Abdominal Aortic Aneurysms: Current Knowledge, Diagnosis, and Treatment Options

Craig Seidman, MD  FACS.
ACS Board Certified Vascular Surgeon
Medical director OHVI
Northwest Surgical Specialists
• Nothing to Disclose
Abdominal Aortic Aneurysm

- Definition: dilation of vessel to 1.5 times normal diameter
  - 3.0cm
- the 15th leading cause of death in US, 10th in men
- > 15,000 deaths per year
  - Increasing rapidly
• 20% of aneurysms found have a positive family history
  – Except for Marphans and Ehlers-Danlos, inheritance is obscure.
  • Partial penetrance
  • Tobacco, HTN,
  • Majority not discovered
    – Autopsy 4.3% men /2.1% women
Wall Injury

• Loss or failure of collagen / elastin lamellar units
  – Tobacco
  – Aging – decreases lamellar units
  – Blood supply – vasovasorum
  – Chronic inflammation ? infective
  – Elastase - (antiprotease deficiency - TIMP/alpha1 AT)
  – Hemodynamic stress
Inflammatory Aneurysm
Medical Management
Abdominal Aortic Aneurysm: Diagnosis

- Physical exam
- Accidental
- Screening – Rare
- Symptoms
Screening

- High risk groups
  - Male
  - 65 years old
  - Hx smoking (>100 cigarettes)
  - Family hx

- Medicare will pay for “welcome to medicare” screening for this high risk group screening in women also permitted.

- Other risk factors: White, atherosclerosis
Ultrasound: Diagnosis and Follow-up
Following Small AAA

- Less than 5.5 cm, safer to watch than fix
  - Follow with US
    - Less than 4.5cm q year
    - >4.5cm US q 6mo
    - Rapid expansion >0.5cm in 6-12 mo
  - Operate for symptoms

- Exceptions
  - Shape- more important than size
  - COPD, HTN, living remote
Medical Treatment

- Smoking cessation
  - faster expansion, more rupture
- Statins- no empiric data
- Blood pressure control
  - Assoc with cv death, not clearly aneurysm rupture.
  - ACE inhibitor- greater effect than BP explains
  - Propranolol- not supported by Canadian and Denmark studies (50% don’t tolerate it, 4x mortality in the Denmark study)
- NSAIDS- 1 small study supports this (n=78)
- Doxy- MMP9 inhibitor 2 studs (n=36/n=32)
- Weigh risks versus benefits
CT angiogram: Most useful for planning surgery

- Usually do not need conventional angiogram
MRA
Open AAA Repair

• Advantages:
  – Less monitoring (young and non-compliant)
  – Less reintervention
  – Proven long term durability
  – Anatomic considerations- will an endograft work
  – Blood flow considerations- Bowel/Buttock ischemia.

• Disadvantages:
  – 5% operative mortality
  – Higher blood loss
  – Longer length of stay/recuperation
Traditional Aortic Graft
Open Repair
Hypogastric Aneurysms and colonic blood supply considerations
Paravisceral/Pararenal Aneurysms

Pararenal

Preferred cross-clamp sites

Suprarenal

Preferred cross-clamp site
Right renal artery
Left renal graft

Type IV TAA

Preferred cross-clamp site
Right renal artery
Left renal graft

SMA
Celiac
12FR pump catheter in right renal orifice

Anterior
Lateral
Thoracoabdominal Repair
Incisions for open surgery
Endovascular repair of AAA
Endovascular Repair of AAA

• Minimally invasive repair done through the groins (open incision or even percutaneous with closure devises)
• Aneurysm bridged with a covered stent to off load pressure
• Currently several proprietary devises on the market (home made no longer acceptable)
Endovascular AAA repair

• Advantages
  – Smaller surgery with less trauma, shorter hospital stay and less recovery.
  – Elderly return to baseline
  – Better tolerated in high risk pt where open is not an option
  – Pt preference

• Disadvantages
  – Cost
  – Durability
  – Follow-up/compliance
  – Need for reintervention (15%) and even conversion to open surgery (5%).
History of the Endograft

• 1990 Palmaz- stent and a dacron graft
  – Very poor results, the revolution was on
  – Locally made devices became common
• 2003 more than 50,000 devices placed
• Devices now very sophisticated and well tested
• In many centers open AAA repair is only for patients who are not candidates for endoAAA
• 3 of 4 devices currently on the market were FDA approved after 2000.
  – All are modified and improved frequently base on register and trial data.
Endografts
The Low Permeability Design GORE EXCLUDER® AAA Endoprosthesis
C- ARM
Modern Endovascular Suite
Anatomic Requirements for Endovascular AAA Repair

- Proximal neck-15mm
- Access vessels-6.5mm
- Tortuosity
- Blood supply – Hypogastrics
- Distal Neck
CT angio

- **Endovascular Protocol**
  - Less than 1mm cuts
  - Surgical planning
  - Information on aneurysm sizing, thrombus, impending rupture and occlusive disease
Measurements needed for Endo repair

- Trunk-Iipsilateral Leg Endoprosthesis
- Contralateral Leg Endoprosthesis
- Contralateral Leg Endoprosthesis Used as Iliac Extender
- Aortic and Iliac Extenders

⚠️ Attention, See Instructions for Use
Endovascular Repair of AAA
5-Year Clinical Update* U.S. Pivotal Trial Data (98-03)

Major Device Efficacy Complications – Test Subjects

<table>
<thead>
<tr>
<th></th>
<th>≤ 30 days</th>
<th>Year 1 (&gt; 30 days-14 mo)</th>
<th>Year 2 (14 mo-28 mo)</th>
<th>Year 3 (28 mo-40 mo)</th>
<th>Year 4 (40 mo-52 mo)</th>
<th>Year 5 (52 mo-64 mo)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Test Subjects</td>
<td>235</td>
<td>232</td>
<td>213</td>
<td>185</td>
<td>161</td>
<td>128</td>
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<tr>
<td>Occlusion of Branch Vessel (Renal or Hypogastric)</td>
<td>1 (0.4%)</td>
<td>1 (0.4%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Prosthesis Migration</td>
<td>1 (0.4%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Endoleak with Intervention</td>
<td>2 (0.9%)</td>
<td>15 (6.5%)</td>
<td>14 (6.6%)</td>
<td>2 (1.1%)</td>
<td>4 (2.5%)</td>
<td>1 (0.8%)</td>
</tr>
<tr>
<td>Aneurysm Increase with Intervention</td>
<td>0</td>
<td>1 (0.4%)</td>
<td>8 (3.8%)</td>
<td>1 (0.5%)</td>
<td>6 (3.7%)</td>
<td>2 (1.6%)</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0</td>
<td>1 (0.5%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
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* Site Reported Data Through October 3, 2005

1 Intra-operative migration following deployment treated with aortic extender.
2 Also had endoleak.
3 Six also had endoleak.
4 Two also had endoleak.
5 Disease progression proximally requiring prophylactic use of aortic extenders.
Sacred Heart: Endovascular Experience

• 2002: began deploying proprietary devices
  – Percent endo vs open increasing.
    • NWSS 449 Aortic aneurysms repaired 01/01/2002 to 8/31/07
      – Endovascular AAA- 190 (42%)
      – Endovascular Thoracic Aneurysms- 12
    • NWSS 419 Aortic aneurysms repaired 01/01/2006 to present
      – Endovascular AAA- 227 (54%)
      – Endovascular Thoracic Aneurysms- 16
Sacred Heart Experience: Endovascular Treatment of Ruptured AAA

• Since 2002
  – 8 abdominal
    • 1 death (12.5 percent)
  – 1 Thoracic
• Patient selection is critical
  – Numbers cannot be compared to open rupture
• Procedure well rehearsed
• Equipment available
• MD and Staff experience a must
  – Cutting edge use of the technology
Endovascular Treatment of Ruptured AAA

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Trials

• **EVAR 1**- British randomized prospective study compares endovascular to open repair in patients fit enough to undergo open repair.
  – Initial lower mortality in EVAR maintained over 4 years.
  – Improved late survival not seen in EVAR
  – Increased cost, complications and re-interventions in EVAR
  – At 1 Year QOL not different

• **DREAM**- Dutch randomized study agreed and saw less initial survival advantage.

• **EVAR 2** – no 2 year advantage in unfit patients
Who should get an endograft?

- Case by case basis.
  - Anatomic considerations
    - Push this envelope too hard and you will be sorry
  - Elderly favor endograft
    - Difficulty returning to baseline after open repair
  - Follow up
    - Onerous for the young or noncompliant
  - Renal failure
Endograft follow up

• Evolving
  – CT angiogram (endo protocol)
    • 1mo
    • 6mo
    • 12mo
    • 18mo
    • Then annually
  – Plain films regularly?
  – Alternative modalities where patient has renal failure-efficacy less well known
  – Intra sac monitors
  – Ultrasound
Open Conversions

• 2-15%

• 80% within the first month (early)
  – Early due to access problems or device migration
  – 18% mortality

• Late conversions
  – Persistent leak +/- sac growth
  – Rupture
  – 27% mortality
Endoleaks

- Pressurize sac
  - Growth
  - Rupture

Type Ia: Proximal fixation site
Type Ib: Distal fixation site
Type Ic: Iliac occluder
Type IIa: Inferior mesenteric artery
Type IIb: Lumbar artery
Type IIIa: Disjunction
Type IIIb: Fabric tear
Type IV: Fabric porosity
Endoleaks
Complex Thoracoabdominal Aortic Aneurysms

Type I

Type II

Type III
Future directions
Hybrid Cases: Sum is greater than the parts

Endovascular and conventional surgery
Hybrid Between the Open and Endovascular Approach

<table>
<thead>
<tr>
<th>Stage I</th>
<th>Stage II</th>
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<tbody>
<tr>
<td>1. Infraenal repair</td>
<td>Thoracic stent-graft via previously placed infraenal</td>
</tr>
<tr>
<td>2. Visceral reconstruction</td>
<td>graft limb</td>
</tr>
<tr>
<td>3. Celiac/SMA ligation</td>
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</tbody>
</table>
Phase I: Aortic Arch Debranching
Phase II: Visceral Debranching
Visceral graft in place
Phase III: Aortic Stent Grafting