The Expansion Rate of Small AAA

And the Threshold for Intervention

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St Georges Vascular Institute, London, UK
Consultancy fees, Speakers bureau, Research funding

- Medtronic
- Endologix
**Current Guidelines**

**Class I**

1. For patients with chronic dissection, particularly if associated with a connective tissue disorder, but without significant comorbid disease, and a descending thoracic aortic diameter exceeding 5.5 cm, open repair is recommended.\(^{371,382,468}\) (Level of Evidence: B)

2. For patients with degenerative or traumatic aneurysms of the descending thoracic aorta exceeding 5.5 cm, saccular aneurysms, or postoperative pseudoaneurysms, endovascular stent grafting should be strongly considered when feasible.\(^{371,469}\) (Level of Evidence: B)

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**Interventions on descending aortic aneurysms**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>AHA 2010</th>
<th>ESC 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEVAR should be considered, rather than surgery, when anatomy is suitable.</td>
<td>IIa C</td>
<td>C</td>
</tr>
<tr>
<td>TEVAR should be considered in patients who have descending aortic aneurysm with maximal diameter ≥55 mm.</td>
<td>IIa C</td>
<td>C</td>
</tr>
<tr>
<td>When TEVAR is not technically possible, surgery should be considered in patients who have descending aortic aneurysm with maximal diameter ≥60 mm.</td>
<td>IIa C</td>
<td>C</td>
</tr>
<tr>
<td>When intervention is indicated, in cases of Marfan syndrome or other elastopathies, surgery should be indicated rather than TEVAR.</td>
<td>IIa C</td>
<td>C</td>
</tr>
</tbody>
</table>

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Thoracic Aortic Aneurysms

- Systematic review growth rates
  - Analysis large database
    - TAA growth rates
  - Implications for repair / surveillance
Systematic Review of TAA Expansion Rates

- PRIMSA guidelines - search until April 2015

- 11 studies (3 prospective / 8 retrospective)

- 1383 patients

- Heterogenous (location / pathology / methodology)
## Systematic Review of TAA Expansion / Rupture Rates

<table>
<thead>
<tr>
<th></th>
<th>Growth Rates (mm/y)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All TAA</strong></td>
<td>0.2-4.2</td>
</tr>
<tr>
<td><strong>Ascending and arch</strong></td>
<td>0.2-2.8</td>
</tr>
<tr>
<td><strong>Descending / TAAA</strong></td>
<td>1.9-3.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Aortic dissection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Large TAA</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Distal location</strong></td>
<td>COPD</td>
</tr>
<tr>
<td><strong>Marfan</strong></td>
<td>BAV</td>
</tr>
</tbody>
</table>
Growth Rates TAA and Surveillance

- Commercial imaging database (M2S Inc)
  - 2004-2013
  - TAA > 30mm
  - 2 CT > 3 months apart
- Annualised growth rates - time to threshold
- Surveillance intervals
M2S Database and TAA Growth

- 995 patients
- Mean time first-last CT 758d
- Mean TAA diameter 48.3mm
- No clinical information!!
TAA Expansion – Initial Diameter

Annualised Expansion Rate (mm/y)

Initial TAA Diameter (mm)

1

2.4

2.6

5.9

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Time to Threshold (55mm) – Starting Diameter

- 50-54mm
- 45-49mm
- 40-44mm
- 30-39mm

Proportion to threshold 55mm vs. Time (days)
<table>
<thead>
<tr>
<th>Initial Diameter (mm)</th>
<th>3 years</th>
<th>2 year</th>
<th>1 year</th>
<th>6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-39</td>
<td>44%</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>40-44</td>
<td>20%</td>
<td>5%</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>45-49</td>
<td>58%</td>
<td>25%</td>
<td>5%</td>
<td>0</td>
</tr>
<tr>
<td>50-54</td>
<td>89%</td>
<td>65%</td>
<td>36%</td>
<td>15%</td>
</tr>
</tbody>
</table>
Predicted Aortic Events Within One Year of Diagnosis

Cardiovascular Surgery

Risk of Rupture or Dissection in Descending Thoracic Aortic Aneurysm

Joon Bum Kim, MD, PhD; Kihoon Kim, BA; Mark E. Lindsay, MD, PhD; Thomas MacCollum, MD; Eric M. Dietrich, MD; Richard P. Callewaert, MD; Thoai M. Sundi III, MD

Background—Current practice guidelines recommend surgical repair of large thoracic aortic aneurysms to prevent fatal aortic dissection or rupture, but limited natural history data exist to support clinical criteria for timely intervention. Methods and Results—Of 3247 patients with thoracic aortic aneurysms registered in our institutional Thoracic Aortic Center Database, we identified and reviewed 257 asymptomatic patients (age 72.4 ± 10.5 years; 143 females) with descending thoracic or thoracoabdominal aortic aneurysms without a history of aortic dissection in whom surgical intervention was not undertaken. The primary end point was a composite of aortic dissection, rupture, and sudden death. Baseline mean maximal aortic diameter was 52.4 ± 10.8 mm, with 103 patients having diameters ≥55 mm. During a median follow-up of 25.1 months (interquartile range 1.3–55.3 months), definite and possible aortic events occurred in 19 (7.4%) and 53 (21.3%) patients, respectively. On multivariable analyses, maximal aortic diameter at baseline emerged as the only significant predictor of aortic events, with a hazard ratio of 1.05 (95% confidence interval, 1.01–1.10; P = 0.03). Estimated rates of definite aortic events within 1 year were 3.5%, 7.2%, and 9.3% for aortic diameters of 55, 65, and 70 mm, respectively. ROC operating characteristic curves for discriminating aortic events were higher for indeterminate aortic sizes referenced to body surface area (area under the curve 0.832–0.889) but not significantly different from absolute maximal aortic diameter (area under the curve 0.805). Conclusions—Aortic size was the principal factor related to aortic events in unruptured descending thoracic or thoracoabdominal aortic aneurysms. Although the risk of aortic events started to increase with a diameter ≥5.0 to 5.5 cm, it is uncertain whether repair of thoracic aortic aneurysm in this range leads to overall benefit, and the threshold for repair requires further evaluation.

Key Words: aortic □ aorta □ prognosis □ risk factors □ surgery

Aneurysm of the descending thoracic (DTA) and thoracoabdominal aorta (TAAs) is a life-threatening condition that is associated with high mortality and morbidity once complications occur. The decision to intervene prophylactically, however, is complicated by the significant mortality and morbidity associated with surgical intervention for these conditions. Current practice guidelines call for surgical repair of aneurysm more than 5.5 cm in diameter with any aneurysmal behavior.1,2 Therefore, aortic aneurysmal behavior with a diameter of ≤55 mm is considered a class III recommendation.3

Editorial by I.I. Reference p 1629

Recent observations have shown that adverse aortic events may occur in smaller diameters.12 For instance, reports from the International Registry of Acute Aortic Dissection showed that 40% of patients with aortic dissection had aortic diameters ≤55 mm, and among those with type A AD, as many as 30% had aortic diameters ≤55 mm.12 These observations have encouraged re-evaluation of the current practice guidelines. Furthermore, progression of aortic size and remodeling of the aortic disease less invasively, potentially reducing treatment-related mortality or serious morbidity.13

Conversely, recent studies suggest that surgical prophylactic interventions for TAAs may be inappropriate and emphasize the importance of assessing the risk of adverse aortic events.14,15 Thus, further studies are needed to establish the risk of aortic events and the threshold for prophylactic interventions.16

Unfortunately, there are a number of missed opportunities that can increase the risk of adverse aortic events.17

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Predicted Aortic Events Within One Year of Diagnosis

- **Definite event**
  - Probability of event within 1 year:
    - Maximal aortic diameter (mm):
      - 40: 5.5%
      - 50: 7.2%
      - 60: 9.3%
      - 70: 15.4%
      - 80: 28.1%

- **Possible event**
  - Probability of event within 1 year:
    - Maximal aortic diameter (mm):
      - 40: 8.0%
      - 50: 11.2%
      - 60: 15.6%
Summary and Conclusions

- Expansion and event rate low below 40mm

- Rapid increase in expansion and event rate after 50mm

- Bi-annual surveillance < 40mm, annual surveillance > 40mm

- Argument that threshold should be lower
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