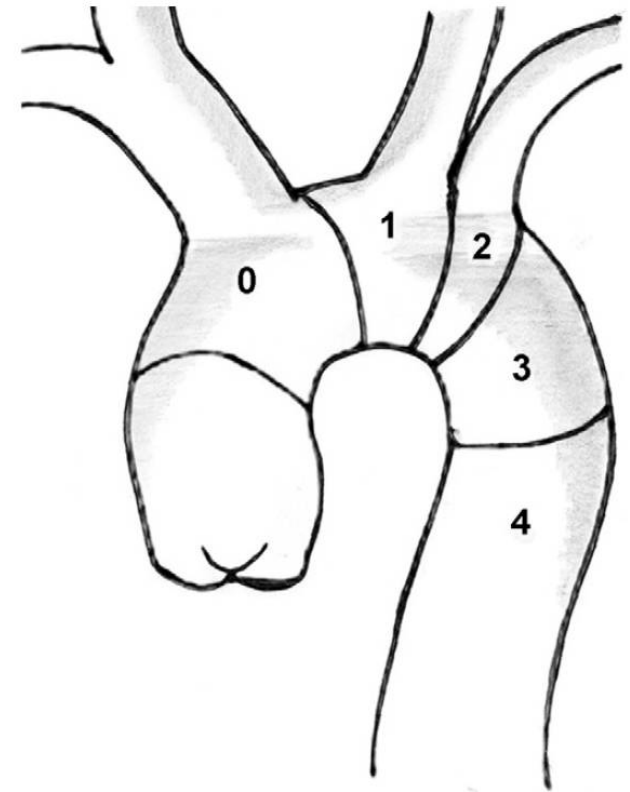
.Outcomes :

.Post op HD (7.9%)

.Paraplegia (2.7%)

.Stroke (13.1%)

.Overall 30-day mortality (23.7%)



Hybrid Aortic Arch Debranching With Staged Endovascular Completion in DeBakey Type I Aortic Dissection

.Midterm results of a hybrid approach to DeBakey type I AD

.Outcomes :

.Hospital mortality (4.2%)

.Complete thrombosis of the residual distal FL (95.6%)

.Overall actuarial survival at 28 months ($92.1 \pm 7.9\%$)

Thoracoabdominal aneurysm-dissection

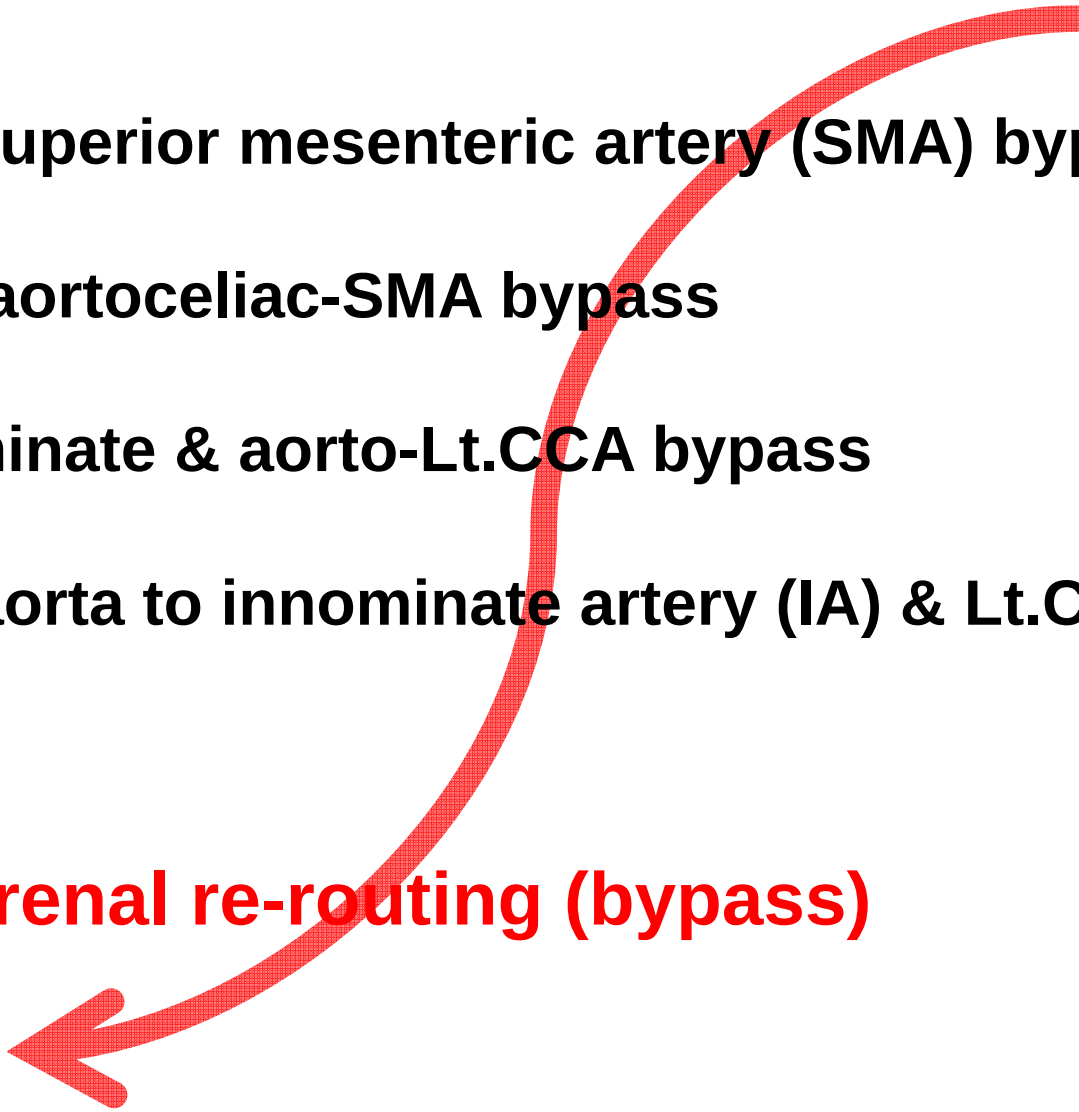
- .A fundamental **problem** in the surgery :
 - .**Extensive aortic exposure & prolonged interruption of aortic flow to the visceral branches** while excluding the aneurysm itself from circulation
- .Associated with remarkable morbidity & mortality rates

Benefit of hybrid approach

.Not require thoracotomy :

- .Fewer systematic & cardiac complications**
- .Less postoperative pain & blood loss**
- .Fewer coagulation disorders**
- .Reduced rate of spinal cord injury**
- .Reduced duration of mesenteric & visceral ischemia**
- .Reduced renal failure**

Various surgical procedures

- .Iliac-celiac-superior mesenteric artery (SMA) bypass
 - .Retrograde aortoceliac-SMA bypass
 - .Aorto-innominate & aorto-Lt.CCA bypass
 - .Ascending aorta to innominate artery (IA) & Lt.CCA bypass
 - .Visceral or renal re-routing (bypass)**
- 

Single or staged (2nd stage) procedure

.Single stage strategy :

- .Eliminate the risk of intersurgical aortic rupture**
- .Offer a prompt iliac or aortic access site**
(when femoral accesses are not adequate)

.Two staged approach :

- .Reduces the burden of procedure**
- .Theoretically, reduces the risk of coagulopathy**

Safety & efficacy (in thoracoabdominal aortic pathology)

- .Reduce complications in the average, low risk patient**
- .Extend the indications for repair to patients considered higher risk based on age, co-morbidities, or anatomic considerations**
- .Debate – high risk patients (outcomes of meta-analysis)**

Hybrid procedures for thoracoabdominal aortic aneurysms and chronic aortic dissections – A single center experience in 28 patients

.Mean follow up 22 months, upto 6 years

.Outcomes :

.30 days mortality rate (14.3%)

.Overall survival rate at 3 years (70%)

.Type I endoleak rate (8%)

.Permanent paraplegia rate (11%)

Combined endovascular and surgical approach (CESA) to thoracoabdominal aortic pathology: A 10-year experience

.In high risk patients :
.Acceptable morbidity & mortality

**.Mean follow up of 16.6 months (range, 1-119 months)
with a hybrid approach in 20 patients**

.Outcomes :

.No perioperative mortality

.Cumulative survival at two years (76%)

.Two stage approach is preferable

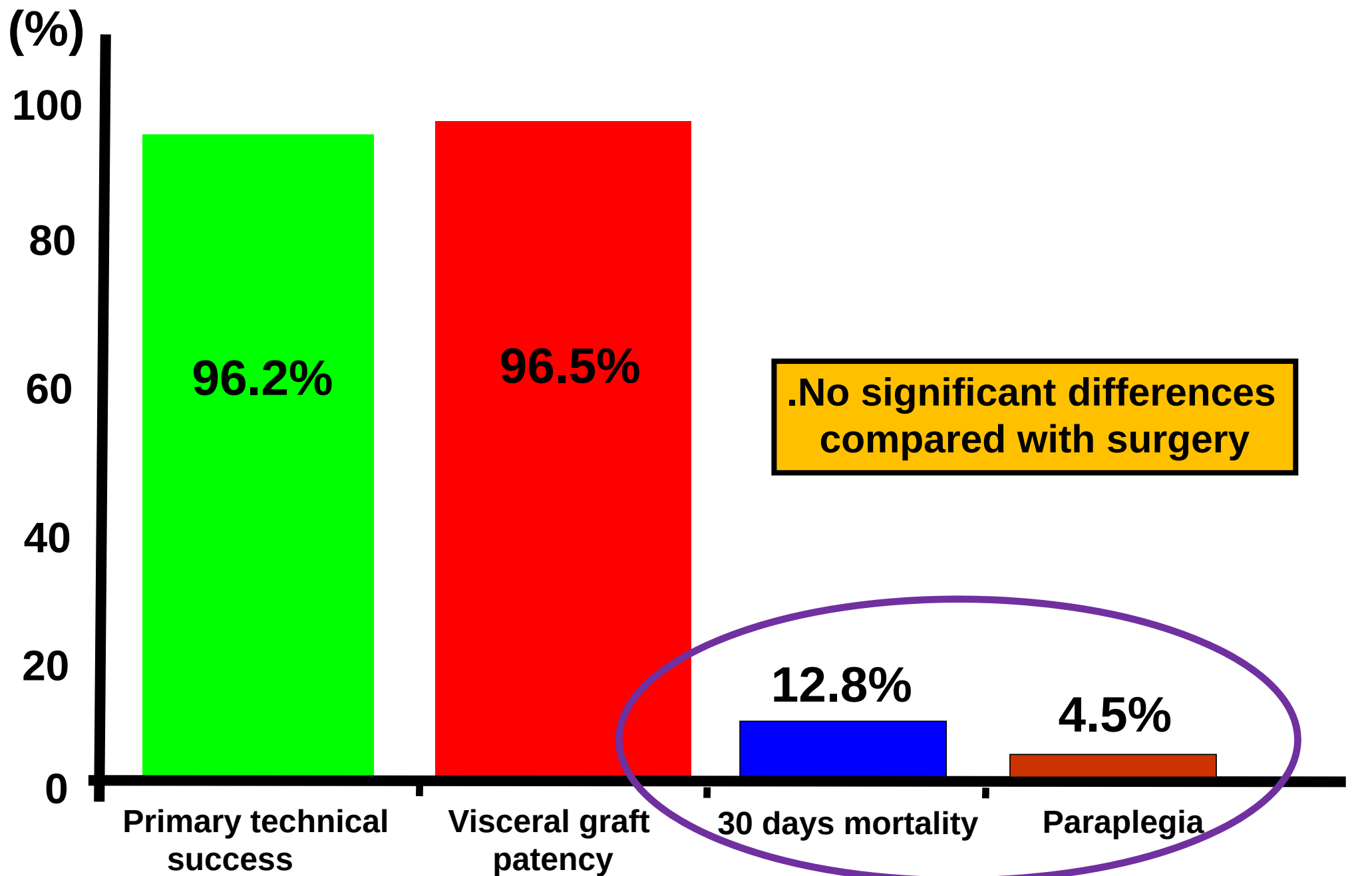
Hybrid Open Endovascular Technique for Aortic Thoracoabdominal Pathologies

.Meta-analysis

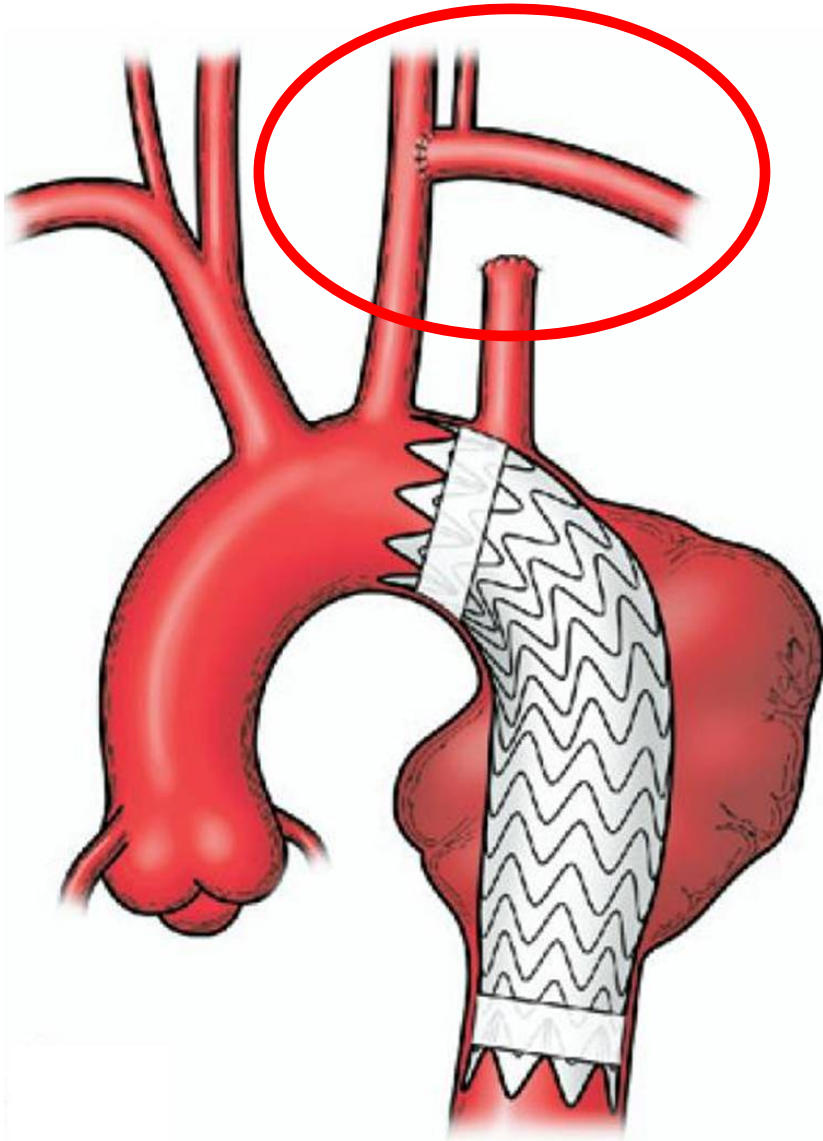
.To assess **the safety & efficacy** of these technique :

.19 studies with a total of 507 patients

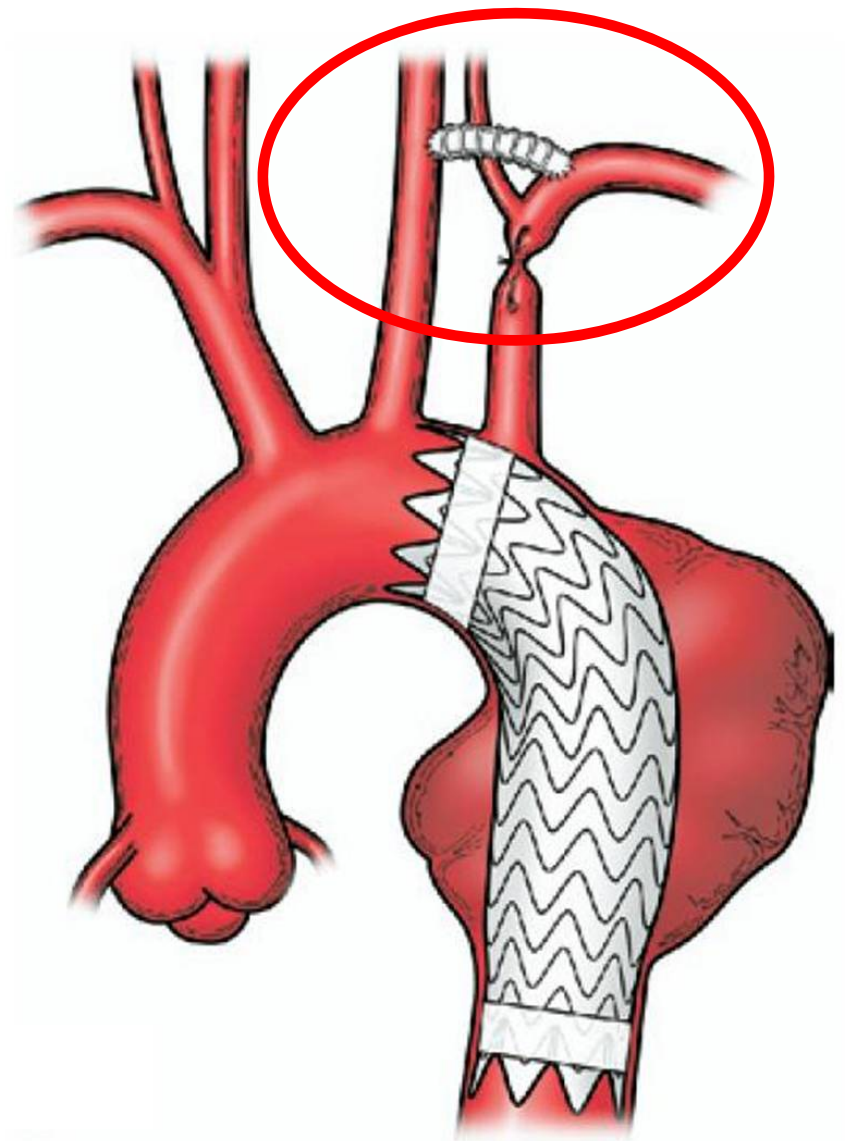
.Technical success, **visceral graft patency**, spinal cord ischemia, renal insufficiency, & **30 days mortality**



LSA coverage during TEVAR



Or



.Up 40% of patients undergoing TEVAR :

.Pathology that extends near the LSA

.Debate regarding the operative management of the LSA :

.Satisfactory outcomes with intentional coverage

.Revascularization to reduce the incidence of complications
such as stroke, paraplegia, arm ischemia

The Society for Vascular Surgery Practice Guidelines: Management of the left subclavian artery with thoracic endovascular aortic repair

.Recommendation, but very low evidence

.Rec 1 :

.In elective TEVAR (coverage of LSA for SG sealing)

.Suggest routine pre-op revascularization

.Rec 3 :

.In urgent TEVAR (life threatening condition)

.Suggest that revascularization should be individualized

.Rec 2 :

.In anatomy that compromises perfusion to critical organ

.Strongly recommended routine pre-op revascularization :

.Presence of a patent LIMA to CABG

.Stenotic or poor developed Rt.VA

.Functioning AVF in the Lt.arm (HD patient)

.Prior infra-renal aortic repair with ligation of lumbar artery

.Hypogastric artery occlusion

.Abnormality of Lt.VA or vertebrobasilar collaterals

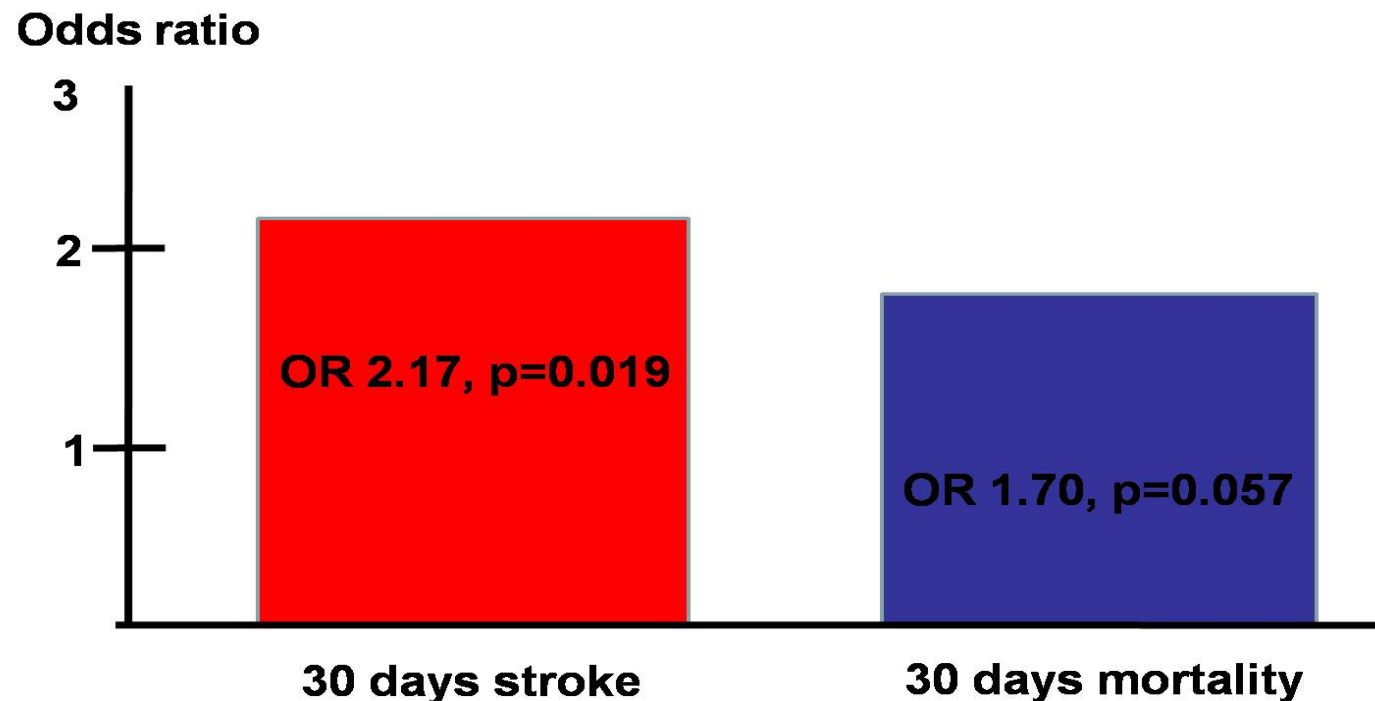
Outcomes of the endovascular management of aortic arch aneurysm: Implications for management of the left subclavian artery

<i>Outcome</i>	<i>Revascularized (n = 35)</i>	<i>Not revascularized (n = 43)</i>	<i>P value</i>
Stroke, No. (%)	0	5 (11.6)	.061
Paraplegia, No. (%)	0	3 (6.98)	.248
Death, No. (%)	0	6 (14.0)	.03
Combined outcome, No. (%)	0	12 (27.9)	<.0001

Left subclavian artery coverage during thoracic endovascular aortic repair and risk of perioperative stroke or death

.30 days-stroke or mortality (no cover, n=454 vs cover, n=279) :

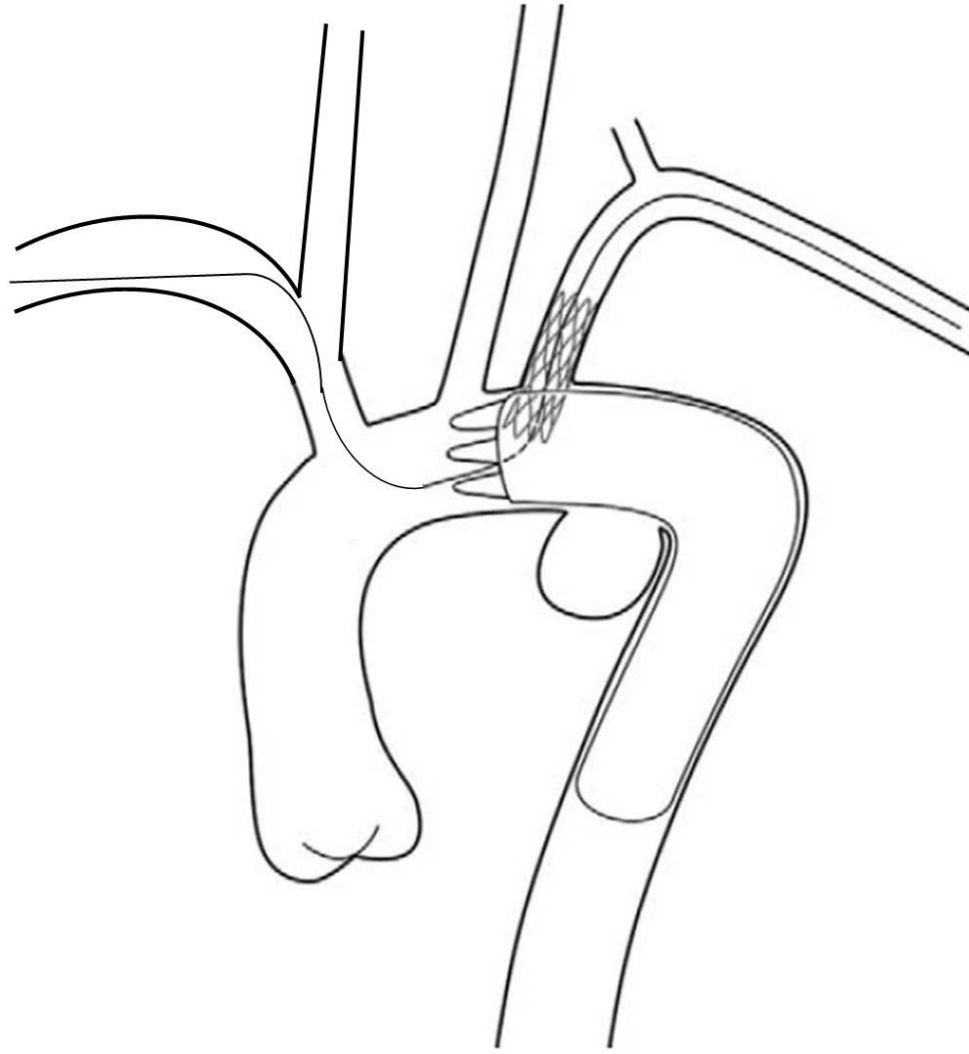
.Stroke rate 5.7%, mortality rate 7.0%



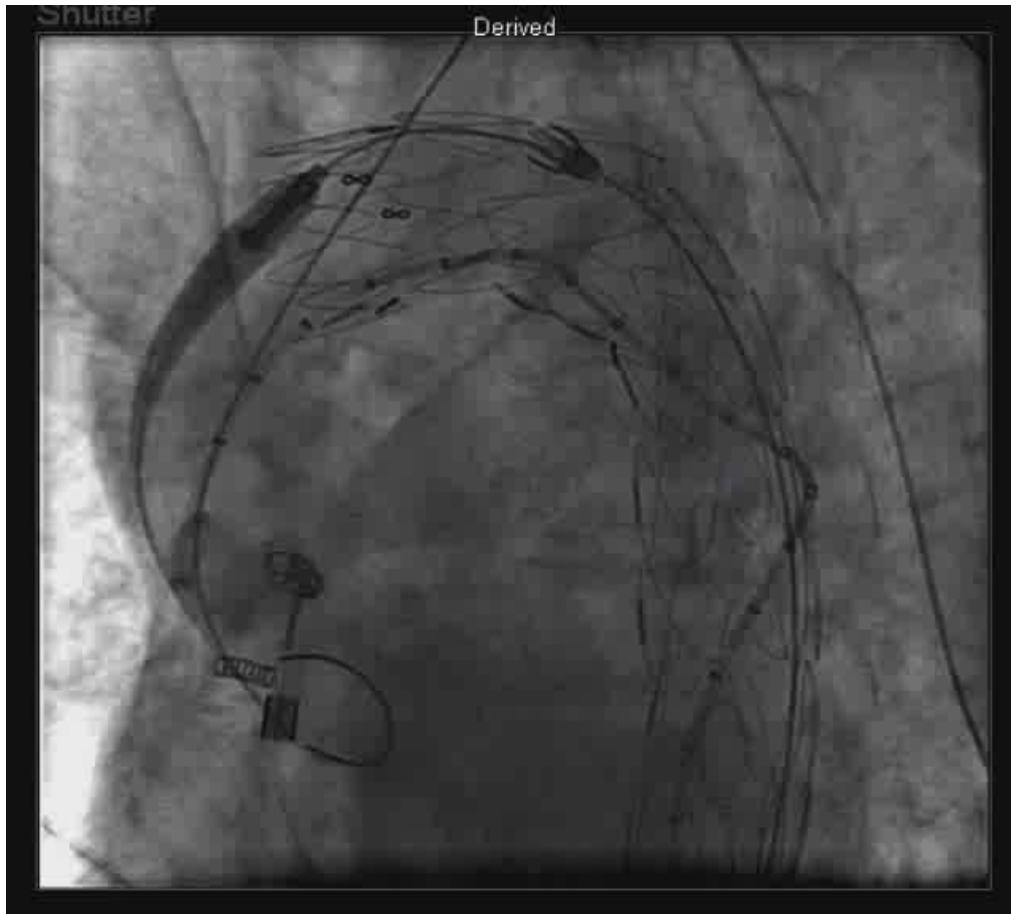


.Post-traumatic aortic pseudo-aneurysm
.Left.hemothorax with multiple rib fracture

Modified TEVAR with chimney technique



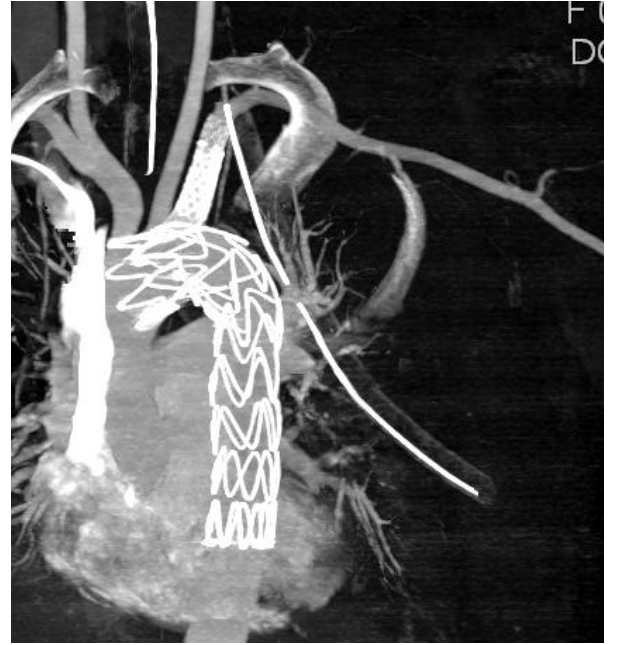
SG deployment



Shutter

Derived





Conclusion

.Selection of hybrid approach :

.High-risk for surgery

.Inadequate length of the landing zone

.Results compare favorably with surgery (in TAA / TAD)

.Debate in patients with thoracoabdominal aortic pathology

.Revascularization of LSA before endovascular stenting

Thanks yours attention

