MAJOR ARTERIAL DISEASES

ROBERT LUND MD, DBIM
Two Main Types of Major Arterial Disease

Atherosclerotic Peripheral Vascular Disease (PAD)

• Lower extremity Arteries
• Visceral arteries
• Aortic arch and large branches

Vascular Disease Due to Weakening of Arterial (Mainly Aortic) Tissue

• Aneurysm
• Dissection
Peripheral Artery Disease (PAD)

Atherosclerosis

- Cause of progressive narrowing of lower extremity arteries
- Source of atheroembolization
Manifestations of Atherosclerosis

Those with PAD will also have CAHD and cerebral artery disease in 40 – 60% of cases

Figure A7.

Risk Factors for PAD ~ to Those for Coronary Atherosclerosis

Groups with Higher Prevalence of PAD

• Age $\geq$ 70 years
• Age 50 to 69 years with history of diabetes or smoking
• Age 40 to 49 with diabetes and at least one other risk factor for atherosclerosis
• Leg symptoms suggestive of claudication with exertion, or ischemic pain at rest
• Abnormal lower extremity pulse examination
• Known atherosclerosis at other sites (e.g., coronary, carotid, renal artery disease)

Asymptomatic – 20 to 50 %

Atypical leg pain – 40 to 50 %
  - Leg fatigue, difficulty walking, atypical pain
  - Comorbidities: arthritis, neuropathy, spinal stenosis

Classic claudication – 10 to 35 %

Threatened limb – 1 to 2 %
  - Tissue loss, gangrenous digits or foot

PAD Increases Markedly with Age

Ankle-brachial Index (ABI)
Normal = 1.00 to 1.09

Exertional extremity pain
(either classic claudication or atypical sx)

- ABI < 0.9 is diagnostic for PAD

Symptoms of PAD correlate roughly with ABI

- Claudication: 0.4 to 0.9
- Rest pain: 0.2 to 0.4
- Tissue loss (gangrene, ulcer): 0 to 0.4

Neschis DG and Golden MA, *UpToDate* June 12, 2014.
Ankle Brachial Index Correlates with Over-All Mortality Risk

<table>
<thead>
<tr>
<th>Referent ABI = 1.11 – 1.2</th>
<th>RR, All Cause Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>.91 – 1.0</td>
<td>1.4</td>
</tr>
<tr>
<td>.81 - .9</td>
<td>1.73</td>
</tr>
<tr>
<td>.71 - .8</td>
<td>1.8</td>
</tr>
<tr>
<td>.61 - .7</td>
<td>2.08</td>
</tr>
<tr>
<td>&lt; .6</td>
<td>1.82</td>
</tr>
</tbody>
</table>

When ABI > 1.4 mortality risk rises as well (high ABI felt due to arterial calcification)

O'Hare AM, et al, *Circulation* 2006;113:388 - 393
Noncritical LE Claudication: 5 Year Outcomes

**Limb morbidity**
- 70 – 80% stable claudication
- 10 – 20% worsening claudication
- 1 – 2% critical limb ischemia

**Cardiovascular morbidity and mortality**
- 20% nonfatal myocardial infarction and stroke
- 15 – 30% death

Outcomes decidedly worse for diabetics and smokers

Critical Limb Ischemia (CLI) Is Associated with ~ 20 - 25 % Mortality in First Year after Diagnosis

CLI: Rest pain, ischemic ulcer, gangrene

Outcomes at One Year

- 50% alive with two limbs
- 25% amputation
- 25% cardiovascular mortality

Figure A8.


Occlusive Atherosclerotic Peripheral Arterial Disease (PAD) of The Lower Extremities Is Associated with Coronary Artery Disease

~ 50 % of late deaths in those with PAD are due to coronary atherosclerotic heart disease

Those with PAD at increased risk of cardiovascular morbidity and mortality

- Combined annual rates for AMI, CVA and hospitalization for CV disease in those with PAD comparable or greater than similar rates for those with diagnostically confirmed CAD alone

Relative Risk of Death in Those with Large-Vessel Peripheral Arterial Disease without Evidence of Cardiovascular Disease

Study population: community dwelling So. California residents, comparing survivals of those with and without PAD over ten years. PAD diagnosed via ABI and Doppler flow velocity

<table>
<thead>
<tr>
<th>Unilateral versus bilateral disease</th>
<th>Asymptomatic versus symptomatic disease</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unilateral</strong></td>
<td><strong>Bilateral</strong></td>
</tr>
<tr>
<td>CVD</td>
<td>6.1</td>
</tr>
<tr>
<td>CHD</td>
<td>4.3</td>
</tr>
</tbody>
</table>

CVD: cardiovascular disease (coronary atherosclerotic heart disease and cerebrovascular disease)

CHD: coronary atherosclerotic heart disease

Relative Risk of Death in Those with Large-Vessel Peripheral Arterial Disease without Evidence of Cardiovascular Disease

<table>
<thead>
<tr>
<th>Moderate versus severe disease</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVD</td>
<td>5.3</td>
<td>10.6</td>
</tr>
<tr>
<td>CHD</td>
<td>3.2</td>
<td>9.7</td>
</tr>
</tbody>
</table>

Overall RR versus matched “normals”

- 3.1 all causes
- 5.9 cardiovascular disease
- 6.6 coronary atherosclerotic heart disease

When large vessel disease was both severe and symptomatic

- RR ~ 15 fold increased of dying from CVD and/or CHD

Ankle / Brachial Index < 0.8, Decreased Doppler flow velocity

**Moderate disease** = one test abnormal

**Severe disease** = both tests abnormal

CVD: cardiovascular disease
(coronary atherosclerotic heart disease and cerebrovascular disease)

CHD: coronary atherosclerotic heart disease

Survival of Surgically Treated Symptomatic Atherosclerotic Occlusive Disease by Vascular Category

Abdominal visceral arteries (celiac, superior mesenteric and renal)

Terminal abdominal aorta and major branches

Survival correlated most consistently with age, diabetes and hypertension.

Expected Mortality: 1989 – 91 Texas Decennial Life Table

<table>
<thead>
<tr>
<th>Age = 51 (54.7% M)</th>
<th>From surgery</th>
<th>PP x 1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality Ratio (%)</td>
<td>316</td>
<td>243</td>
</tr>
<tr>
<td>EDR / K</td>
<td>28.3</td>
<td>21.8</td>
</tr>
<tr>
<td>Entrants</td>
<td>426</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age = 60.5 (79.4% M)</th>
<th>From surgery</th>
<th>PP x 1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality Ratio (%)</td>
<td>175</td>
<td>157</td>
</tr>
<tr>
<td>EDR / K</td>
<td>28.4</td>
<td>24.2</td>
</tr>
<tr>
<td>Entrants</td>
<td>5772</td>
<td></td>
</tr>
</tbody>
</table>

Surgical Treatment of Intermittent Claudication

62% Inflow Reconstructions (Aorto-Iliac Disease)

- 68% aortobifemoral bypass grafts
- Graft patency at 4 years: 92%

38% Outflow Reconstruction (Infrainguinal Bypasses)

- 93% femoropopliteal bypass grafts
  - Prosthetic grafts only to above knee popliteal artery
  - 67% of grafts were autogenous
  - Graft patency at 4 years: 81%

Determinants of Optimal Results (regarding patency and sx)

- Non diabetic
- Inflow procedure
- < 70 years of age at surgery
- Post operative ankle / brachial index ≥ 0.85
  - 29% with post op ABI < 0.5 developed resting ischemia at 23 mo. requiring further surgery

Survival after Surgical Treatment for Intermittent Claudication

Boston, MA, 1987 – 1994, 114 entrants

Mean age = 63 years (67 % men)

Actuarial survival at 5 years = 80%

- Mortality ratio = 208 %
- EDR / K = 23.5

Only negative survival predictor:

- Diabetes

Figure 3.

Expected population: 1989 – 91 Massachusetts
Decennial Life Table

Mortality ratio = 144%
EDR / K = 28.4

Elective reconstruction for claudication
- Mortality ratio = 144%
- EDR / K = 28.4

Mean age = 64 years (73 % men)
86% with history of “substantial cigarette consumption”

Surgical reconstruction for limb salvage
- Mortality ratio = 297%
- EDR / K = 68.4


Figure 3.
Expected population: 1989 – 91 New York Decennial Life Table

Survival after Surgical Treatment for Intermittent Claudication

Pittsburgh, PA, 1983 – 1998, 2777 entrants (male veterans)

Mean age = 64.7 years (100 % men)
94% current or past smokers

Survival at 5 years = 58%
Survival at 10 years = 35%

Negative survival predictors:
• Mortality ratio = 250 %
• EDR / K = 52.6

• Diabetes requiring medication
• Older age
• History of prior stroke
• Lower ABI

Figure 1.
Expected population: 1989 – 91 Pennsylvania Decennial Life Table, Males

Atherosclerosis of Aortic Arch


Survival correlated most consistently with age, diabetes and hypertension.

Expected Mortality: 1989 – 91 Texas Decennial Life Table
NASCET Results for 70 – 99 % Carotid Stenosis (critical stenosis)

“Critical Stenosis” is beyond these values: PS > 230 cm / sec and ED > 115 cm / sec
Cardioembolic Stroke: Worst Prognosis of The Ischemic Strokes

Survival after first ischemic cerebral infarct by etiology

In Holland:

- Annual risk of dying after first-time stroke is about 9% (approximately 2.3 times that of general population)
- Death related to recurrent stroke was about the same in all three subtypes (13 – 16%)
- It is unknown whether treating risk factors post initial stroke lowers post stroke mortality

Functional Outcome **6 Months** After Ischemic Stroke Predicts Long-Term Survival

Follow up begins at 6 months post CVA per modified Rankin Scale score

Modified Rankin Scale score = 3  
“Moderate disability; requiring some help, but able to walk without assistance”

<table>
<thead>
<tr>
<th>mRS Score</th>
<th>Mortality Ratio (%)</th>
<th>EDR / K</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2</td>
<td>112</td>
<td>8.0</td>
</tr>
<tr>
<td>3</td>
<td>246</td>
<td>67.2</td>
</tr>
<tr>
<td>4</td>
<td>322</td>
<td>93.5</td>
</tr>
<tr>
<td>5</td>
<td>393</td>
<td>117.0</td>
</tr>
</tbody>
</table>

At 6 months post stroke potential for further functional improvement is limited

Expected mortality:
United Kingdom Total Population, mortality.org

487 patients admitted to hospital for PAD

- Symptomatic (claudication [80.7 %] or critical limb ischemia [19.3 %])
- Median age = 70 (69.8 % Male)

Peripheral arterial disease diagnosed

- Ankle / brachial Index
- Doppler flow
- Arteriography

Cardiovascular comorbidity present in 43.5 %

- CAHD in 113, symptomatic CHF in 32, 59 CVD, 40 had CAHD & CVD
NT-pro BNP: An Independent Predictor of All-Cause Mortality at 5 Years in Individuals with Symptomatic PAD

Rates of death at 5 years as a function of NT-pro BNP by sextiles

NT-pro BNP > 213 ng / L had overall RR for death = 2.27

NT-pro BNP ≤ 213 ng / L

Mortality Ratio = 245 %
EDR / K = 52

Figure 1.


Figure 2.

Expected Mortality: Austrian General Population Life Table, Years 2001 – 2005 at Mortality.ORG
Relative Mortality Risk for Symptomatic PAD per NT-pro BNP (213 ng / L ~ 95 percentile in “normals” for age = 70)

Mortality Risk Ratio

Claudication

PAO Associated with Poor Outcomes at Younger Ages

<table>
<thead>
<tr>
<th>Mean age = 35 (37.9% female)</th>
<th>Groningen, Netherlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extensive and progressive LE atherosclerosis present</td>
<td>Vascular reconstruction done</td>
</tr>
<tr>
<td>31 % died after 10 years</td>
<td>Morality ratio = 1279%</td>
</tr>
</tbody>
</table>

AORTIC ANEURYSM AND DISSECTION
Abdominal Aortic Aneurysm (AAA)

**Definition**
- Diameter of dilated region > 50% larger than normal aorta
- Infra-renal aorta > 3.0 cm

**Vast majority located below the renal arteries**

**~ 40% of AAA have associated aneurysms of iliac arteries**
Ultrasonographic Screening for AAA in Medicare-Aged US Adults

Ultrasonographic screening criteria for infra-renal artery AAA

• Aortic diameter ≥ 3.0 cm
• Ratio of infra-renal artery aorta to supra-renal aorta > 1.4

Aneurysm prevalence = 8.8%

• 87.7% on aneurysms ≤ 3.5 cm in diameter

Those having aneurysms relative to those without aneurysm

• Higher overall mortality
• Higher cardiovascular mortality
• Higher incidence of cardiovascular events

Overall Mortality of Small AAA Found at Screening

Median age = 75 years, 61% male, follow up = 4.5 years

<table>
<thead>
<tr>
<th>Men</th>
<th>Mortality Ratio (%)</th>
<th>EDR / K</th>
<th>Women</th>
<th>Mortality Ratio (%)</th>
<th>EDR / K</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0 - 3.5 cm</td>
<td>Standard</td>
<td>0</td>
<td>3.0 – 3.5 cm</td>
<td>Standard</td>
<td>0</td>
</tr>
<tr>
<td>Ratio &gt; 1.4*</td>
<td>Standard</td>
<td>0</td>
<td>Ratio &gt; 1.4*</td>
<td>203</td>
<td>47.7</td>
</tr>
<tr>
<td>&gt; 3.5 cm</td>
<td>176</td>
<td>46.9</td>
<td>&gt; 3.5 cm</td>
<td>307</td>
<td>100.6</td>
</tr>
</tbody>
</table>

* Ratio of infra-abdominal aortic diameter to aortic diameter 1 cm below superior mesenteric artery (above the renal arteries)

Indications for Repair

Asymptomatic

- Size ≥ 5.5 cm or greater
- Rapidly expanding
  - Expansion of > 0.5 cm over six month period
- Infection
- Complications following prior repair

Symptomatic

- Back pain
- Flank pain
- Embolization
- Rupture
Two Main Types of Reapairs

**Open surgical Repair with Synthetic Graft**

- Abdominal aorta
- Aneurysm
- Graft sewn in place
- Blood flows through graft

**Endovascular Repair (EVAR)**

- Abdominal aorta
- Blood flows through stent graft
- No flow in aneurysm sac
- Endovascular stent graft in place

Credit: UpToDate®

Copyrights apply
Endovascular Repair (EVAR) of AAA Has Surpassed Open Surgical Repair as Most Common Elective Procedure

Medicare patients undergoing elective isolated repair of AAA, years 2003 - 2007

EVAR Versus Open Repair

EVAR Long-Term
- Higher costs
- More need for long-term surveillance
- More contrast dye exposure

EVAR Acutely
- Less mortality
- Shorter hospitalization

Reinterventions or Readmissions
- 9.6% all EVAR deaths
- 7.6% all open repair deaths

Figure 1.
Endovascular Repair Versus Open Surgical Repair of Abdominal Aortic Aneurysm – Little Difference in Mortality

Mean age = 76 years (78 % male)

<table>
<thead>
<tr>
<th>From time of surgery</th>
<th>Mortality Ratio (%)</th>
<th>EDR / K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endovascular Repair</td>
<td>135</td>
<td>24.4</td>
</tr>
<tr>
<td>Open Repair</td>
<td>135</td>
<td>24</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Postpone 1 year from time of surgery</th>
<th>Mortality Ratio (%)</th>
<th>EDR / K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endovascular Repair</td>
<td>133</td>
<td>24.4</td>
</tr>
<tr>
<td>Open Repair</td>
<td>124</td>
<td>19.4</td>
</tr>
</tbody>
</table>

Expected mortality:
2005 US Decennial Life Table

Figure 1.

Probability of Late Aneurysm Rupture or Complication Is Greater in Those Having Endovascular Repair

- Interventions for management of the aneurysm or its complications more frequent in the endovascular repairs
- Interventions for complications related to laparotomy more frequent in open repairs
- Through 8 years of follow up aneurysm rupture occurred in 5.4% of the endovascular repair group versus 1.4% of the open repair group

Figure 2.
Increasingly, rAAA Is Being Treated with EVAR

Use of EVAR for rAAA Repair
- 2001: 6% of cases
- 2008: 31% of cases

Perioperative mortality
- EVAR: 33.8%
- Open Repair: 47.7%

Average hospital stays for survivors
- EVAR: 7 days
- Open repair: 14 days

Figure 2A.

Treatment of Ruptured AAA – EVAR Versus Open Repair

Years 2001 – 2008, Mean age = 78.2 years
EVAR and 77.2 years Open Repair
(Gender diff., entire cohort: 72.4% male)

Perioperative mortality: EVAR = 33.8%
Open repair = 47.7%

EVAR for rAAA

• Lower perioperative and long term mortality

EVAR associated with higher rates of AAA reinterventions

• 10.9% versus 1.5% at 3 years

Actually, if postpone until one year post repair for overall mortality calculation, open repair survival is better.

Survivals relative to survival at year one

Calculating mortality from one year after surgical repair of rAAA

<table>
<thead>
<tr>
<th></th>
<th>Mortality Ratio (%)</th>
<th>EDR / K</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVAR</td>
<td>163</td>
<td>47.6</td>
</tr>
<tr>
<td>Open Repair</td>
<td>134</td>
<td>22.3</td>
</tr>
</tbody>
</table>

Expected mortality: 2005 US Decennial Life Table

THORACIC AORTIC ANEURYSM
## Thoracic Aortic Aneurysms

<table>
<thead>
<tr>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Dilatation of aorta to at least 50% greater diameter than expected normal diameter</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fusiform or saccular</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Saccular felt more likely to rupture</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Etiologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Degeneration of the aortic media</td>
</tr>
<tr>
<td>• Some association with atherosclerosis (risk factors contribute)</td>
</tr>
<tr>
<td>• Some connective tissue disorders (e.g., Marfan or Ehlers-Danlos)</td>
</tr>
<tr>
<td>• Bicuspid aortic valve (has component of aortic media weakening)</td>
</tr>
<tr>
<td>• Aortic inflammatory processes</td>
</tr>
</tbody>
</table>
Distribution of Thoracic Aortic Aneurysms (There Is Some Overlap)

- Ascending aorta to innominate artery: 60%
- Aortic arch: 10%
- Descending aorta from left subclavian artery to diaphragm: 40%
- Thoracoabdominal: 10%
Mortality Risks

- Rupture
- Dissection
5 Year’s Risk of Rupture Is Related to Size

- < 4.0 cm
  - 0 %
- 4.0 – 5.9 cm
  - 16 %
- 6.0 cm or greater
  - 31 %

Marfan syndrome or other connective tissue diseases
  - Rupture tends to occur at relatively smaller aneurysmal sizes

### Yearly Rate of Rupture or Dissection by Aneurysmal Size

<table>
<thead>
<tr>
<th>Size Range</th>
<th>Yearly Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5.0 cm</td>
<td>2%</td>
</tr>
<tr>
<td>5.0 – 5.9 cm</td>
<td>3%</td>
</tr>
<tr>
<td>6.0 cm or greater</td>
<td>7%</td>
</tr>
</tbody>
</table>

- Combined yearly risk of rupture, dissection or death: 15.6%
- Five year survival: 56%

Natural History by Size

Followed x 5 years for occurrence of rupture, dissection or death, censored at time of surgery

<table>
<thead>
<tr>
<th>Initial Size</th>
<th>Mortality Ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0 – 3.9 cm</td>
<td>49</td>
</tr>
<tr>
<td>4.0 – 4.9 cm</td>
<td>148</td>
</tr>
<tr>
<td>5.0 – 5.9 cm</td>
<td>160</td>
</tr>
<tr>
<td>6.0 cm and up</td>
<td>370</td>
</tr>
</tbody>
</table>

Expected mortality: 1989 – 91 Connecticut Decennial Life Table

### Natural History of Thoracic Aortic Aneurysms
**304 Initially Dissection Free Patients**

<table>
<thead>
<tr>
<th>Mortality Ratio (%)</th>
<th>No dissection</th>
<th>Dissection (chronic)</th>
<th>Ascending aorta / aortic arch</th>
<th>Descending aorta / thoracoabdominal aorta</th>
<th>Medical therapy only</th>
<th>Elective surgery (PP x 1 Year post op)</th>
<th>Emergent surgery (PP x 1 year post op)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>224</td>
<td>406</td>
<td>233</td>
<td>360</td>
<td>267</td>
<td>55</td>
<td>538</td>
</tr>
</tbody>
</table>

**Expected mortality: 1989 – 91 Connecticut Decennial Life Table**

Indications for Surgical Repair of Thoracic Aortic Aneurysm

Development of symptoms

Aortic diameter 5.0 – 6.0 cm for *ascending* and 6.0 – 7.0 cm for *descending* aneurysms (in smaller individuals when aneurysm > 2 x normal aortic size)

Accelerated growth rate (≥ 10 mm/year) in aneurysms < 5.0 cm in diameter

Evidence of dissection

Ascending aneurysm > 4.5 cm in diameter at time of aortic valve surgery

Woo YJ and Mohler ER, UpToDate, Nov 14, 2012
Thoracic Aortic Aneurysms: A Population-Based Study

Mean age at diagnosis = 69 years, 51 % women
Mean age at diagnosis by gender:
Women = 75.9 years, men = 62.8 years

<table>
<thead>
<tr>
<th>Years 1980 - 1994</th>
<th>Mortality Ratio (%)</th>
<th>EDR / K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculation from time of surgery</td>
<td>250</td>
<td>55.3</td>
</tr>
<tr>
<td>Calculation from 1 year post - op</td>
<td>208</td>
<td>43</td>
</tr>
</tbody>
</table>

Expected mortality:
Minnesota State Decennial Life Table, 1989 – 91.


- Women relatively more frequently affected by thoracic aortic aneurysm relative to AAA where men predominate
- Women with thoracic aortic aneurysms are relatively more likely to rupture
- Rupture risk over 5 years by size
  - < 4 cm: 0%
  - 4 – 5.9 cm: 16%
  - 6 cm or more: 31%
Mortality Relatively Similar Regardless of Reason for Surgical Intervention (Elective vs. Rupture or Dissection)

Mean age = 70 years, 62 % Male
Survival from 30 days post-op

<table>
<thead>
<tr>
<th>Reason for Procedure</th>
<th>Mortality Ratio (%)</th>
<th>EDR / K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective Repair</td>
<td>160</td>
<td>22.1</td>
</tr>
<tr>
<td>Rupture</td>
<td>183</td>
<td>30.1</td>
</tr>
<tr>
<td>Dissection</td>
<td>170</td>
<td>20.3</td>
</tr>
</tbody>
</table>

Figure 2.
Expected mortality:
Swedish Life Tables, mortality.org

Surgical Treatment of Dissection

Mortality calculations done one year from completion of initial surgery

**Acute Dissection**

- **Ascending Aorta**
  - Mortality Ratio = 125 %
  - EDR / K = 11.8

**Chronic Dissection**

- **Ascending aorta**
  - Mortality Ratio = 188 %
  - EDR / K = 33.9

- **Descending aorta**
  - Mortality Ratio = 224 %
  - EDR / K = 23.0


Thoracoabdominal Aortic Aneurysm Repair

1986 – 1998, 1220 patients, median age = 68 years (40.9 % F)

91 % of procedures were elective

Mortality Ratio = 170 %

- EDR / K = 36.2

Paraplegia developed in 4.6 %

Elective mortality: 1989 – 1991 Texas State Decennial Life Table

Figure 1.

### Experience of 1509 Thoracoabdominal Aortic Aneurysms Surgically Repaired between 1969 - 1991

<table>
<thead>
<tr>
<th>Median age = 66 years, 65 % male</th>
<th>Mortality Ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No post-op paraplegia</td>
<td>186</td>
</tr>
<tr>
<td>Post-op paraplegia present</td>
<td>237</td>
</tr>
<tr>
<td>No dissection at time of surgery</td>
<td>188</td>
</tr>
<tr>
<td>Chronic dissection at time of surg.</td>
<td>200</td>
</tr>
<tr>
<td>No CAD</td>
<td>153</td>
</tr>
<tr>
<td>Concomitant CAD</td>
<td>239</td>
</tr>
<tr>
<td>Post-op creatinine ≤ 3.0 mg / dL</td>
<td>174</td>
</tr>
<tr>
<td>Post-op creatinine &gt; 3.0 mg / dL</td>
<td>381</td>
</tr>
</tbody>
</table>

- Calculations done from 6 months post-op
- Overall incidence of paraparesis or paraplegia = 16 %

Expected mortality: US Decennial Life Table 1979 – 81.

Thoracic Aortic Endovascular Repair (TEVAR)

Thoracic endovascular grafts require proximal and distal seal zones of at least two centimeters.
### 5 Year Survival after Thoracic Endovascular Repair (TEVAR)

> > 10,000 Medicare patients, 2005 – 2010, **Descending Thoracic Aorta**

<table>
<thead>
<tr>
<th>Condition</th>
<th>(mean age / % male)</th>
<th>Mortality Ratio (%)</th>
<th>EDR / K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic aortic dissection</td>
<td>(73.0 / 53.7%)</td>
<td>229</td>
<td>55.1</td>
</tr>
<tr>
<td>Acute aortic dissection</td>
<td>(72.6 / 54.3%)</td>
<td>180</td>
<td>34.1</td>
</tr>
<tr>
<td>Thoracic aortic aneurysm</td>
<td>(75.1 / 54.2%)</td>
<td>210</td>
<td>54.0</td>
</tr>
<tr>
<td>Thoracoabdominal aortic aneurysm</td>
<td>(72.5 / 51.9%)</td>
<td>250</td>
<td>69.2</td>
</tr>
<tr>
<td>Thoracic aortic aneurysm plus abdominal aortic aneurysm</td>
<td>(76.0 / 60.5%)</td>
<td>232</td>
<td>72.0</td>
</tr>
<tr>
<td>Rupture of thoracic aorta</td>
<td>(77.0 / 49.4%)</td>
<td>402</td>
<td>114.5</td>
</tr>
<tr>
<td>Trauma to thoracic aorta</td>
<td>(70.3 / 57.4%)</td>
<td>263</td>
<td>60.5</td>
</tr>
</tbody>
</table>

All calculations done from 1 year post-op; total post-op follow = 5 years.

Less complex aortic disease is associated with better post – TEVAR survival.

Expected mortality:

US Decennial Life Table 2007.

Post-Operative Repair Characteristics Associated with Worse Long-Term Outcomes

<table>
<thead>
<tr>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery for chronic dissection</td>
</tr>
<tr>
<td>Emergent surgery</td>
</tr>
<tr>
<td>Surgery on descending thoracic aorta or thoracoabdominal aorta</td>
</tr>
<tr>
<td>• Especially if post-op paraplegia present</td>
</tr>
<tr>
<td>Surgical procedure was TEVAR (after first year post-op)</td>
</tr>
<tr>
<td>Concurrent CAD present</td>
</tr>
<tr>
<td>After surgery serum creatinine &gt; 3.0 mg / dL</td>
</tr>
</tbody>
</table>
THANK YOU FOR YOUR ATTENTION!