True Lumen Volume / False Lumen Volume Ratio (<0.8) on CT can Predict the need for TEVAR in Uncomplicated Acute TBAD

Jean M Panneton MD FRCSI FACS
Chief & Program Director
Division of Vascular Surgery
Eastern Virginia Medical School
Norfolk, VA

42nd VEITH Symposium

Acute TBAD

Natural History

Despite adequate antihypertensive treatment, delayed aortic dilatation will develop in 20-50% of patients with acute uncomplicated type B aortic dissection. Anywhere from 32-65% of these patients will go on to require delayed repair.


Acute TBAD

Objectives

Characterize the predictive impact of volumetric analysis of the initial diagnostic CT scan on the natural history of acute uncomplicated type B aortic dissection. Evaluate the need for eventual aortic intervention and assess these end points:

- Growth Rate
- Survival Free From Aortic Intervention
- Aortic Related Mortality

Acute TBAD

Volumetric analysis

Although few studies have analyzed aortic volumes post TEVAR, limited studies exist on the natural history implications of initial volumetric analysis at the time of presentation of an acute aortic dissection.

Acute TBAD

Methods

CT scan diameter & volume analysis was performed on TeraRecon iNtuition Workstation

- Measurement of aortic volume
  - True lumen volume (TLV)
  - Total aortic volume (TAV)
  - False lumen volume (FLV) = TAV-TLV
- TLV/FLV Ratio
**Acute TBAD**

**Management protocol**

- Admission to our VICU
  - aggressive BP & impulse control with beta blockade
  - pain control

- Indications for intervention
  - Malperfusion
  - Rupture
  - Refractory pain
  - Uncontrolled HTN
  - Rapid expansion

**Acute TBAD**

**Study population**

- 164 with Acute Type B AD
- 116 underwent urgent repair (<14 days)
- 11 with inadequate imaging for CT analysis
- 117 available for radiographic analysis
- 32 underwent eventual repair
- 85 underwent no intervention

**Acute TBAD**

**Aortic data**

<table>
<thead>
<tr>
<th></th>
<th>No intervention (N=85)</th>
<th>Intervention (N=32)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum diseased aortic diameter (mm^2 +SD)</td>
<td>45.1 (±7.4)</td>
<td>48.4 (±9.4)</td>
<td>0.047</td>
</tr>
<tr>
<td>True lumen volume (mm(^3) +SD)</td>
<td>180 (±61)</td>
<td>167 (±86)</td>
<td>0.386</td>
</tr>
<tr>
<td>False lumen volume (mm(^3) +SD)</td>
<td>139 (±64)</td>
<td>223 (±65)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>TLV/FLV Ratio</td>
<td>1.557 (±0.82)</td>
<td>0.822 (±0.55)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mean growth rate (mm/mo +SD)</td>
<td>0.42 (±1.9)</td>
<td>2.24 (±5.3)</td>
<td>0.003</td>
</tr>
</tbody>
</table>

**Subgroup analysis – TLV/FLV ratios were split into three groups**

<table>
<thead>
<tr>
<th></th>
<th>TLV/FLV &lt; 0.8</th>
<th>TLV/FLV &gt;0.8 and &lt;1.6</th>
<th>TLV/FLV &gt;1.6</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Growth Rate (mm/mo)</td>
<td>4.6</td>
<td>2.4</td>
<td>0.8</td>
<td>.025</td>
</tr>
</tbody>
</table>

The higher the false lumen volume compared to true lumen volume, the more rapid aortic expansion was observed

**Acute TBAD**

**Delayed repair**

All 32 patients underwent successful repair, 3 open and 29 TEVAR using a mean of 2 endografts

Mean time between presentation and intervention: 24 months (range 2-61mo)

TEVAR deployment
Zone 1-2 8
Zone 3 21

No intraoperative mortality
One 30 day mortality (3%)

**Acute TBAD**

**Univariate analysis**

Univariate analysis revealed significant correlation with need for aortic intervention with the following patient characteristics

<table>
<thead>
<tr>
<th>Patient Variables</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
</tr>
<tr>
<td>Race (Caucasian)</td>
<td></td>
</tr>
<tr>
<td>History of cocaine abuse</td>
<td></td>
</tr>
<tr>
<td>History of diabetes</td>
<td></td>
</tr>
<tr>
<td>Maximum aortic diameter (mm)</td>
<td></td>
</tr>
<tr>
<td>False lumen volume (mm(^3))</td>
<td></td>
</tr>
<tr>
<td>TLV/FLV ratio</td>
<td></td>
</tr>
</tbody>
</table>
Younger age and increasing false lumen volume were found to be independent predictors of delayed aortic intervention.

**Table V. Summary of univariate characteristics included in multivariate model**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Odds ratio</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>0.943</td>
<td>0.895-0.993</td>
<td>.027</td>
</tr>
<tr>
<td>Race, White</td>
<td>0.943</td>
<td>0.849-1.058</td>
<td>.289</td>
</tr>
<tr>
<td>History of cocaine use</td>
<td>1.815</td>
<td>1.069-3.058</td>
<td>.028</td>
</tr>
<tr>
<td>History of diabetes</td>
<td>0.690</td>
<td>0.005-1.521</td>
<td>.695</td>
</tr>
<tr>
<td>Maximum aortic diameter</td>
<td>0.977</td>
<td>0.901-1.104</td>
<td>.649</td>
</tr>
<tr>
<td>TLV/FLV ratio</td>
<td>1.015</td>
<td>0.601-1.540</td>
<td>.937</td>
</tr>
</tbody>
</table>

**TLV/FLV ratio >1.6 was highly predictive for freedom from intervention**

- Area=0.80
- Sensitivity = 91%
- Specificity = 42%
- PPV = 61%
- NPV = 86%

**TLV/FLV ratio <0.8 was highly predictive for need for an eventual intervention**

- Area=0.80
- Sensitivity = 69%
- Specificity = 84%
- PPV = 71%
- NPV = 81%

---

**Acute TBAD**

**Multivariate analysis**

**Summary**

- TLV/FLV ratio <0.8 predicts necessity for delayed aortic intervention
- TLV/FLV ratio >1.6 predicts freedom from future aortic intervention

Initial CT scan volumetric analysis in patients presenting with uncomplicated acute type B AD is a useful tool to predict aortic growth and need for future intervention.

---

**Division of Vascular Surgery**

**Eastern Virginia Medical School**

Sadaf S. Ahanchi, MD
Siddharth Bhende, MD
John O. Colonna, MD
Richard J. DeMasi, MD
Deepak N. Doshi, MD
David D. Daws II, MD
Robert G. Gayle, MD
Todd W. Gentzler, MD
Michael E. Landis, MD
Michael J. Marcinczyk, MD
C. Scott McEntire, MD
Peter M. Moy, MD
Kedar S Lavingia, MD- PGY4

F. Noel Parent, MD
Rashid M. Shah, MD
Samuel N. Steerman, MD
Gordon K. Stokes, MD
Christopher L. Stout, MD
Colin Brandt, MD – PGY7
Daniel P Miller, MD – PGY7
Joseph Wiaumetti, MD – PGY7
Bradon Cain, MD – PGY6
Sarah Ongstad, MD – PGY6
Obie Powell, MD – PGY6

---