Thoracic Aorta
Current Imaging and Endovascular Management

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Current Endovascular Options

- Descending Thoracic Aortic Aneurysms
- Aortic Coarctation
- Trauma
- Complicated Type B Aortic Dissection

Current Hybrid (Surgical/Endovascular) Options

- Type A Dissection
- Ascending Aorta and Arch Pathology

Future Direction

- Endovascular Type A
- Branched Arch
- Branched Thoraco-Abdominal
Evolving Global Paradigm Shift in the Treatment of Thoracic Aortic Pathology
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37 year old female
3 young kids
Presents to ER with cough
Abnormal CXR → CTA Chest
Options?
37 year old female
3 young kids
Presents to ER with cough
Abnormal CXR → CTA Chest
Options?

Open Repair
Morbid
Prolonged Recovery
Pain Syndrome
37 year old female
3 young kids
Presents to ER with cough
Abnormal CXR $\rightarrow$ CTA Chest
Options?

TEVAR
1.5 inch groin incision
Home in 2 days
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Aortic Coarctation

Traditional open repair with conduit or patch aortoplasty
Aortic Coarctation

30 year old male

Bicuspid aortic valve
Aortic Coarctation

30 year old male

Bicuspid aortic valve

Discharged home same day
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Aortic Dissection

‘Delamination’ of aortic wall layers
True lumen and false lumen
Intimal tear allows flow between lumens
Aortic Dissection

Stanford Classification

Type A
- Ascending aorta
- Surgical repair
- Evolving endovascular options?

Type B
- Descending aorta
- Medical management (uncomplicated)
- Endovascular treatment (complicated)
- Complicated
  - rupture
  - aneurysmal enlargement
  - malperfusion
  - pain
Complicated Type B Dissection

56 year old male

Acute malperfusion
  ischemic gut
  ischemic leg
  renal failure
Resolution of malperfusion
Complicated Type B Dissection

63 year old female

Acute Type B

Static right renal malperfusion
Complicated Type B Dissection

63 year old female

Acute Type B

Static right renal malperfusion
Complicated Type B Dissection

63 year old female

Acute Type B

Static right renal malperfusion
Complicated Type B Dissection

72 year old male

Prior Type A with standard surgical repair

Enlarging false lumen with intimal tear in abdominal aorta
Complicated Type B Dissection

72 year old male

Prior Type A with standard surgical repair and post-op residual Type B

Enlarging false lumen with primary intimal tear in abdominal aorta
Complicated Type B Dissection

72 year old male

Prior Type A with standard surgical repair

Enlarging false lumen with intimal tear in abdominal aorta
Complicated Type B Dissection

72 year old male

Prior Type A with standard surgical repair

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Complicated Type B Dissection

72 year old male

Prior Type A with standard surgical repair

Enlarging false lumen with intimal tear in abdominal aorta

Small stentgraft from right arm to open innominate true lumen (and efface adjacent false lumen outflow)
Complicated Type B Dissection

72 year old male
Complicated Type B Dissection

72 year old male

2011

2014
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Type A Dissection

Most common acute aortic catastrophe

Mortality 1% per hour for 1st 48 hours

Standard of care – surgical replacement ascending aorta

Operative mortality ~20%

Often with a residual Type B dissection

Persistent post-op malperfusion in 50%
Type A Dissection

Goals of surgical repair

- Resect 1º intimal tear (PIT)
- Replace ascending aorta
- Restore aortic valve competence
- Occlude false lumen
- Limit distal dissection
Type A Dissection

Outcomes for survivors of surgery for Type A dissection

Long Term survival ~50% at 10 years (often young population)

Patent false lumen up to 80% of patients
need for distal operation 20-50% at 10 years

Mortality from distal operation ~20-30%
Type A Dissection

Many aortic centers now advocating extended hybrid distal aortic repair in the acute setting to prevent long term complications of the residual dissection.
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Surgical Principles of our Type II Hybrid Arch Technique

Arch debranching after asc ao replacement

Left subclavian vs. axillary

Single stage antegrade delivery of endovascular prosthesis under fluouroscopy
Proposed Advantages:

No Prolonged Circulatory arrest/deep hypothermia

More Proximal Operation

Endovascular prosthesis has robust landing zone in surgical Dacron graft

Single Stage procedure for diffuse disease process
Type A Dissection

Primary entry tear in arch
Zone 0 Type 2 Hybrid Repair
Type A Dissection

Ascending/Hemi-arch Anastamosis
Frozen stented elephant trunk
Aorto-subclavian bypass
Type A Dissection

46 year old male OSH
Visceral ischemia
Lower extremity ischemia
Type A Dissection

Ascending aorta/hemiarch open repair
Frozen elephant trunk
Radiographic resolution of visceral ischemia
Type A Dissection

Persistent profound LE ischemia
Type A Dissection

Persistent profound LE ischemia
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Ascending Aorta

Prior conventional Type A open repair
Delayed anastomotic leak ascending aorta
Ascending Aorta

Prior conventional Type A open repair
Delayed anastamotic leak ascending aorta
Ascending Aorta

Prior conventional Type A open repair
Delayed anastomotic leak ascending aorta
Aortic Arch

56 year old male

Diffuse thoracic aneurysmal disease

Severe aortic insufficiency
Aortic Arch

56 year old male

Diffuse thoracic aneurysmal disease

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Diffuse thoracic aneurysmal disease

Severe aortic insufficiency
Aortic Arch

56 year old male

Diffuse thoracic aneurysmal disease

Severe aortic insufficiency
Aortic Arch

Tight Rope Act – walking a fine line
56 year old male

POD #2 developed asymmetric BP in right arm, no neurologic event
Aortic Arch

56 year old male

Diffuse thoracic aneurysmal disease

Severe aortic insufficiency

POD #2 developed asymmetric BP in right arm, no neurologic event
Aortic Arch

56 year old male

Diffuse thoracic aneurysmal disease

Severe aortic insufficiency

Completion CTA after additional reinforcement
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Endovascular Type A Repair

Concept presented at recent aortic multi-disciplinary rounds

Research project underway looking at feasibility of doing closed chest repair of Type A dissection

Approximately 1/3 of Type A patients potential candidates for simple stentgraft repair

So far only 20-30 cases reported worldwide

Not ready for prime time yet but…
Endovascular Type A Repair

Stanford 2004

89 year old female

Discharged home POD #8

Resolution of thoracic false lumen
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64 y.o male
Type A repair 2009
Complicated course

Aorta growing at rate of 1cm/year

Arch dissected
Large residual primary intimal tear in arch
True lumen effaced
Branched Arch

Custom built branched arch graft
Branched Arch
Branched Arch
Branched Arch
Branched Arch
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Branched Thoraco-Abdominal

Ongoing device development

Custom
Snorkels, Chimneys and Sandwiches

Improvised ‘branched’ devices using off the shelf supplies

74 year old female

Thoraco-abdominal aneurysm
Snorkels, Chimneys and Sandwiches

Improvised ‘branched’ devices using off the shelf supplies
Questions?