Does a Frozen Elephant Trunk Approach Make an Open Technique Obsolete?

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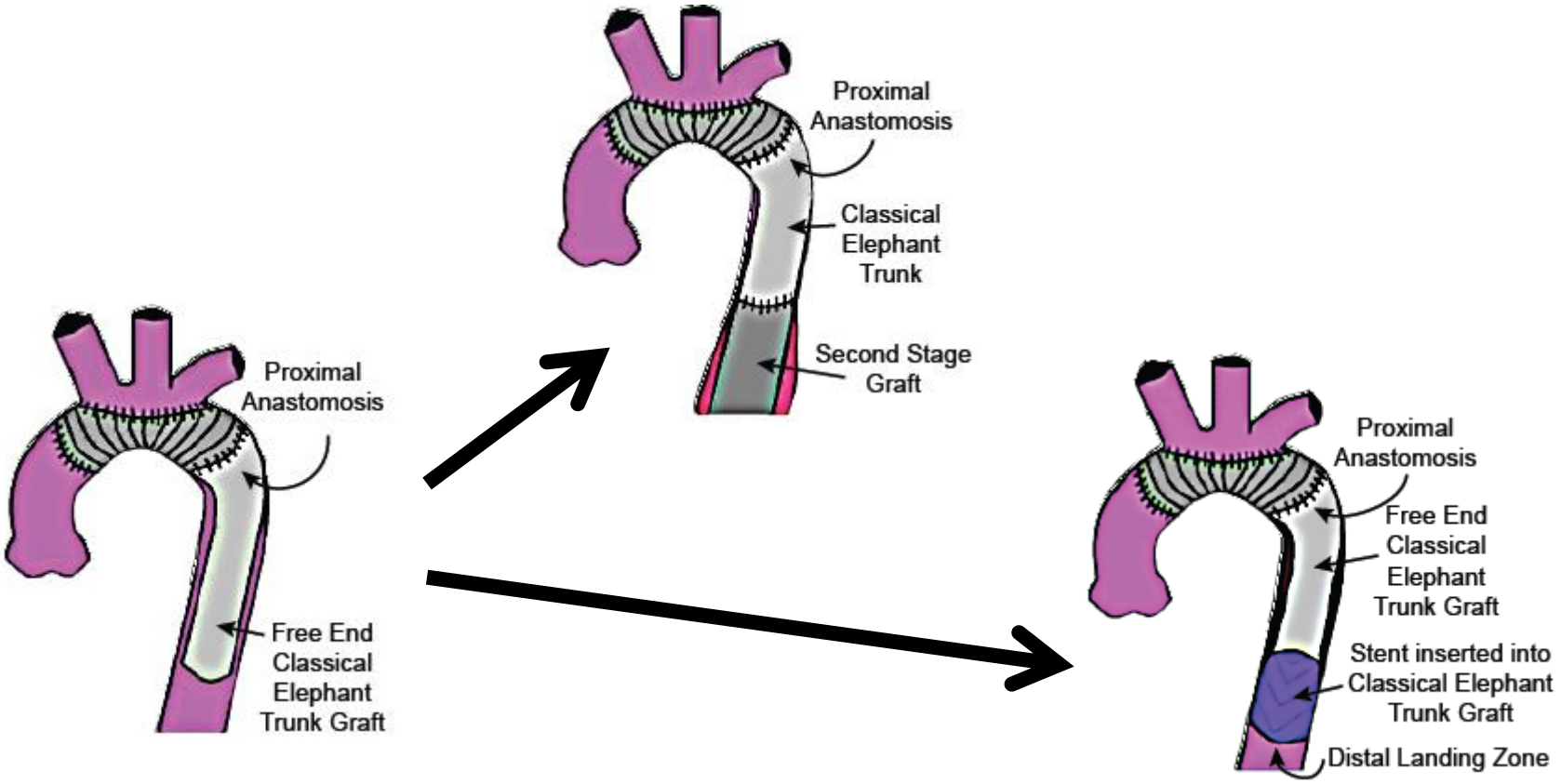
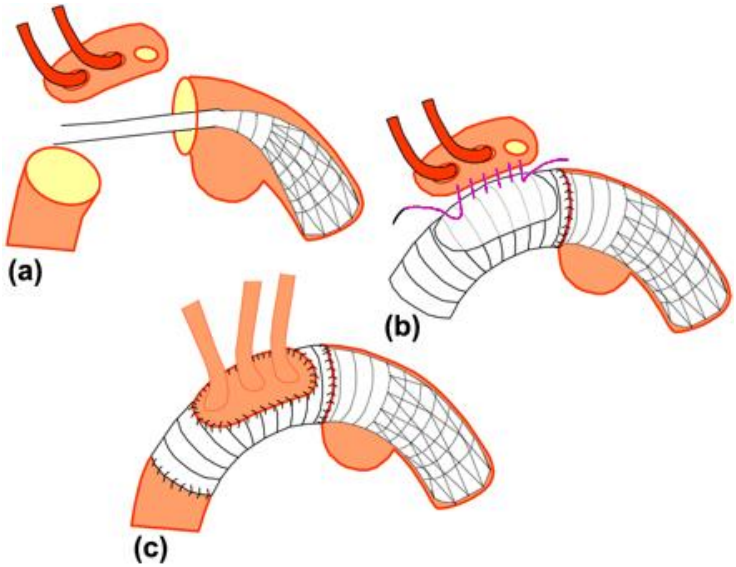
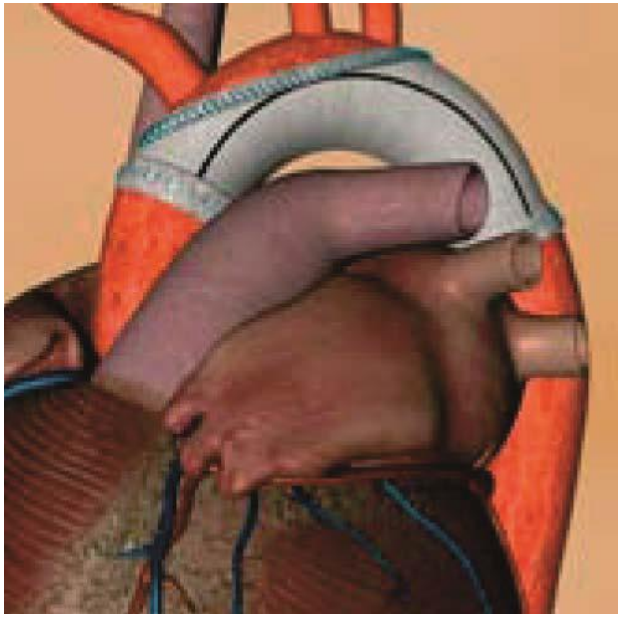
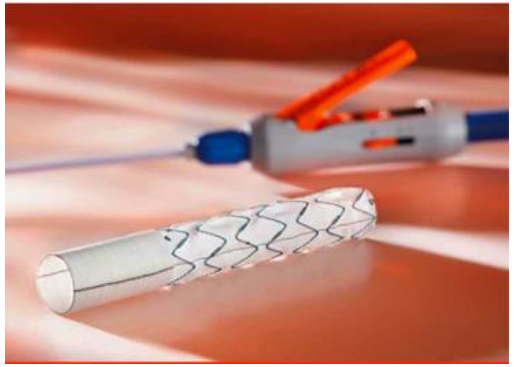
The Frozen Elephant Trunk Technique Using a Hybrid Prosthesis



Surgical Approach







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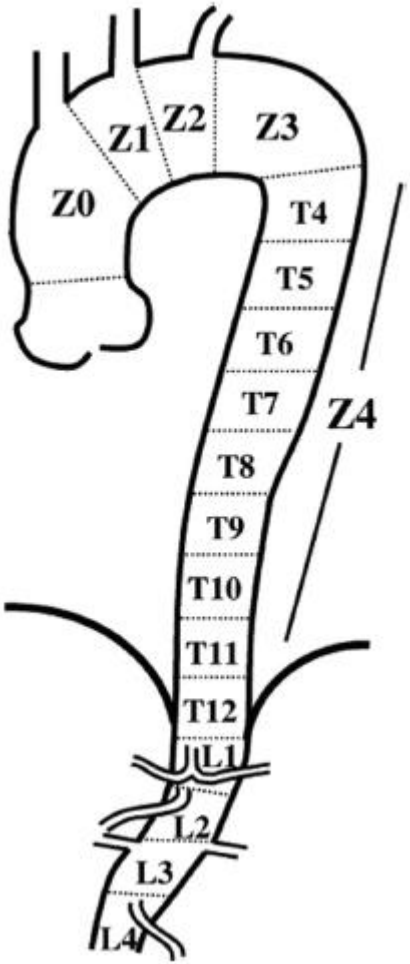


1. Aortic aneurysm extending proximal and distal to the LSCA

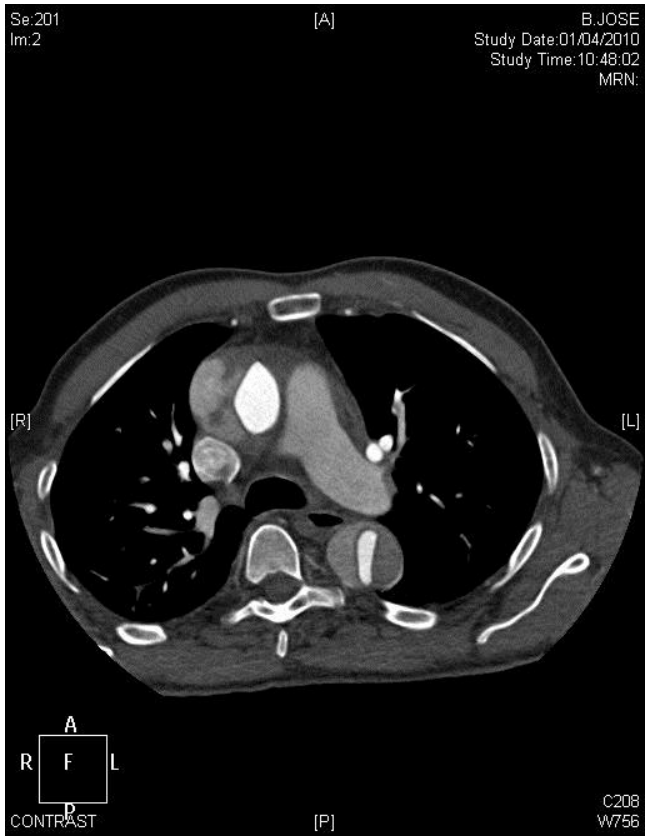
2. Saccular aneurysms of the distal arch

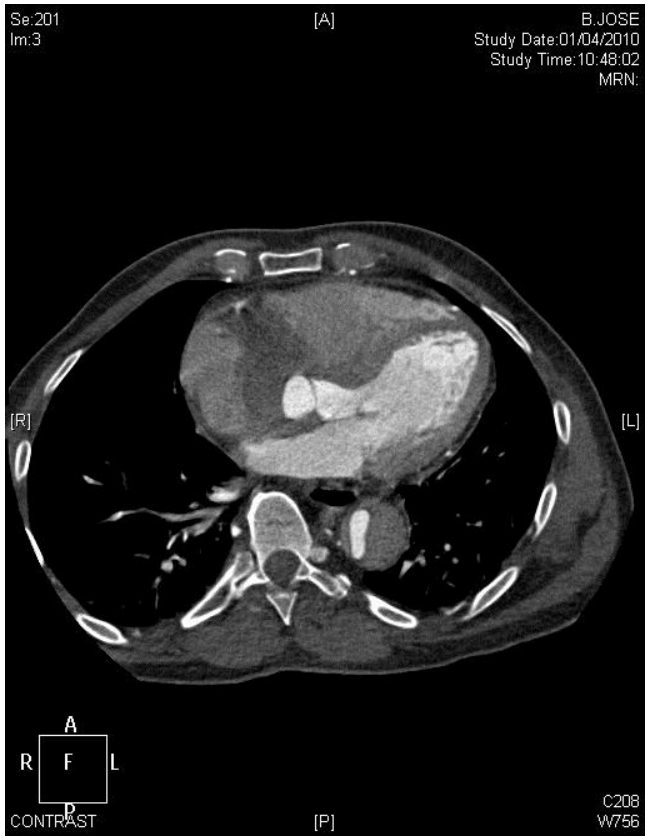
3. Chronic type A or type B aortic dissection

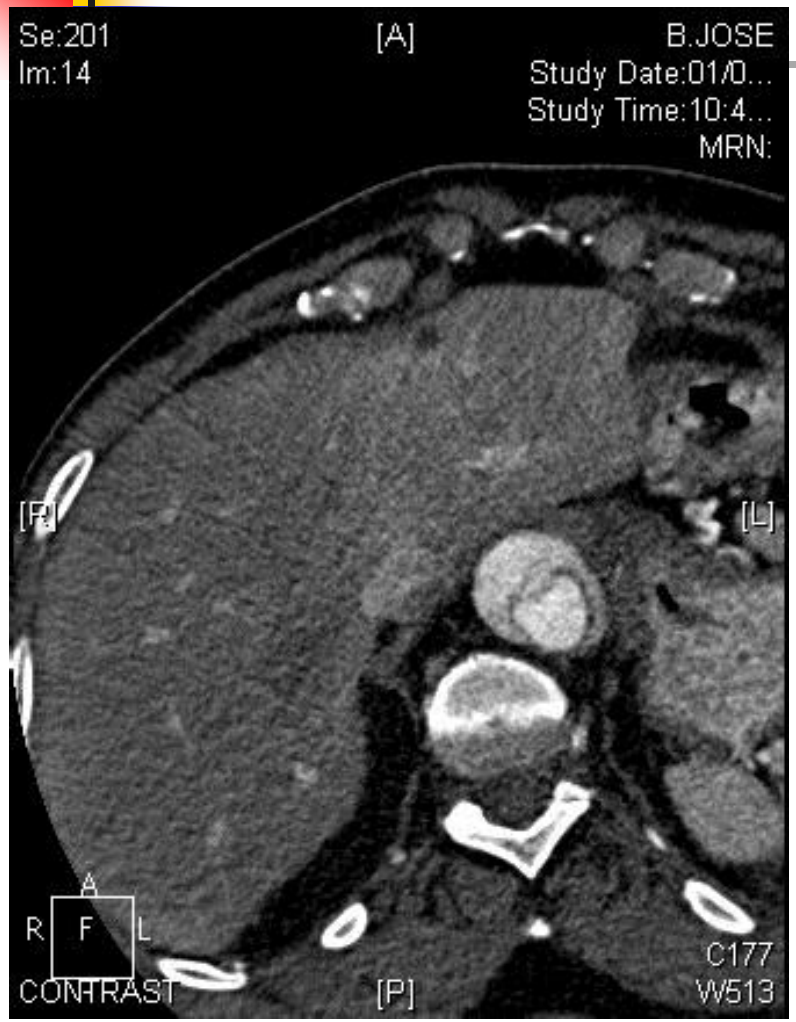
4. Acute type A dissection with distal re-entry and/or dynamic malperfusion

5. Complicated acute type B dissection not eligible for TEVAR

Case 1: Acute TAAD with Digestive Malperfusion



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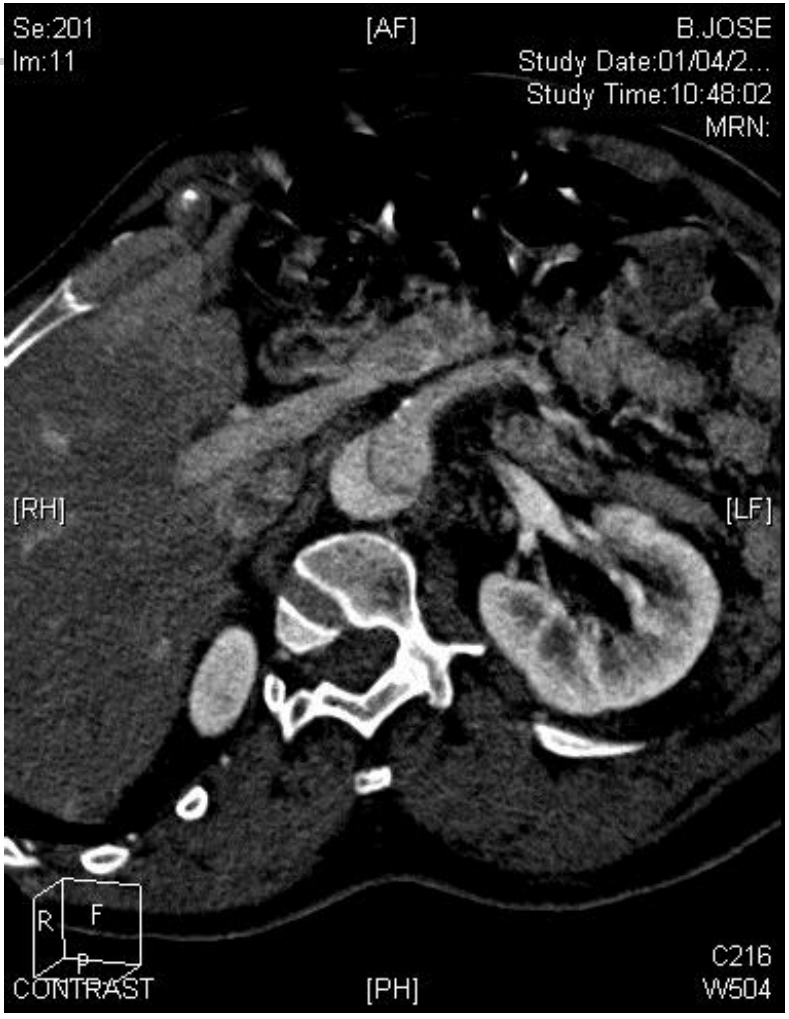
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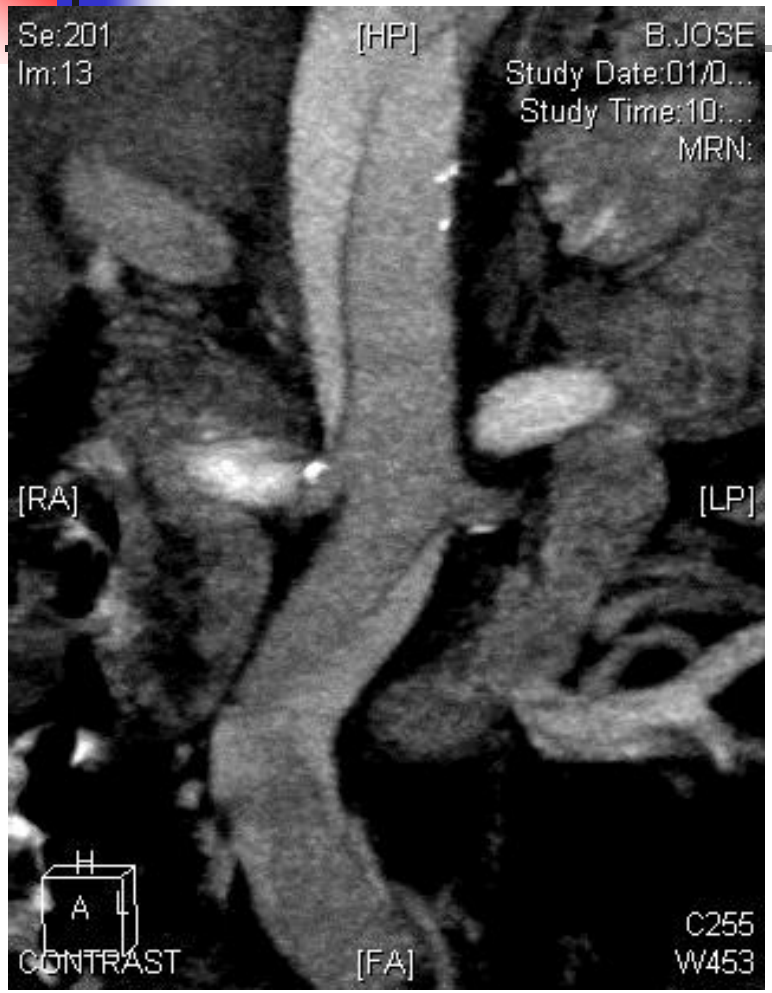
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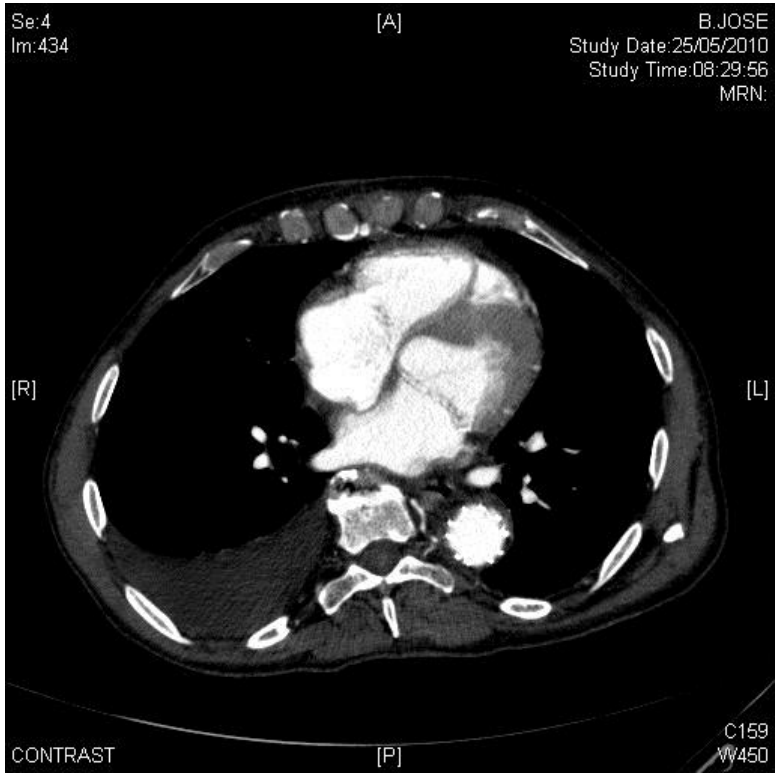
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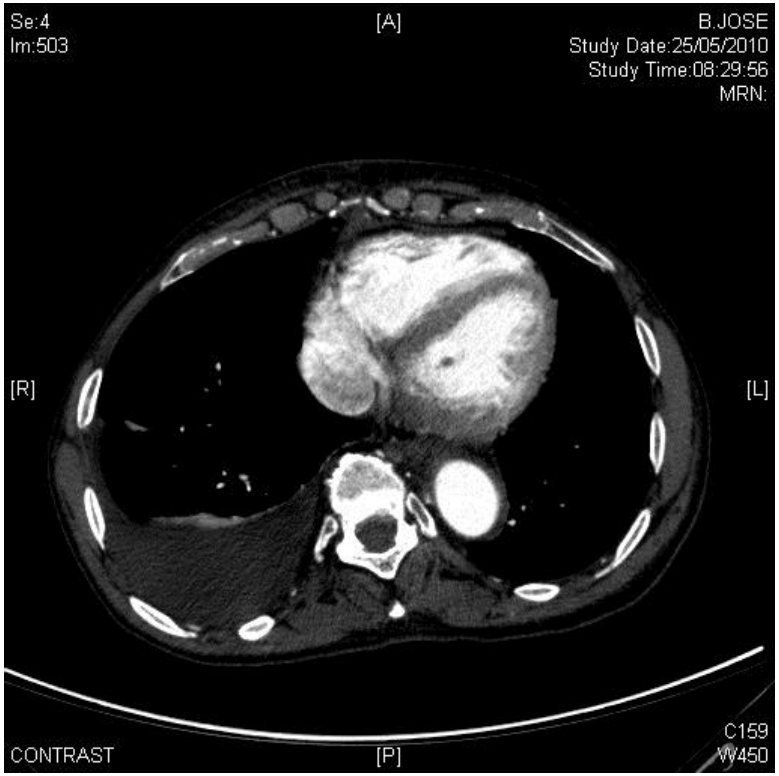
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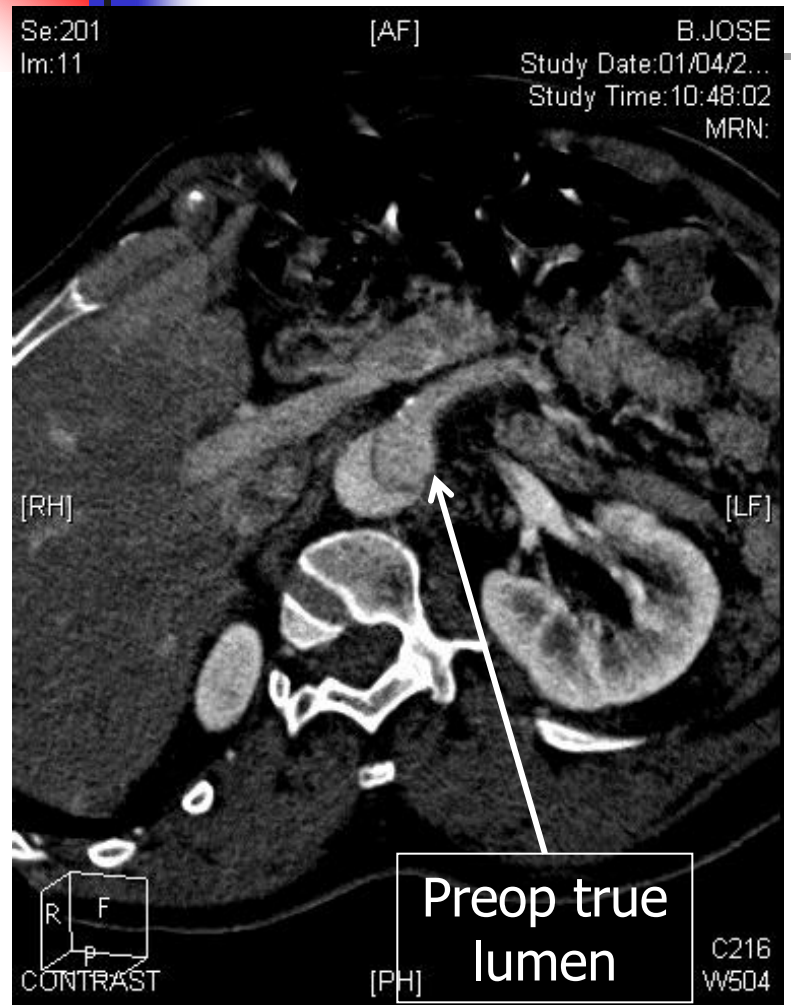
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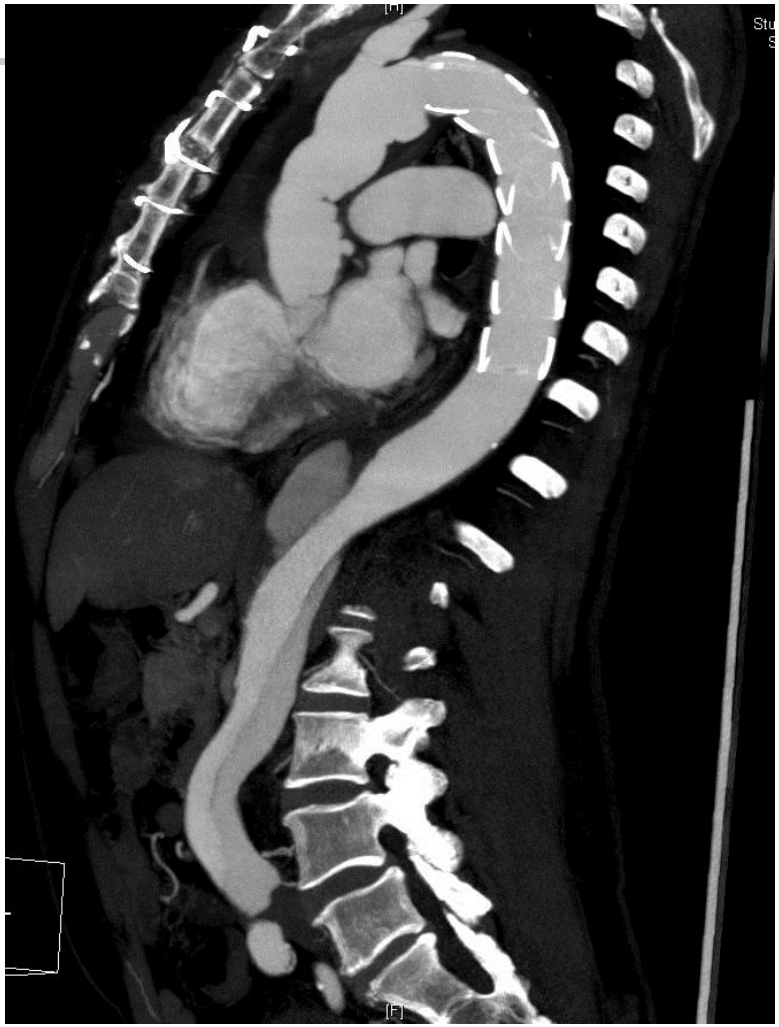
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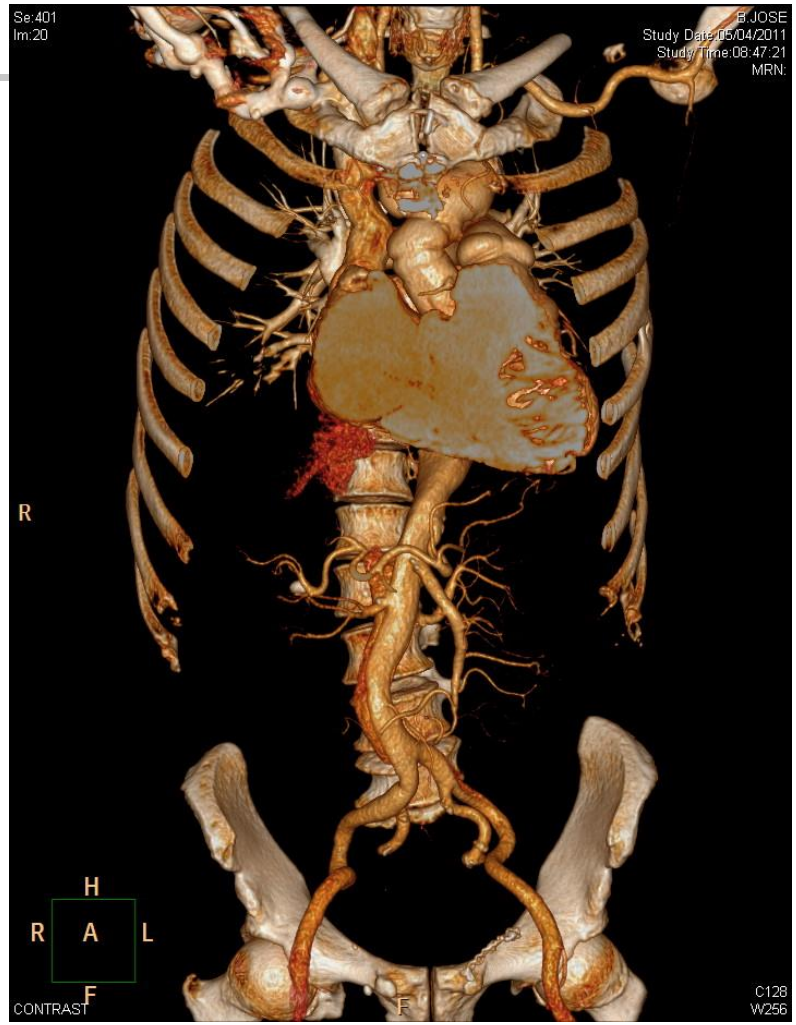
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Two Years Evolution

Influence of Operative Strategy for the Aortic Arch in DeBakey Type I Aortic Dissection: Analysis of the German Registry for Acute Aortic Dissection Type A

- **OBJECTIVE:** to analyze the operative strategy for treatment of type I DeBakey aortic dissection from the German Registry for Acute Aortic Dissection Type A (GERAADA) data.
- **METHODS:** Group A: replacement of the ascending aorta with hemiarch. Group B: total arch replacement or conventional or frozen elephant trunk.
- **RESULTS:** 518 patients in group A and 140 patients in group B were treated. 30-day mortality of 20.2%, 18.7% in group A compared with 25.7% in group B ($p = 0.067$), the onset of new neurologic deficit (13.6% *vs* 12.5%, $p = 0.78$) and new malperfusion deficit (8.4% *vs* 10.7%, $p = 0.53$) showed no statistical difference.
- **CONCLUSIONS:** a more aggressive approach can be applied without higher perioperative risk even in the onset of a TAAD

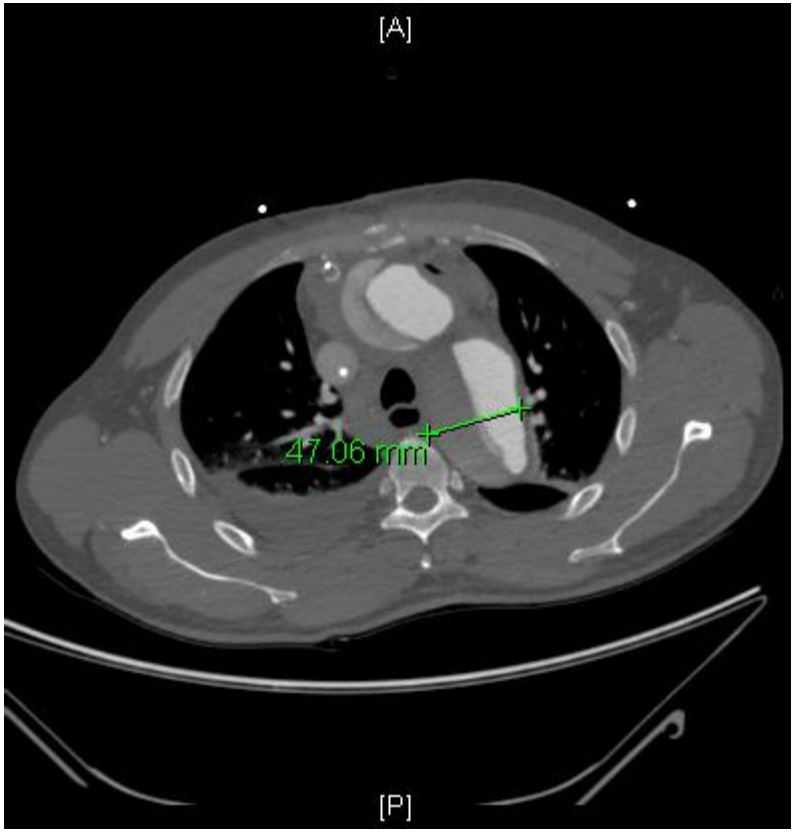
Easo J. *J Thorac Cardiovasc Surg* 2012;144:617-23

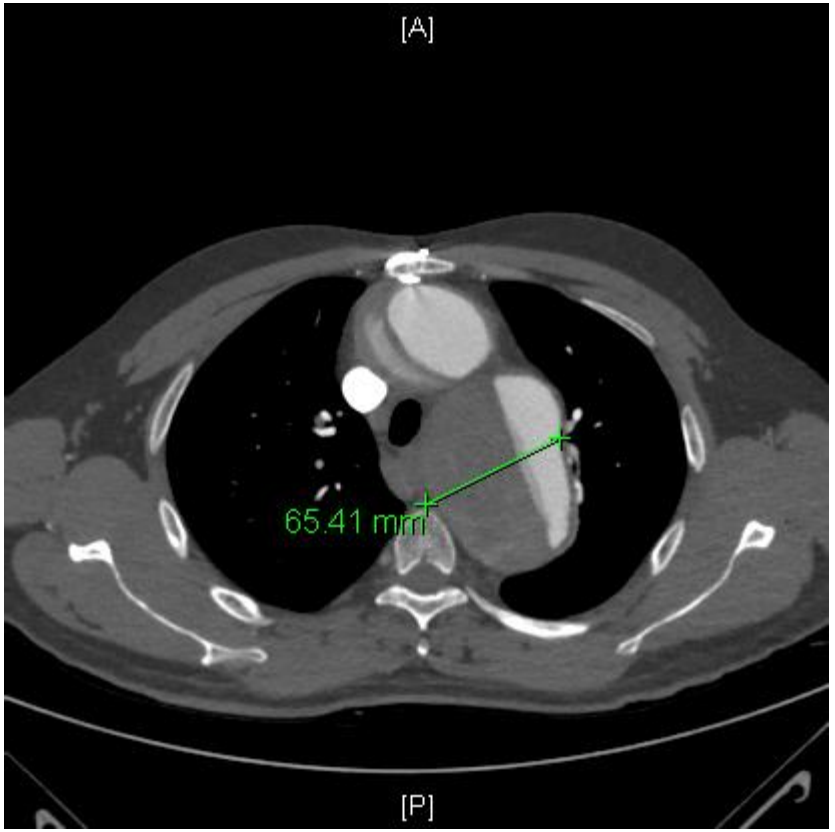
Might type A acute dissection repair with the addition of a frozen elephant trunk improve long-term survival compared to standard repair?

	Without (N)/With (Y)	Inhospital Mortality/morbidity	False lumen Pattency	Redo on the Descending Aorta
Jacob (2008)	22/23	NS	89%/10%	33%/10%
Pochettino (2009)	42/36	Mortality NS TIA > groupe N Medullar isch > group Y	75%/23%	10%/0%
Uchida (2009)	55/65	ns	?/0%	?/2%
Sun (2009)	-/107	Mortality 4,7% Neuro Events 5,6%	-/5%	-/0%

Murzi M. *Interact Cardiovasc Thorac Surg* 2010;11:98-102

Case 2: Isthmic Dilatation after Acute TAAD Surgery





Postoperative CT-Scan

The Frozen Elephant Trunk for the Treatment of Chronic Dissection of the Thoracic aorta: a Multicenter Experience

- 90 patients, 77% TAAD, 69% aortic redo
- No standardized approach for the ascending aorta
- *Contrasted results…*

Inhospital mortality	12,2%
Permanent TIA	1,1%
BUT	
Medullar Ischemia	8,9%
ARI	20%
Ventilation >72H	31%

Pacini D. *Ann Thorac Surg* 2011;92:1663-70

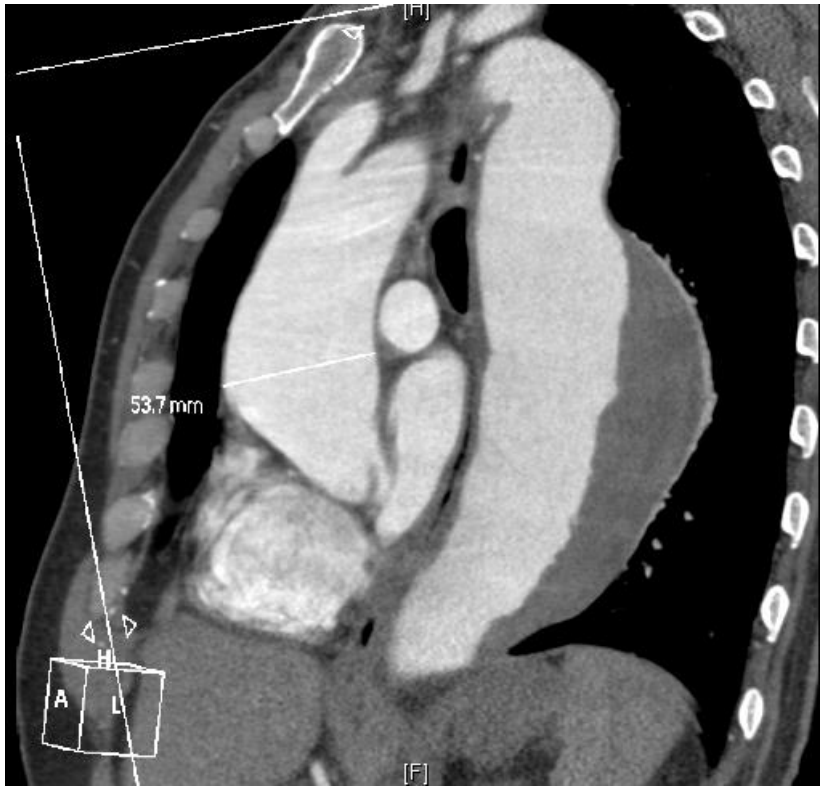
Follow Up

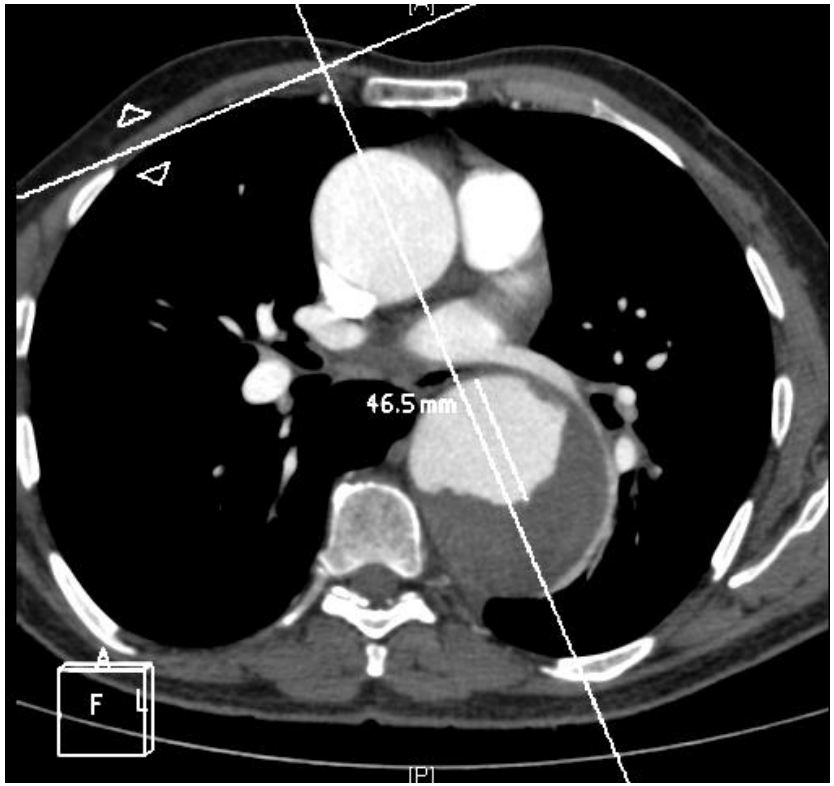
- Mean Follow Up for 20±16 months in 80% of the survivors

Periprosthetic thrombosis	92%
Thoracic false lumen thrombosis	48%
Abdominal false lumen thrombosis	19%
Descending aorta redo (open/TEVAR)	22,5%
No reduction in aortic diameter	

Pacini D. *Ann Thorac Surg* 2011;92:1663-70

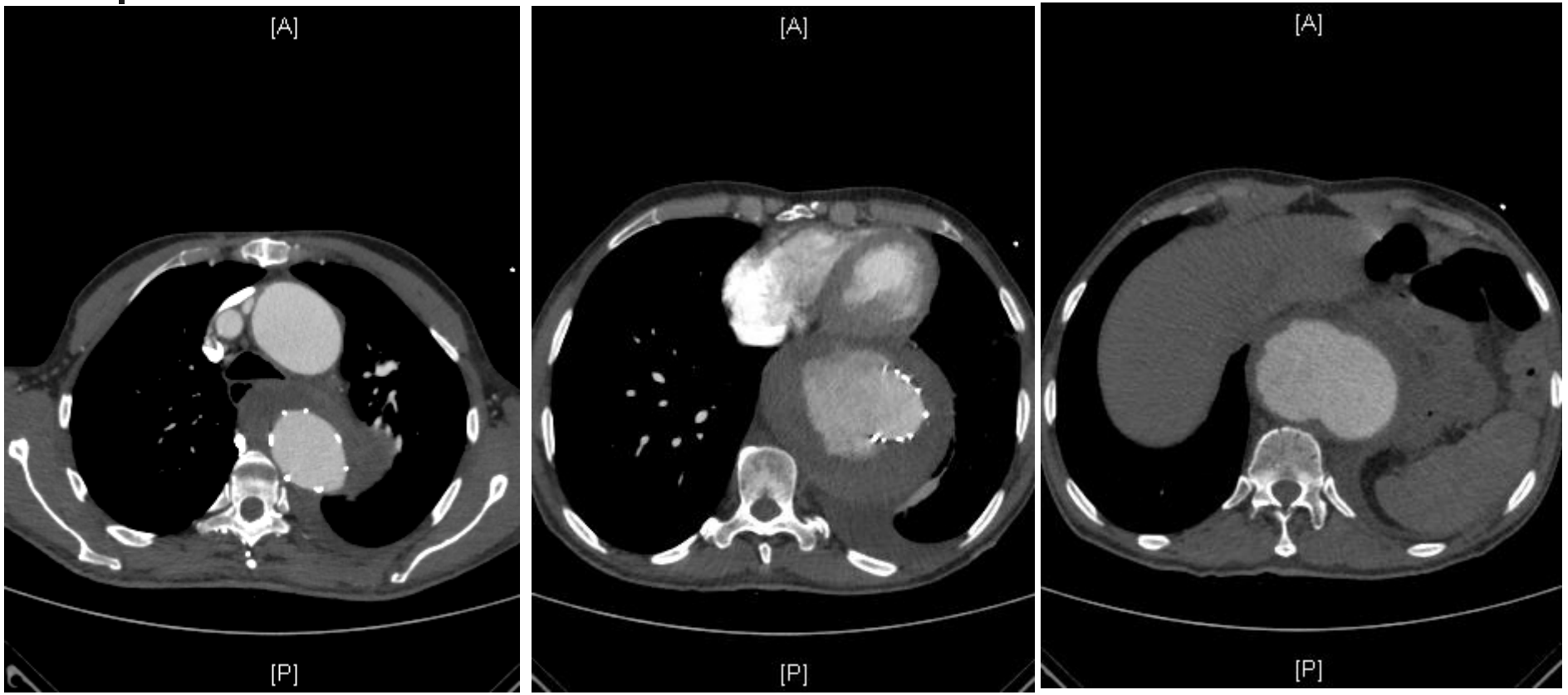
Case 3: Ascending and Descending Aortic Aneurysm





Additional TEVAR (44mm Valiant®)

Two Years Evolution



The Frozen Elephant Trunk Technique for Treatment of Thoracic Aortic Aneurysms

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Background. The frozen elephant trunk technique allows for single-stage repair of combined aortic arch and descending aortic aneurysms using a hybrid prosthesis with a stented and a nonstented end. This report summarizes the operative and follow-up data (mean follow-up: 20 months) with this new treatment.

Methods. Between September 2001 and March 2006, 39 patients (15 women; mean age, 62 years) were operated on after approval by the local Institutional Review Board. Indications for operation were aneurysms in 18 patients and aortic dissections in 21. The stented end of the hybrid prosthesis was placed through the opened aortic arch under fluoroscopic control using hypothermic circulatory arrest and selective antegrade cerebral perfusion.

Results. All patients survived the procedure. Five patients (12.8%) died early postoperatively, with two deaths directly related to the procedure. Symptoms of neurologic dysfunction developed in 5 patients and resolved completely in 2. In 1 patient, the descending aorta was perforated owing to misplacement of the stented end of the hybrid prosthesis. In 23 of 25 patients with postoperative computed tomography imaging (>6 months postoperatively), complete thrombus formation around the frozen elephant trunk was observed.

Conclusions. This procedure is performed through a median sternotomy and combines the concepts of the elephant trunk principle and endovascular stenting of descending aortic aneurysms. Favorable intraoperative and postoperative results in the follow-up with thrombus formation around the stented descending aortic segment has encouraged us to evaluate all patients with thoracic aneurysms extending proximal and distal of the left subclavian artery for this treatment.

(Ann Thorac Surg 2007;83:S819–23)
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Patients with extensive aortic aneurysms involving the ascending aorta, aortic arch, and the descending aorta are still considered to be a challenge for many cardiovascular surgeons [1]. In this context, major concerns include the adequate protection of the heart, the management of the aortic valve, the protection of the brain, the avoidance of respiratory compromise, and the minimization of spinal cord injury and organ failure caused by prolonged circulatory arrest times.

In 1983, Borst and colleagues [2] introduced the elephant trunk procedure to facilitate staged surgery for the aortic arch and the distal aortic segments. The procedure involves the prosthetic replacement of the ascending aorta and the aortic arch with an elephant trunk extension of the arch graft into the descending aorta through a median sternotomy. In a second-stage operation, the elephant trunk can be extended to the desired level through a lateral thoracotomy; however, the cumulative risk for early mortality adds up to 15% after a stage-two repair. Furthermore, many patients fail to return for the second operation; they die owing to aortic rupture during the time interval between the procedures, or comorbidities preclude another procedure through a lateral thoracotomy [3, 4].

To complete the surgical treatment during a single operation through a median sternotomy, we introduced the "frozen elephant trunk" procedure [5]. A prototype, hybrid prosthesis stent graft (Chavan-Haverich endograft, Curative Medical Devices GmbH, Dresden, Germany) is placed into the descending aorta in an antegrade fashion though the opened aortic arch, and the ascending aorta and the aortic arch are replaced conventionally [5]. In this article we briefly report our surgical experience with this novel combined surgical and interventional approach.

Material and Methods

Patients

The frozen elephant trunk procedure was approved by the Institutional Review Board of Hannover Medical School. Between September 2001 and March 2006, 39 patients with combined pathologies of the aortic arch and the descending aorta were operated on using the hybrid prosthesis. Informed consent was required in each case. Mean patient age was 62 years (range, 37 to 78 years), and 11 patients were older than 70 years; 15 (38.5%) were women.

Presented at Aortic Surgery Symposium X, New York, NY, April 27–28, 2006.

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0003-4975/07/$32.00
doi:10.1016/j.athoracsur.2006.10.083

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Favorable intraoperative and postoperative results in the follow-up with thrombus formation around the stented descending aortic segment has encouraged us to evaluate all patients with thoracic aneurysms extending proximal and distal of the left subclavian artery for this treatment.

SUPPLEMENT

Conclusion

- A frozen elephant trunk approach does not seem to emphasize the perioperative mortality and morbidity
- In case of chronic dissection, a second surgical or TEVAR approch is unnecessary in 80% of the patients
- Aneurysmal lesions could benefit from a TEVAR complement in case of a distal type I endoleak