Acute Aortic Syndrome

A. Michael Borkon, M.D.
Director of CV Surgery
Mid America Heart Institute
Saint Luke’s Hospital
Kansas City, MO

Disclosures:
No financial relationships to disclose
Acute Aortic Syndrome

Objectives

1. Define pathology
2. Identify risk factors
3. Identify patients at risk
4. Critical symptoms and signs
5. Discuss Imaging
6. Current appropriate Treatment

Scientific
American August 2005

Sudden-onset chest pain with contained disruption in aortic wall

To reduce mortality

1. Recognize patients with at risk aortas
2. Identify and urgently treat patients with acute aortic syndrome
Acute Aortic Syndrome

Causes

1. Acute Aortic Dissection
2. Intramural Aortic Hematoma
3. Penetrating Aortic Wall Ulcer
4. Contained Aortic Aneurysm Rupture
5. Traumatic Aortic Disruption

- All Life-threatening
- All Time Sensitive
- All Mortal consequences

Acute Aortic Syndrome

Penetrating Aortic Ulcer

Disrupted atherosclerotic plaques that can penetrate the aortic wall and lead to contained rupture
Acute Aortic Syndrome
Intramural Aortic Hematoma

Sudden collection of blood within the aortic wall that occurs without an obvious intimal tear that can grow and result in classic dissection.

Acute Aortic Syndrome
Vulnerable Aorta

1. Acquired risk factors
   1. Aortic size
   2. Age
   3. Tobacco use
   4. Hypertension
   5. Iatrogenic
   6. Pregnancy
   7. Cocaine
   8. Weight lifting

2. Genetic risk factors
   1. Marfan Syndrome
   2. Familial TAA
   3. Bicuspid aortic valve

Pape LA, Tai T, Lee SD, Chen Y, et al. Acute diameter >5.5 cm is not a good predictor of type A aortic dissection—observations from the International Registry of Acute Aortic Dissection (IRAD). Circulation 2007;116:1306–7
Aortic Dissection

Classification

Spontaneous intimal tear allows redirection of blood flow from aortic true lumen through the defect into the medial of the aortic wall = false lumen

Aortic Dissection Incidence

- Most frequently recognized lethal condition of the aorta
- Occurs nearly 3 times as frequently as AAA rupture
Aortic Dissection

Incidence


<table>
<thead>
<tr>
<th>IRAD</th>
<th>TYPE A</th>
<th>TYPE B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>62</td>
<td>64</td>
</tr>
<tr>
<td>Male</td>
<td>1992 (68%)</td>
<td>972 (66%)</td>
</tr>
<tr>
<td>MARFAN</td>
<td>122 (5%)</td>
<td>56 (4%)</td>
</tr>
<tr>
<td>H/O HTN</td>
<td>2089 (74%)</td>
<td>1158 (81%)</td>
</tr>
<tr>
<td>ANEURYSM</td>
<td>337 (13%)</td>
<td>291 (21%)</td>
</tr>
</tbody>
</table>

IRAD Database
12/26/95-2/6/2013

Aortic Dissection

Pathogenesis

Although the role of increased aortic wall strain is intuitive, the mechanism by which hypertension actually leads to dissection is unclear.
Aortic Dissection
Complications

• Rupture
• Pericardial tamponade
• Aortic Regurgitation

TYPE A

Aortic Dissection
Complications

Malperfusion

• Renal 23-75% = Renal Failure
• Extremities 25-60% = Limb ischemia
• Abdominal viscera 10-20% = Bowel ischemia
• Cerebral 3-13% = Stroke
• Coronary 5-11% = MI
• Spinal 2-9% = Spinal paralysis
Aortic Dissection

Complications

Development of a Chronic Aneurysm
Made worse by:

• Patent or partially thrombosed false lumen
• Hypertension
• Connective tissue disorder

Aortic Dissection

Symptoms

1. 40% die at onset
2. 30% misdiagnosed thought to be MI
3. Sudden onset of chest pain
   1. Ripping/tearing/migratory
   2. Location indicates aortic tear
4. Stroke
5. Paralysis
6. Abdominal pain
Aortic Dissection
Symptoms & Signs
IRAD Database
2/24/10-2/6/13

<table>
<thead>
<tr>
<th>IRAD</th>
<th>TYPE A</th>
<th>TYPE B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worse</td>
<td>365</td>
<td>201</td>
</tr>
<tr>
<td>Anterior pain</td>
<td>328</td>
<td>129</td>
</tr>
<tr>
<td>Tearing pain</td>
<td>72</td>
<td>53</td>
</tr>
<tr>
<td>Syncope</td>
<td>83</td>
<td>13</td>
</tr>
<tr>
<td>HTN</td>
<td>121</td>
<td>141</td>
</tr>
<tr>
<td>Pulse deficit</td>
<td>75</td>
<td>33</td>
</tr>
</tbody>
</table>


Aortic Dissection
Physical Findings
Type A (ascending)

- Acutely ill appearing
- Hypertension
- Shock
- Pericardial tamponade
- Aortic regurgitation
- Stroke symptoms
- Extremity ischemia

Table 1D. International Registry of Acute Aortic Dissection (IRAD) Physical Findings of 597 Patients with Type A Aortic Dissection

<table>
<thead>
<tr>
<th>Physical Findings</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>122%</td>
</tr>
<tr>
<td>Hemodynamics</td>
<td>14%</td>
</tr>
<tr>
<td>Shock</td>
<td>12%</td>
</tr>
<tr>
<td>Cardiac tamponade</td>
<td>9%</td>
</tr>
<tr>
<td>Acute aortic insufficiency</td>
<td>43%</td>
</tr>
<tr>
<td>Pulse deficit</td>
<td>20%</td>
</tr>
<tr>
<td>Pericardial rub</td>
<td>2%</td>
</tr>
<tr>
<td>Cardiomechanical arrest</td>
<td>8%</td>
</tr>
<tr>
<td>Ischemic pericardial injury</td>
<td>3%</td>
</tr>
<tr>
<td>Ischemic stroke and embolism</td>
<td>2%</td>
</tr>
<tr>
<td>Ischemic lower extremity</td>
<td>10%</td>
</tr>
<tr>
<td>CAPILLARINE UNSTABLE</td>
<td>12%</td>
</tr>
<tr>
<td>Coregroove heat sensation</td>
<td>9%</td>
</tr>
<tr>
<td>Feet blood pressure gradient, mean</td>
<td>130 mm Hg</td>
</tr>
<tr>
<td>Posterior blood pressure gradient, mean</td>
<td>75 mm Hg</td>
</tr>
</tbody>
</table>

Adapted from Pape et al. 2015
Aortic Dissection

Imaging

- Chest X-ray
- EKG
- MRI
- ECHO
- Aortogram

CT best
Quick and easy
99% sensitive & Specific
Chest-abdomen-pelvis

Aortic Dissection

Initial Treatment

- Consult CV surgery
- ICU/CVOR
- Anti-impulse therapy
  - Beta-blockers
  - Hydralazine
Aortic Dissection
Type A Repair

Operative Mortality 20%
Non-operative mortality >60%
Aortic Dissection
Type A Repair


Aortic Dissection
Complicated Acute Type B Dissection
Endovascular repair

- Malperfusion
- Obliteration false lumen

Operative mortality 30% if need TEVAR
Medical management alone 7-12%
Aortic Dissection
Complicated Acute Type B
Dissection
Endovascular repair

Size isn’t everything!
Dissection can occur in the small
diameter aorta

Pape LA, Tsai TE, Hendelke IM, Oh JK, et al. Aortic diameter 5.5 cm is not a good predictor of type A aortic dissection—observations from the International Registry of Acute Aortic Dissection (IRAD). Circulation 2007;116:1120–7
Aortic Aneurysm

Size is everything!
Risk of rupture increases over 6 cm diameter

Aortic Dissection

Large aorta thousands-fold greater risk of dissection

Aortic Aneurysm

Rupture and/or dissection are increased in ascending aorta ≥ 6 cm

All aortic aneurysm need to be referred to Aortic Program
To be followed by knowledgeable team

Indications for operation ascending aorta
- Symptoms
- >5.5 cm
- Rapid growth
- Operative coincidence

Marfan Syndrome

- 1 in 5000 persons
- 53 distinct genetic patterns
- Autosomal Dominant 50% transmission
- 25% spontaneous mutation

Indications for operation ascending aorta or aortic root >4.5 cm
Bicuspid Aortic Valve

- BAV aortopathy 25-30%
- Aneurysm risk is 80-fold > Tricuspid
- AR 10-times > risk of for dissection vs. AS
- Marfan risk of dissection is 10-fold > BAV!

Aortic repair for size:
- No aortic risk factors > 5.5 cm
- Aortic risk factors > 5.0 cm
- Low patient-risk > 5.0 cm
- Concomitant AVR > 4.5 cm
- Aortic arch resection > 5.5 cm
- Root > 4.5 – 5.0

Presence of aortic root involvement is concerning
Acute Aortic syndrome
Dissection is NOT random

Susceptibility to aortic aneurysm and dissection is set from birth by genetics

- Aortic wall damaged over time
- Aorta enlarges losing distensibility below wall tension
- Aortic Dissection
- Emotional stress or physical exertion
- Acute hypertensive event exceeds tensile limit of wall

Hatzaras I.S., et al. (2007) Role of exertion or emotion as inciting events for acute aortic dissection. Am J Cardiol 100:1470–1472

Emotional stress or physical exertion 66%

Acute Aortic syndrome
Ritter Rules
High index of suspicion

1. Urgent need for diagnosis and repair
2. Severe, sudden onset, severe pain #1 symptom
3. Often misdiagnosed, always rule out aortic dissection
4. Get the right scan: CTA
5. Know the risk factors:
   1. Enlarged aorta
   2. Family history aortic disease
   3. Genetic syndromes prone to aortic disease
   4. Bicuspid aortic valve
6. Triggers
   1. Lifestyle
   2. Trauma
   3. Hypertension
   4. Pregnancy
7. Immediate referral to CV surgery