Hybrid Procedures and Debranching of the Arch
When to do it and how

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Disclosure

• I have the following potential conflicts of interest to report:
• Consulting PQ Bypass, Intact Vascular, Philips Medtronic, Boston Scientific, Endologix, Shockwave, VIVA Physicians
Conventional Surgery Involving the Arch

- 394 patients over 10 years
  - Mean DHCA: 31 min

Complications
- Mortality: 6.3%
- Stroke: 4.8%
- Seizure: 3.1%

For extended DHCA (>40 min)
- Stroke: 13.1%
  - 62% embolic, 38% flow related

Predictors of poor outcome:
- Emergency procedures
- Descending aortic involvement

We can do better!
Why Is Endo A Challenge?

- Involving SCA
  - Distance between the SCA and LCCA
  - Arch angulation

- Inferior aspect of the arch
  - Arch angulation
  - Ascending – descending aortic size discrepency

- Arch and descending aortic aneurysms
Arch Debranching: Background

Up to 50% of TEVAR will require deployment in zones 0, 1, or 2
Arch Debranching: When

Landing zone

• Landing zone has a dual purpose:
  • Obtain a seal between the endograft and a healthy aortic wall
  • Provide secure fixation of the endograft to the aorta

• What is a good proximal landing zone?
  • Normal aortic wall without thrombus or IMH
  • Parallel aortic walls with a maximal diameter of 38-40 mm
  • Length of 20 mm before the aneurysm or the primary entry tear

But does this apply for a landing zone in the arch?
Arch Debranching: When

Anatomical arch features affecting the landing zone

Arch type and angulation

Supra aortic trunk variations
Arch Debranching: When

Anatomical arch features affecting the landing zone

Left vertebral artery take off from the arch

PICA anomaly

Right-sided arch with aberrant LSA with Kommerell diverticulum
Arch Debranching: When
Anatomical arch features affecting the landing zone

Ascending aorta diameter

Narrow
Radius of curvature

Outer & inner curvature length
Arch Debranching: When
Anatomical arch features affecting the landing zone

- Gothic arch
- Distal arch angulation
- Aortic buckle treated with branch graft to LSA
Arch Debranching: When

Trying to seal with zone 3 TEVAR

When wishful thinking is not going to work it’s time to create a landing zone

Type Ia endoleak requiring redo TEVAR
Arch Debranching: When

Preoperative planning

1. Imaging
2. Patient selection
3. Preparation
4. Timing with TEVAR
Arch Debranching: When

Preoperative imaging

1. Gated chest CTA
2. 3D reconstruction software with CLL
3. CTA of abdomen / pelvis
4. Carotid duplex
5. CTA head & neck
6. Circle of Willis Study
Arch Debranching: When to Go to Zone 2
When the aorta in zone 3 is not healthy, landing zone is too short, the entry tear is too close
Arch Debranching: When to Go to Zone 0

Choosing from a 10 mm seal in zone 1 to 40 mm seal zone with a zone 0 branch graft
Arch Debranching: How

Zone 2: LSA

Left subclavian artery is debranched through a supraclavicular approach

LCA to LSA bypass

Journal of Vascular Surgery 2009 49, 251-254
Arch Debranching: How

Zone 1: LCA & LSA
Debranching of the LCA & LSA require bilateral cervical incisions with multiple revascularization and routing options.

Preferred option: RCA to LSA bypass with LCA transposition through retropharyngeal tunnel.
Arch Debranching: How

Zone 0

Total arch debranching

Median sternotomy
Graft off the side of the ascending aorta

Gold marker distal to the debranching graft after antegrade TEVAR

CTA @ 6 months
Ascending Aorta Bypass

- Debranching
  - Anatomic
  - Via sternotomy
Endovascular Completion
Hybrid Arch Repair Meta-Analysis

- Up to Dec 2012
- 26 Studies, 956 pts
- Mortality: 11.9%
- Stroke: 7.6%
- SCI: 3.6%
- RF: 5.7%
- Cardiac Cx 6%
Hybrid Arch Repair Dissection

• Systematic review
• 2002-2011
• 50 studies, 1886 patients
• Mortality 10.8% (1.6-25%)
• Stroke 6.9% (0.8% -25%)
• SCI 6.8% (1-25%)
Hybrid vs. Open Arch Repair

- Risk adjusted comparisons using propensity score
- 143 open, 50 hybrid
- 2008-2013
- Mortality 3% vs. 2% (NS)
- Morbidity equivalent
- ICU stay 4.7 vs. 1.6 days
  - p=0.018
Arch Debranching: How

Operative principles & technical tips

• Stage the debranching (few days before TEVAR)
• Debranch the right number of vessels
• Transposition has better patency than bypass
• Keep bypass grafts short
• Use transient hypertension during clamping
• Use Tissel at the anastomosis
• Assess degree of anticoagulation and use protamine reversal
Arch Debranching: Summary

• Wishful thinking does not create a landing zone
• Careful case planning with high-quality imaging will help determine which arch zone is appropriate and how many vessels need to be debranched
• Arch debranching can be achieved safely and meticulous execution will help avoid most complications
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