Aortic Disasters

Diagnosis, Imaging Techniques and Management


Case 1

- 51 yo female presents with sharp anterior chest pain while at rest. She says the pain is worse with movement. No associated symptoms. Pain is improved in ED
- **Pmhx:** Asthma, **Turner’s Syndrome**
- **Fmhx:** none
- **PE:** VS: 125/85, 75, 24, 37, Pulse Ox: 100%
  Otherwise normal examination
  W/u: Cxr, EKG, CBC, Trop/Myo x2: normal
  Dispo: home, ETT, PMD f/u

Case 2

- 32 yo male presents with mid chest pain after a minor parking lot MVA. He denies striking any part of the car. He seems more “upset than sick”
- **Pmhx:** none
- **Fmhx:** father with cardiac dz
- **PE:** VS: 95/65 (says BP always low), 70, 24, 37
  Otherwise normal
  W/u: Chest X-ray, EKG, CBC, CMP: normal
  Dispo: home with 3 day f/u

Case 3

- 57 yo male presents with acute onset upper Abd Pain accompanied by **SOB.** No n/v/d/c, fever or prior hx of similar pain.
- **Pmhx:** HTN, Smoking, occ alcohol
- **Fmhx:** none
- **PE:** VS: 165/110, 95, 24, 37, Pulse Ox: 100%
  + Mid epigastric tenderness
  W/u: Cxr, EKG, CMP, Lipase: normal
  ED US…….
Case 4

- 65 yo female presents with chest pain - acute onset, sharp and associated with weakness and dizziness.
- Pmhx: HTN, Smoking, occ alcohol
- Fmhx: none

- PE: VS: 105/70, 95, 24, 37, Pulse Ox: 100%
  Normal examination
W/u: Cxr, EKG, CMP, Trop/Myo: normal
Observed for 4 hours – pain improves

Dx: HTN medication reaction, atypical CP

One month later

Aortic Dissection
**Definitions**

- **Aneurysm**: localized dilatation of the entire vessel wall involving all three layers
- **Dissection**: hematoma within the arterial media causing a lengthwise separation
- **Aortic Transection**: traumatic tear of aorta usually at lig arteriosum

**Classification (Stanford)**

- Type A
- Type B

**Epidemiology**

- Long standing HTN (not atherosclerosis)
- Elastin and connective tissues disorders
  - Marfan’s, Cystic medial necrosis, Pregnancy,
- Cardiac Disorders
  - Coarctation, Bicuspid aortic valve
  - Turner’s syndrome
- Trauma
- Acute stressors
  - Cocaine/Metamphetamine

**DNA is Destiny**

- ~ 0.5 -1% of MI rate
- Long standing HTN (not atherosclerosis)
- Elastin and connective tissues disorders
  - Marfan’s, Cystic medial necrosis, Pregnancy,
- Cardiac Disorders
  - Coarctation, Bicuspid aortic valve
  - Turner’s syndrome
- Trauma
- Acute stressors
  - Cocaine/Metamphetamine
Case 1

- 51 yo female presents with sharp anterior chest pain while at rest. She says the pain is worse with movement. No associated symptoms. Pain is improved in ED
- Pmhx: Asthma, Turner’s Syndrome
- Returned to ED 48 hours later in Arrest
- Post mortem: Pericardial tamponade from AD

Case 2

- 32 yo male presents with mid chest pain after a minor parking lot MVA. He denies striking any part of the car. He seems more “upset than sick”
- Pmhx: none
- Fmhx: father with cardiac dz
- Father had a Aortic Dissection from a Bicuspid valve – survived to have surgery
- This patient died at home the next day

Age-related Risk Factors associated with aortic dissection

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>AD &gt; 40 y</th>
<th>AD &lt; 40 y</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marfan syndrome</td>
<td>2%</td>
<td>49%</td>
<td>&lt;.001%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>74%</td>
<td>35%</td>
<td>&lt;.001%</td>
</tr>
<tr>
<td>Bicuspid valve</td>
<td>3%</td>
<td>16%</td>
<td>&lt;.001%</td>
</tr>
<tr>
<td>Prior aortic valve replacement</td>
<td>5%</td>
<td>13%</td>
<td>&lt;.01%</td>
</tr>
<tr>
<td>Atherosclerosis</td>
<td>31%</td>
<td>2%</td>
<td>&lt;.001%</td>
</tr>
</tbody>
</table>

95% of Aortic Dissection occurs > 40 yo

Acute Aortic Syndrome

- Classical AD
  - True and false lumen
  - Longitudinal spread
- Intramural Hematoma
  - Localized hematoma
  - No Doppler flow/contrast on CT
- Penetrating Aortic Ulcer
  - Typically descending aorta
  - Rupture atherosclerotic plaques

Haro et al. EM Clinics, Nov 2005
Natural history

- Type A: 1-2%/hour mortality rate (untreated),
  - 50% at 30 days
- Type B: Mortality 10% at 30 days if uncomplicated

*International Registry of Aortic Dissection

Anatomy is Destiny

Pain
Maximal at onset, May come and go (15% painless),
Follows aortic anatomy (front-back, top-down radiation),
(Neck/jaw pain uncommon)

+ Other Symptoms
- Neurologic: transient loss of vision, numbness,
  weakness or dysarthria etc
- Limb ischemia or pain
- Syncope, SOB,

Presentation
Pain Type
Chest anterior Chest Posterior Ant & Post Neck Abd Sharp Tearing/Ripping Migratory

<table>
<thead>
<tr>
<th>Maximal</th>
<th>Proximal</th>
<th>Distal</th>
</tr>
</thead>
<tbody>
<tr>
<td>65%</td>
<td>6%</td>
<td>27%</td>
</tr>
<tr>
<td>10%</td>
<td>57%</td>
<td>52%</td>
</tr>
<tr>
<td>8%</td>
<td>16%</td>
<td>16%</td>
</tr>
<tr>
<td>8%</td>
<td>64%</td>
<td>68%</td>
</tr>
<tr>
<td>6%</td>
<td>50%</td>
<td>52%</td>
</tr>
</tbody>
</table>

Anatomy is Destiny

• Aortic Dissection is a disorder that varies in TIME and SPACE

Pain
Maximal at onset, May come and go (15% painless),
Follows aortic anatomy (front-back, top-down radiation),
(Neck/jaw pain uncommon)

+ Other Symptoms
- Neurologic: transient loss of vision, numbness,
  weakness or dysarthria etc
- Limb ischemia or pain
- Syncope, SOB,

Case 3

- 57 yo male presents with acute onset upper abd pain accompanied by SOB. +Mild chest pain earlier in day. No n/v/d/c, fever or prior hx of similar pain.
- Pmhx: HTN, Smoking, occ alcohol
- Fmhx: none
- PE: VS: 165/110, 95, 24, 37, Pulse Ox: 100%
  + Mid epigastric tenderness
W/u: Cxr, EKG, CMP, Lipase : normal
ED US…….
Presentation

Physical findings of AD present in < 50% of cases

<table>
<thead>
<tr>
<th>Signs</th>
<th>Proximal</th>
<th>Distal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>35%</td>
<td>70%</td>
</tr>
<tr>
<td>Hypotension</td>
<td>12%</td>
<td>2%</td>
</tr>
<tr>
<td>Pulse Deficit</td>
<td>18%</td>
<td>9%</td>
</tr>
<tr>
<td>AI Murmur</td>
<td>44%</td>
<td>12%</td>
</tr>
<tr>
<td>Neuro Deficit</td>
<td>6%</td>
<td>2%</td>
</tr>
</tbody>
</table>

*International Registry of Aortic Dissection

Mechanism of obstruction

Case 4 - continues

• 65 yo female presents with syncope – seen yesterday for chest pain and BP medication reaction
• PE: VS: 100/70, 146, 24, Pulse Ox: 95%
• Cath lab activated: 30% LAD and Diagonal branch stenosis
• Retrospectoscope: EKG shows pericarditis
Diagnosis

- Clinical Suspicion/Appropriate patient type
  PLUS
  - Sudden, atypical or migratory pain, tearing,
  - mixed cardiovascular/neuro presentations
- Physical Exam:
  - Excludes alternative diagnosis
  - AI murmur, Pulse deficits

Diagnosis can not be made without imaging study

Chest radiography

- 65% sensitive
- Widened knob
- Double wall sign
- Effusion or cap
- Wide mediastinum
Advantages: accurate, excellent anatomic detail
Disadvantages: slow, unavailable, costly
Serologic screening

- **Experimental……**
  - Smooth muscle myosin heavy chain (SMMHC)
  - Soluble elastin fragments (sELAF)
- **D-dimer:** sensitivities 82-100%
  - Small, retrospective studies, ? methods
  - Unclear cut off (500 or lower), ? whether accurate in Intramural hematomas

? Sensitivity and low specificity means potential misses and/or many unnecessary imaging studies

Treatment

**Stop extension of dissection**

- Control dP/dt - ie contractility of the aorta
- Decrease blood pressure and decrease heart rate
- Target: lowest blood pressure that allows for normal mental status, SBP ~ 100-110
- Pain control
- Stabilization for surgery…… (Type A)

Drugs

Goal is reduction of **Force and Rate of contraction**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Blood press</th>
<th>Contractility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nipride</td>
<td>↓↓↓</td>
<td>↑</td>
</tr>
<tr>
<td>Propranolol(Esmolol)</td>
<td>↓↓↓</td>
<td>↓↓↓</td>
</tr>
<tr>
<td>Labetalol</td>
<td>↓↓↓</td>
<td>↓↓↓</td>
</tr>
<tr>
<td>Trimethaphan</td>
<td>↓↓↓</td>
<td>↓↓↓</td>
</tr>
<tr>
<td>Fenoldopam</td>
<td>↓↓↓</td>
<td>↑</td>
</tr>
</tbody>
</table>

Variant mgt scenarios

- **Dissection + Hypotension/CHF:** Diff Dx
  - AI: gentle rate control, early surgery
  - Pericardial tamponade: IVF, early surgery (pericardiocentesis – worse outcome..)
  - MI: gentle rate control - early surgery, (avoid ASA, anti-thrombotics)
- **Dissection + Neuro deficits**
  - Obstructive: gentle pressure and rate reduction (hold if neuro deficit widens), early surgery
Surgery

Reserved for most (80%) Type A and any (20%) Type B with vascular or neurologic complications.

Isolated Arch dissections – medical Tx

Uncomplicated Type B treated medically - B-blockers/anti-HTN vs endovascular grafts and stents

How not to miss AD

- Know the subtle presentations - think beyond the textbook
  - Mixed Neuro/Cardiac, Extremity Pain/Cardiac
- Explore the risk profile (Turners/Marfans/FamHx)
- If ACS/PE/MSK just isn’t fitting, think AD
- Look for the AI, Abnl pulse, migratory sx
- CT when in doubt......

Noninvasive Endografts, Stents and Fenestration

hematome due to dissection

aorta

eンドロビジ

endoprosthesis