Management of Aortic Aneurysms

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Objectives

1. Identify the types of aortic aneurysms.

2. Discuss the different tests to confirm diagnosis of aortic aneurysms.

Anatomy of the Circulatory System

- Jugular vein
- Subclavian vein
- Superior vena cava
- Pulmonary artery
- Carotid artery
- Arch of the aorta
- Pulmonary vein
- Inferior vena cava
- Thoracic aorta
- Abdominal aorta
The Circulatory System
Definitions

Permanent, localized dilatation of the aorta

Diameter at least 50% greater than is normal at that anatomic level
Definitions

Descending Thoracic Aorta – the portion of the aorta between the left subclavian artery and the diaphragm
Epidemiology of Aortic Aneurysms

TAA is diagnosed in approximately 15,000 to 25,000 people in the US annually.

TAA is diagnosed in 5.9 to 10.4 per 100,000 people per year.

Incidence is increasing due to:
  • Aging population (increased prevalence)
  • Increased access to sophisticated imaging
Epidemiology

- Mortality: 6,000 deaths annually due to TAA
- Male to female ratio: ~ 1:1
- Average age at diagnosis: 76 for women and 63 for men
- 5-year Survival (untreated patients): 19 to 39%
- Annual procedures volume: >18,000 thoracic aortic repair procedures (includes TAA and other aortic diseases)
- Percent of AAA patients who also have TAA: 12%
Thoracic Aortic Aneurysms

- Localized to a single aortic segment
- Involve multiple segments
  - Thoracoabdominal aortic aneurysms (TAAAs)
    - Descending thoracic aorta
    - Abdominal aorta
  - Mega-aorta
    - Entire aorta is aneurysmal
- Can either be “true” or “false”
Thoracic Aortic Aneurysms

- **True aneurysms**
  - **Fusiform**
    - More common
    - Symmetrical dilatations of the aorta
  - **Saccular**
    - Localized outpouchings of the aorta

- **False aneurysms (Pseudoaneurysms)**
  - Leaks in the aortic wall that cause blood to collect in pouches of scar tissue on the exterior of the aorta
Types of Aortic Aneurysms

- Aortic root aneurysm
- Ascending thoracic aortic aneurysm
- Aortic arch aneurysm
- Descending thoracic aortic aneurysm
- Thoracoabdominal aortic aneurysm
Pathology of Aortic Aneurysms

• Result from medial degeneration or aortic dissection (changes in elastin and collagen causing reduced strength and integrity)
• Often associated aortic atherosclerosis
• Less common causes of include trauma, genetic syndromes, connective tissue disease, coarctation, infection and aortitis (Takayasu’s arteritis)
<table>
<thead>
<tr>
<th>Causes of Thoracic Aortic Aneurysms</th>
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</thead>
<tbody>
<tr>
<td>Non-specific medial degeneration</td>
</tr>
<tr>
<td>Aortic dissection</td>
</tr>
<tr>
<td>Genetic disorders</td>
</tr>
<tr>
<td>Marfan syndrome</td>
</tr>
<tr>
<td>Loeys-Dietz syndrome</td>
</tr>
<tr>
<td>Ehlers-Danlos syndrome</td>
</tr>
<tr>
<td>Familial aortic aneurysms</td>
</tr>
<tr>
<td>Congenital bicuspid aortic valve</td>
</tr>
<tr>
<td>Poststenotic dilatation</td>
</tr>
<tr>
<td>Infection</td>
</tr>
<tr>
<td>Aortitis</td>
</tr>
<tr>
<td>Takayasu’s arteritis</td>
</tr>
<tr>
<td>Giant cell arteritis</td>
</tr>
<tr>
<td>Rheumatoid aortitis</td>
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<tr>
<td>Trauma</td>
</tr>
</tbody>
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Pathology of Aortic Aneurysms

Occur in the medial layer separating the intima from the adventitia

Blood flows into false lumen which weakens aortic wall

Progressive degeneration and dilatation of the aortic wall causes aneurysm
Natural History

- Untreated aneurysm can progress to dissection, rupture or both
- Factors that determine aortic size: HTN, connective tissue disorder, body habitus
TAA is often called a “silent killer” because there are no obvious symptoms of the disease. Only half of patients with TAAs notice symptoms.
Symptoms

• Most thoracic aortic aneurysms are found incidentally during testing for other disorders

• Possible TAA symptoms include:
  – Pain in the chest, back, neck, or jaw
  – Coughing, stridor, or dyspnea and wheezing
  – Plethora and edema
  – Most patients are hypertensive

• Symptoms indicating a rupture may include:
  – Chest or back pain
  – Hemothysis/hematemesis
  – Cardiovascular collapse
Diagnostic Methods

Chest X-Ray

Magnetic Resonance Imaging (MRI)

Computed Tomography (CT)

Angiography

Transesophageal Ultrasound (TEU)
Management Options

Medical management/monitoring ("watchful waiting")
Open surgical repair
Endovascular stent-graft repair
Medical Management

Wait, watch, and control hypertension, smoking cessation

Typically reserved for aneurysms < 5 or 6 cm that are not rapidly expanding or causing symptoms

Most commonly monitored with CT or MRI scans every 6 months
Open Surgical Repair

Indications:
Based on aortic diameter, aneurysm expansion rate, and symptoms

- risk of rupture increases in proportion to the diameter of the aneurysm; diameter is the principal criterion for surgery in asymptomatic patients
- growth rate of >1 cm/year

Symptomatic patients should undergo aortic repair regardless of diameter
Open Surgical Repair

Replacement of the weakened portion of the aorta with a synthetic graft

Access via anterior or lateral thoracotomy

Often performed with either partial or full cardiopulmonary bypass to temporarily redirect blood flow around the aneurysm
Open Surgical Repair

Benefits

5-year survival: 58 - 70% vs. 19 to 39% for untreated patients

Challenges

30-day operative mortality (for elective procedures): 8 – 20%
Survivors suffer from morbidity rates of up to 50% related to renal, intestinal, and spinal cord ischemia
Neurologic complication rate (paraplegia, paraparesis, stroke): 8 – 15%
Average 7 to 10 days hospitalization
Endovascular Stent Graft Repair

Also reserved for patients who cannot tolerate open repair

(poor physiologic reserve and the inability to tolerate thoracotomy, single-lung ventilation, and aortic clamping)

Determined by physiologic reserve and the complexity of the vascular anatomy
Key Point

• Although endovascular devices are approved for use in repairing simple descending thoracic aortic aneurysms, the long-term durability of this type of aortic repair has yet to be clearly established.
Endovascular Stent Graft Repair

* Access via direct iliac, femoral, or aortic arteriotomy or via conduit
* Stent-grafts are deployed using angiographic guidance
* Anchoring of endoluminal device above and below DTAA in normal arterial segments
* Tube-shaped stent-graft relines the vessel and excludes the aneurysm from circulation
* Exclusion and depressurization prevent DTAA rupture
* May be performed under general, regional or local anesthesia
Endovascular Stent Repair Graft

Pre-Stent Graft Deployment

Post Stent Graft Deployment
Surgical Complications

Hypertension - avoided because it can disrupt fragile suture lines and cause severe bleeding

Hypotension - prevented because it can precipitate ischemic complications, including paraplegia and acute renal failure

Vocal cord paralysis - is suspected in patients with post-op hoarseness

Development of pseudoaneurysms at suture lines or new aneurysms in other aortic segments or in reimplanted patches

Infection of the prosthetic graft
Outcomes

• Contemporary results of open repairs of descending thoracic aortic aneurysms indicate that early mortality rates range from 4.4 to 8.0% and paraplegia rates range from 2.3 to 5.7%; stroke rates are generally lower, ranging from 1.8 to 2.1%

• Contemporary series of open thoracoabdominal aortic repairs show acceptable survival. Reported outcome rates range from 5 to 12% for early mortality, 4 to 9.5% for paraplegia, 1.7 to 5.2% for stroke, and 6 to 12% for renal complications.
Prevention

- Lifelong surveillance using non-invasive imaging techniques
- Smoking cessation
- BP control
- Genetic counseling


Thank You