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

Sean P. Lyden, MD
Cleveland Clinic
Cleveland, Ohio
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 discrepancy

- 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

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 Tisseal 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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