Determinants and Outcomes of Non-operative Management of Blunt Traumatic Aortic Injuries


Department of Cardiothoracic and Vascular Surgery
McGovern Medical School
The University of Texas Science Center at Houston
Memorial Hermann Heart & Vascular Institute
Disclosures

- Azizzadeh and Charlton-Ouw – Consultants to W. L. Gore & Associates and Medtronic
Traumatic Aortic Injury (TAI): Epidemiology

- 2nd - cause of death
- Majority - MVC
- Rapid deceleration
- 1/3 of MVC fatalities have TAI

Traumatic Aortic Injury (TAI): Mechanism

- Majority of strain occurs at aortic isthmus
- Less than 25% of TAI patients make it to a hospital

Fabian, T.C J trauma 1997, 42:374-380
TAI Treatment Evolution

- Open repair used historically
- TEVAR is the new standard of care
- Medical therapy (blood pressure control, anti-impulse) is implemented in patients diagnosed with TAI
- Recently literature suggests minimal aortic injuries may be successfully treated with optimal medical therapy alone
Memorial Hermann TMC

- Level 1 trauma center
- Adult and pediatric
- >60,000 ER visits / yr
- >18,000 Trauma visits / yr
- >6000 Trauma admissions / yr
- Life Flight® air ambulance
Classification of Traumatic Aortic Injury

GRADE I
Intimal Tear

GRADE II
Intramural Hematoma

GRADE III
Pseudoaneurysm

GRADE IV
Rupture

W. Anthony Lee, MD, Jon S. Matsumura, MD, R. Scott Mitchell, MD, Mark A. Farber, MD, Roy K. Greenberg, MD, Ali Azizzadeh, MD, Mohammad Hassan Murad, MD, MPH, and Ronald M. Fairman, MD, Boca Raton, Fla; Madison, Wis; Palo Alto, Calif; Chapel Hill, NC; Cleveland, Ohio; Houston, Tex; Rochester, Minn; and Philadelphia, Pa

The Society for Vascular Surgery® pursued development of clinical practice guidelines for the management of traumatic thoracic aortic injuries with thoracic endovascular aortic repair. In formulating clinical practice guidelines, the Society selected a panel of experts and conducted a systematic review and meta-analysis of the literature. They used the Grading of Recommendations Assessment, Development and Evaluation methods (GRADE) to develop and present their recommendations. The systematic review included 7768 patients from 139 studies. The mortality rate was significantly lower in patients who underwent endovascular repair, followed by open repair, and nonoperative management (9%, 19%, and 46%, respectively, $P < .01$). Based on the overall very low quality of evidence, the committee suggests that endovascular repair of thoracic aortic transection is associated with better survival and decreased risk of spinal cord ischemia, renal injury, graft, and systemic infections compared with open repair or nonoperative management (Grade 2, Level C). The committee was also surveyed on a variety of issues that were not specifically addressed by the meta-analysis. On these select matters, the majority opinions of the committee suggest urgent repair following stabilization of other injuries, observation of minimal aortic defects, selective (vs routine) revascularization in cases of left subclavian artery coverage, and that spinal drainage is not routinely required in these cases. (J Vasc Surg 2011;53:187-92.)
Treatment Algorithm

GRADE I
Intimal Tear → Med TX

GRADE II
Intramural Hematoma → TEVAR / OR

GRADE III
Pseudoaneurysm → TEVAR / OR

GRADE IV
Rupture → TEVAR / OR (Emergent)
BTAI Management 1999 - 2015
Objective

- To examine outcomes and evaluate the natural history of BTAI treatment with optimal medical therapy (anti-impulse, blood pressure) as opposed to surgical intervention

- To evaluate the role and correlates of non-operative management for blunt traumatic aortic injuries (Grade I and II)
Methods

- Prospective institutional trauma registry data analyzed from 2004-2015
- Urban level 1 trauma center
- Computed tomographic angiography (CTA) used to classify injury grade
- Primary outcome – aortic related mortality
- Secondary outcome - lesion specific evaluation (progression vs. regression)
- Follow up:
  - Office Visit
  - Imaging

- Blunt Aortic Trauma: 273
  - Non-operative Management: 64
    - Died on Admission: 14
    - Medical Management: 48
      - Grade I: 26
      - Grade II: 22
      - Grade III: 2
  - Operative: 150
  - Dead prior to confirmation: 59
    - Delayed TEVAR: 2
baseline Characteristics

- 338 patients with BTAIs
- 48 had minimal aortic injury (26 Grade 1, 22 Grade 2)
- Median age 35 (IQR 25 – 48) years
- No statistically significant correlates of injury progression, sample size limited
- Grade II patients more often presented with abdominal AIS >4, higher admission heart rate and blood pressure
Treatment Frequency

- Medical: 48
- Dead Before Surgery: 12
- Dead Before CT: 2
- Delayed Selective Management: 2
## Results - Outcomes

<table>
<thead>
<tr>
<th>Variable</th>
<th>Grade 1 (n=26)</th>
<th>Grade 2 (n=22)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>1 (4%)</td>
<td>1 (5%)</td>
<td>1.000</td>
</tr>
<tr>
<td>Paraplegia</td>
<td>1 (4%)</td>
<td>0 (0%)</td>
<td>1.000</td>
</tr>
<tr>
<td>ARF</td>
<td>2 (8%)</td>
<td>4 (18%)</td>
<td>0.392</td>
</tr>
<tr>
<td>ICU LOS</td>
<td>4 (2–14)</td>
<td>6 (3 – 15)</td>
<td>0.276</td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>17 (8 – 24)</td>
<td>17 (8 – 46)</td>
<td>0.658</td>
</tr>
<tr>
<td>Follow-up time</td>
<td>30 (19 – 46)</td>
<td>30 (12 – 62)</td>
<td>0.852</td>
</tr>
<tr>
<td>Resolution</td>
<td>17 (65%)</td>
<td>10 (46%)</td>
<td>0.166</td>
</tr>
<tr>
<td>Persistent</td>
<td>2 (8%)</td>
<td>3 (14%)</td>
<td>0.649</td>
</tr>
<tr>
<td>Aortic mortality</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>1.000</td>
</tr>
<tr>
<td>All-cause Death</td>
<td>1 (4%)</td>
<td>1 (5%)</td>
<td>1.000</td>
</tr>
</tbody>
</table>
Results

- Age and ISS - significant predictors for adverse outcome, p<.025, p<.05
- Mediastinal Hematoma - 5.3x increased risk of delayed resolution, p<.013
- Medical therapy did not significantly affect adverse outcomes in grade II, p<.06
Results - Outcomes

- Imaging follow-up: 32/48 (67%)
- 27/32 (84%) resolved (56% of study cohort)
- 5/32 (16%) persistent (10% of study cohort)
Grade II Subgroup analysis

- No statistically significant baseline differences
- Age, ISS, and arch hematoma predictive of surgery
- Date of admission stronger predictor of TEVAR than age
Conclusion

- Medical management is a safe and effective treatment strategy for grade I and II aortic injury.
- Mean injury resolution of 8 weeks.
- Low mortality and excellent intermediate-term outcome.
- Additional investigation is needed to determine long-term outcome.
Thank you