Aortic Injury
Traumatic Aortic Injury

- account for 10% to 15% of all traffic fatalities
- majority fatal at the scene
- 50% who survive the initial injury die in the first 24 hours
- 90% die within the first month if aorta not repaired
- 30-90% overall mortality
Traumatic Aortic Injury

- rapid deceleration
- shearing effect
- mobility of the aorta
- 93% occur distal to the origin of the left subclavian artery - ligamentum arteriosum
Table 3. ASSOCIATED INJURIES IN 76 PATIENTS WITH HCTT DIAGNOSIS OF BAI

<table>
<thead>
<tr>
<th>Injury</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed head</td>
<td>30</td>
<td>39</td>
</tr>
<tr>
<td>Closed head with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>intracranial blood</td>
<td>17</td>
<td>22</td>
</tr>
<tr>
<td>Rib fractures</td>
<td>52</td>
<td>68</td>
</tr>
<tr>
<td>Lung contusion</td>
<td>32</td>
<td>42</td>
</tr>
<tr>
<td>Cardiac contusion</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Diaphragm</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Spleen</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Liver</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>Small bowel</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Pelvic fracture</td>
<td>26</td>
<td>34</td>
</tr>
<tr>
<td>Femur fracture</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td>Tibia fracture</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>Facial fracture</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>Thoracic spine fracture</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Lumbal spine fracture</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>None</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

HCTT = helical computed tomography of the thorax; BAI = blunt aortic injury.
Diagnosis

- suspicion, high-speed mechanism
- most patients show no signs or symptoms on physical exam
Clinical Findings

- precordial murmur
- hypotension
- interscapular pain
- hoarseness
- paraplegia
CXR Findings

- aortic knob obliteration
- opacification of the aortopulmonary window
- depression of the left mainstem bronchus
- elevation R mainstem bronchus
CXR Findings

- deviation of the esophagus/nasogastric tube
- tracheal deviation
- fractures 1\textsuperscript{st}, 2\textsuperscript{nd} ribs

- \textit{may be present in any combination or may be entirely absent}

- \textit{mediastinal widening on CXR is the most frequent indicator of mediastinal hematoma from a torn thoracic aorta}
Table 2. FINDINGS ON ADMISSION CHEST X-RAYS IN 76 PATIENTS WITH HCTT DIAGNOSIS OF BAI

<table>
<thead>
<tr>
<th>Finding</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wide mediastinum</td>
<td>51</td>
<td>67</td>
</tr>
<tr>
<td>Indistinct aortic knob</td>
<td>16</td>
<td>21</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Tracheobronchial compression</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Apical pleural cap</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Nasogastric tube deviation</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Normal</td>
<td>20†</td>
<td>26</td>
</tr>
</tbody>
</table>

* Three were false positive HCTT examinations.
† Two were false positive HCTT examinations.
Imaging

- CT scan with IV contrast if abnormal chest x-ray or normal XR + mechanism
- CT sensitivity and specificity approach 100%
- Aortography for equivocal cases or CT not available
- TEE unstable SICU patients
Findings:
- mediastinal hematoma
- periaortic hematoma
- intraluminal irregularity (intimal flap)
- acute coarctation
- abnormal aortic contour
Management

- Prioritize
  - intra-abdominal bleeding present - laparotomy indicated prior to repair of the torn thoracic aorta
  - craniotomy for intracranial hemorrhage takes precedence over repair of the torn thoracic aorta
Management

Hemmila MR. Delayed repair for blunt thoracic aortic injury: is it really equivalent to early repair? *J Trauma* 2004 Jan; 56

72 pts

Early Repair <16hrs vs Delayed Repair (+AH)

 Increased LOS, complication rate

 No difference in mortality
BP control - prevent HTN, reduce shear forces across the injury
- HR < 100 b/min
- SBP 100 mm Hg young/middle-aged patients
- 110 to 120 mm Hg elderly patients
- esmolol
  - short half-life

initiate early → prevent rupture → allow repair/management of other injuries
Who to call?

a. Trauma Surgery Attending
b. Cardiothoracic fellow
c. Vascular fellow
d. IR fellow
Management

- Prepare for OR
  - T&C, aline, esmolol drip, foley etc
- OR
  - L lateral thoracotomy, 4th ICS
  - Heparin, bypass 134 mins
  - Dacron graft, Biogloe
Techniques of Open Repair

- clamp and sew
  - simple
  - no need to heparinize

- bypass
  - perfuses distal aorta
  - pump – control BP, hypothermia

- end to end anastomosis (15%)
  vs graft interposition
Is there any other solution?
Twenty consecutive cases of endograft repair of traumatic aortic disruption: lessons learned


- 20 consecutive cases treated by endograft repair at one institution
- Mean age 40, 17 male

Results
- No procedure related deaths
- 4 deaths due to co-injuries
- 1 proximal extension for type I endoleak
- 1 graft collapsed requiring surgical removal and aortic repair
- 2 required graft >28mm
- 9 aortas required 23mm abdominal cuffs
- 6 required partial or complete coverage of L subclavian artery
Emergency treatment of acute rupture of the descending thoracic aorta using endovascular stent grafts


- 13 patients (15 male)

Results
- No procedure related deaths
- 1 proximal type I endoleak
- 2 iliac dissections
- 1 fem art rupture
- Mean f/u 13 mo, no complications
Endovascular repair of thoracic aortic tears


- 30 patients (24 male)
- Low dose or no systemic heparin
- Femoral access

Results
- 1 iliac rupture
- 1 cerebellar stroke
- 1 partial stent collapse
- 2 perioperative deaths
- Mean f/u 11 months, no complications
Percutaneous endovascular repair of blunt thoracic aortic transection


- 11 patients
- No systemic heparin
- Femoral or iliac access

Results
- No deaths or complications
- Mean f/u 21 months, no complications
Stent–graft repair of traumatic thoracic aortic disruptions


- 9 patients s/p MVA
- aortogram

Results
- 1 type I endoleak
- No procedure related deaths
- 1 death due to co–injuries
Surgical vs endovascular treatment of traumatic aortic rupture


- 20 patients
- 11 (9 male) surgical repair – direct suture 6, graft 5, delay 2.6 days
- 9 (8 male) endovascular treatment, delay 17 days

Results – stent
- *No deaths or procedure related complications*
- Mean f/u 15 months, no complications

Results – open
- 1 death, 3 complications in surgical group (phrenic/RLN palsies)
The midterm results of stent graft treatment of thoracic aortic injuries


- 27 patients
- 5 open repair, 8 stent placement
- Femoral, iliac or distal abdominal aorta access

Results – stent
- 1 brachial artery thrombosis
- 1 external iliac dissection and ARF
- 2 deaths due to co-injuries
- Mean f/u 16 mo, no complications

Results – open
- 1 death, 1 stroke
Summary

- 130 patients stented for traumatic aortic rupture with other injuries
- 7 deaths due to co-morbidities (5%)
- 2 procedure related deaths (1%)
- 3 type I endoleaks (2%)
- 4 iliac dissections (3%)
- 2 stent collapse (1.5%)
AAST Multicenter Study

Demetriades D, Scalea T. et al. Operative repair or endovascular stent graft in blunt traumatic thoracic aortic injuries: results of an AAST multicenter study

- 193 pts. prospective, open repair (OR) vs. stent graft (SG)
- 74 w/major extrathoracic injuries, 115 without
- 125 SG, 68 OR
Complications of open repair

- paraplegia
    207 pts, surgical repair of BAI
    - significantly reduced with bypass vs clamp and sew
    - cross clamp time <30mins

- hemorrhage
  - not significant w/heparinization
Complications of stenting

- **Endoleak**
  Type I incompetent seal at the proximal (or distal) attachment site. Type II results from flow into and out of the aneurysm sac from a patent branch vessel (lumbar). Type III endoleak results from dissociation of modular components. Type IV is due to leaks through the porous graft material.

- **Stent migration**
- **Pseudoaneurysm**
- **paraplegia**
Review

- ± signs/symptoms
- helical CT for diagnosis
- immediate BP control
- laparotomy or craniotomy 1st
- open repair – <30min XCT, bypass
- stent!