Current treatment of Aortic Aneurysms and Dissections

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Patient 1

- 69 year old well-educated man with reoccurring pain in his upper abdomen and a pulsatile mass.
- Dr. Nissen performed an abdominal exploration and decided to wrap the AAA in polyethene cellophane (causes fibrosis). Surgical repair with graft was still a few years away.
- The patient lived 5 more years and published his last paper the Annals of Mathematics in 1954.
- Patient developed abdominal pain on April 12, 1955 but refused “new” surgery to replace the aorta.
Patient 1

• Albert Einstein
• "I want to go when I want. It is tasteless to prolong life artificially. I have done my share, it is time to go. I will do it elegantly."
Notable People to have expired from aortic pathology

- George C. Scott
- Lucille Ball
- John Ritter
- Albert Einstein
Aortic Aneurysm demographics

• 15,000 people die each year from ruptured aneurysms.
• Incidence of AAA tripling in US
• Abdominal aortic aneurysms are 3\textsuperscript{rd} leading cause of sudden death in men over the age of 60
• 75\% of all patients with ruptured aneurysms die.
Aortic Anatomy
Common areas of aneurysm disease; 
Infra-renal aorta
Thoracic aorta
Causes of aneurysm degeneration

• 1. Atherosclerosis- most common cause in infra-renal and iliac aneurysms

• Tobacco Abuse- independent predictor for aneurysm growth

• 2. Hypertension- most common cause of thoracic aneurysms

• 3. Genetic- Marfan’s, Ehlers-Danlos, Loey-Deitz, Multifactorial- (AT1R; MMP-3, MTHFR polymorphisms)
# Current Screening Recommendations

## Abdominal Aortic Aneurysm: Screening

**Release Date:** June 2014

### Recommendation Summary

<table>
<thead>
<tr>
<th>Population</th>
<th>Recommendation</th>
<th>Grade</th>
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<tbody>
<tr>
<td>Men Ages 65 to 75 Years who Have Ever Smoked</td>
<td>The USPSTF recommends one-time screening for abdominal aortic aneurysm (AAA) with ultrasonography in men ages 65 to 75 years who have ever smoked.</td>
<td>B</td>
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<tr>
<td>Men Ages 65 to 75 Years who Have Never Smoked</td>
<td>The USPSTF recommends that clinicians selectively offer screening for AAA in men ages 65 to 75 years who have never smoked rather than routinely screening all men in this group.</td>
<td>C</td>
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<tr>
<td>Women Ages 65 to 75 Years who Have Ever Smoked</td>
<td>The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for AAA in women ages 65 to 75 years who have ever smoked.</td>
<td>I</td>
</tr>
<tr>
<td>Women Who Have Never Smoked</td>
<td>The USPSTF recommends against routine screening for AAA in women who have never smoked.</td>
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</table>
Current screening recommendations

• If aneurysm is found (>3.0cm), SVS recommends yearly US to monitor growth

• Consider referral to Vascular Surgeon

• Maximize medical therapy
  – Use of statins- slows growth and reduces CV mortality
  – HTN control
  – Tobacco cessation
  – Doxycycline/roxithromycin- MMP-9 inhibition
## Risk of Rupture

<table>
<thead>
<tr>
<th>AAA diameter (cm)</th>
<th>Rupture risk (%/y)</th>
</tr>
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<tbody>
<tr>
<td>&lt; 4</td>
<td>0</td>
</tr>
<tr>
<td>4 ~ 5</td>
<td>0.5 ~ 5</td>
</tr>
<tr>
<td>5 ~ 6</td>
<td>3 ~ 15</td>
</tr>
<tr>
<td>6 ~ 7</td>
<td>10 ~ 20</td>
</tr>
<tr>
<td>7 ~ 8</td>
<td>20 ~ 40</td>
</tr>
<tr>
<td>&gt; 8</td>
<td>30 ~ 50</td>
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</table>
Treatment of AAA

- We recommend treatment of AAA when they reach a size of 5-5.5cm.
- Treatment is usually performed by endovascular means or open surgery.
- Aortic aneurysm anatomy and patient morbidities predict method of treatments.
- 70% of patients with AAA are candidates for EVAR.
What is EVAR

Endovascular aneurysm repair (EVAR), abdominal aortic aneurysm (AAA)
EVAR animation

• https://animation
Criteria for EVAR

Patient selection criteria for EVAR

- Proximal neck length $\geq 1.5$ cm
- Neck angulation $\leq 60$ degrees
- Fusiform AAA $\geq 5 \sim 5.5$ cm in diameter or Saccular AAA
- Preservation of critical side branches
- No severe iliac artery or aortic tortuosity
- Iliofemoral arteries of sufficient diameter for sheath access
A Randomized Trial Comparing Conventional and Endovascular Repair of Abdominal Aortic Aneurysms
DREAM Trial Group; NEJM 2004; vol. 351

• N= 345 patients with AAA >5cm
• 30 day Operative mortality
  – Open surgery- 4.6%
  – EVAR- 1.2%
• 30 Day Operative morbidity
  – Open surgery- 9.8%
  – EVAR- 4.9%
• 2 year survival found to be same in both groups
Case of AAA

- 62 year old male with a 30 pack year hx and PMH significant for hyperlipidemia and HTN. Presented to PCP for possible pre-diabetic work-up and on exam was found to have a pulsatile abdominal mass.
- Ultrasound reveals 4.8 cm AAA
- CTA scan reveals a 5.5cm infra-renal AAA
- Vascular surgery referral...... EVAR or Open?
EVAR case
Other EVAR options

• ZFEN
• P-Branch
• Iliac- branched device
• FEVAR
• SnEVAR
• ChEVAR
ZFEN animation
Case of juxta-renal AAA

- 84 year old male with previous endovascular AAA repair in 1998. Has chronic COPD and CAD with recent EF of 40%
- Routine screening US shows AAA now 6.8cm in size (previous was 4.8cm)
- CTA of abd/pelvis reveals “slipped” or “migrated” stent graft and extremely short neck..... Standard repair would not work.
- ZFEN is now an option
Patient example
ZFEN Patient example
ZFEN case: completion
Thoracic aortic aneurysms

• Commonly seen in patients with previous abdominal aortic pathology or in patients with a history of a type B dissection.
• Screening remains challenging with CTA being first line.
• Recommend operative repair when sizes reaches 5.5cm.
• Endovascular repair is preferred secondary to reduced morbidity and mortality rates.
Thoracic aortic aneurysms
TEVAR vs Open repair

• Improved aneurysm related mortality TEVAR vs open (2% vs 12%)

• Severe morbidity markedly lower with TEVAR; (21% vs 39%)

• Paraplegia rate dramatically reduced
TEVAR animation

TEVAR Alpha
Thoracic Aneurysm case

• 72 year old female with a history of a 6.8 cm thoracic aneurysm repair. Presents to the ER with back pain and CTA of chest reveals new aneurysm proximal to old repair.

• Jehovah witness with a history of CAD, diabetes, and previous left lung surgery

• Thoracic stent with carotid stent.
TEVAR case
TEVAR case
Aortic Dissections

• Tears to the intima of the aortic wall allowing for separation and blood to enter the intima-media space.

• Ascending aorta (Stanford A)- cardiac surgery

• Descending aorta (Stanford B)- Vascular Surgery

• Contrast CT scan of chest and abdomen will display extent of dissection and location of tears
### De Bakey Types

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<tr>
<th>Type</th>
<th>Description</th>
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<tbody>
<tr>
<td>Type I</td>
<td>Originates in the ascending aorta, propagates at least to the aortic arch and often beyond it distally</td>
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<tr>
<td>Type II</td>
<td>Originates in and is confined to the ascending aorta</td>
</tr>
<tr>
<td>Type III</td>
<td>Originates in the descending aorta and extends distally down the aorta or, rarely, retrograde into the aortic arch and ascending aorta</td>
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### Stanford Types

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<td>Type A</td>
<td>All dissections involving the ascending aorta, regardless of the site of origin</td>
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<tr>
<td>Type B</td>
<td>All dissections not involving the ascending aorta</td>
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Descending Aortic Dissection

- Usually classified as distal to the Left Subclavian Artery
- Multiple re-entry tears with a true and false lumen
- Usually not initially aneurysmal
- Perfusion of major branch vessels is paramount
Type B dissections stratification

- Acute uncomplicated - relative symptom free with chest pain and other symptoms resolving with blood pressure control; **Medical Mgmt**

- Acute complicated - mal-perfusion to visceral, renal, carotid, spinal cord, or mesenteric vessels. Also includes rupture, uncontrolled HTN, persistent pain; **Surgical Mgmt**
Type B dissection stratification

• Chronic Type B dissection- typically defined as >14 days from initial presentation. These are managed depending on clinical changes and symptoms.

• Try to manage patients medical until they become Chronic Type B dissections. Surgical intervention within the first 2 weeks has a markedly higher morbidity and mortality rate.
**DISSECTIONS AT A GLANCE**

- Acute uncomplicated type B thoracic dissections should first be treated with medical management.
- Acute complicated type B thoracic dissections are best managed by endovascular stent graft treatment.
- Chronic type B thoracic dissections can be managed medically, with surgery, or by stent graft treatment when there is expansion of the false lumen.
- Type A aortic dissections should be treated with open surgery.
Initial treatment

• Immediate management of pain and elevated blood pressure.
• Target Systolic pressure of less than 100-110mmHg
• Beta-blocker for HR<60
• Addition of calcium channel blockers to reduce heart rate often required
• Addition of vasodilators only after Beta-blockade. (nitroprusside)
Type B Acute complicated

• If immediate medical management fails and the patient has significant end organ perfusion difficulties; paralysis, or stroke, then surgical management with TEVAR is indicated

• If we are able to stabilize the patient, the management of chronic Type B dissections is controversial.

• Type B dissections have a 30-50% mortality rate at 5 years if untreated.
Instead-XL Trial

• Trial looking at OMT (optimal medical management) (n=68) vs TEVAR + OMT (n=72) in 140 patients over 5 years with chronic type B dissections.

• Initially there was little significance between the groups.

• At 2-5 years however, significant differences were seen.
INSTEAD-XL Trial

• Landmark analysis between TEVAR and OMT reveal:
  – All cause mortality significant (0% vs 16.9% p=.0003)
  – Aortic specific mortality (0% vs 16.9% p=.0005)
  – Progression of disease (4.1% vs 28.1%; p=004)
INSTEAD XL Conclusions

• Benefit of TEVAR in chronic Type B dissections is not realized until years 2-5.

• Not unreasonable to proceed with endovascular treatment if life expectancy is greater than 2 years.
Patient 2

• 42 year old hypertensive male with BP of 220/110 and sharp upper back and chest pain. Non-compliant with medications and reports smoking 1ppd.

• CT reveals acute type b dissection just after Left SC bypass with false lumen to the celiac artery.
Treatment

• Admitted to ICU for blood pressure control... and pain subsided.
• Started on home oral BP meds and discharged with BP of 115/70 without pain.........BUT

• Patient readmitted 30 days later with nausea and back pain, CT scan reveals continued dissection and increasing aortic size to 5cm.
Treatment

- Continued medical management or Endovascular treatment.

- Thoracic stenting is indicated based on most recent literature.
Conclusions

• Open vs EVAR for AAA and Thoracic aneurysm repair
• New branched devices and option for many
• Management of dissection remains challenging, however movement toward earlier surgical treatment is becoming common.