Predicting successful aortic remodeling and clinical success of TEVAR in Type B aortic dissections—What can we learn from pre-op CT imaging?

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Disclosures

Speaker name:

I have the following potential conflicts of interest to report:

- [ ] Consulting
- [ ] Employment in industry
- [ ] Stockholder of a healthcare company
- [ ] Owner of a healthcare company
- [ ] Other(s)

- [✓] I do not have any potential conflict of interest
Clinical Questions

- Aortic expansion is the most significant post-TEVAR complication.

<table>
<thead>
<tr>
<th>Clinical Question</th>
<th>Incidence</th>
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</thead>
<tbody>
<tr>
<td>Post-TEVAR aortic aneurysmal degeneration</td>
<td>12-mo: 19.7%-41.7%, 12-mo: 20.9%-54.2%, 5-y for TAE&amp;AAE: 62.7%</td>
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<tr>
<td>Thoracic aortic expansion (TAE)</td>
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<tr>
<td>Abdominal aortic expansion (AAE) &amp; further aortic rupture/impending rupture</td>
<td></td>
</tr>
<tr>
<td>Distal stent-graft induced new entry</td>
<td>2-y: 6.3%-27.3%</td>
</tr>
<tr>
<td>Endoleaks type I &amp; type II &amp; type III...</td>
<td>23.1% by meta-analysis</td>
</tr>
<tr>
<td>Retrograde type A aortic dissection</td>
<td>2%-16%</td>
</tr>
<tr>
<td>Aortic-related death</td>
<td>24-mo: 8.2%</td>
</tr>
</tbody>
</table>

References:

- J Endovasc Ther 2015; 22: 918-33
- J Vasc Surg 2017; 65 : 676-85
- J Cardiovasc Surg 2010; 51:613-32
- J Vasc Surg 2013; 57: 64-71
- J Vasc Surg 2014; 59: 1544-54
- JACC Cardio Intv 2013; 6: 876-82
“Blood Steal Phenomenon” after TEVAR in TBAD

Thoracic false lumen branches (TFLBs): -such as intercostal arteries
Predictive Role of Preop TFLBs in TAE

Previous evidence existences, but limited:
Single center with limited sample size (n=67);
TAE: > 5mm increase in max diameter vs. the preop CTA, rather than aortic volume.

<table>
<thead>
<tr>
<th>Table III. Hazard ratio (HR) and 95% confidence interval (CI) for the association of preoperative thoracic false lumen branches (TFLBs) with risk of distal thoracic aortic enlargement (DTAE)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td>Preoperative TFLBs (for one increase)</td>
</tr>
</tbody>
</table>

*Adjusted for gender, hyperlipidemia, length of dissected aorta and height index (L/H), preoperative abdominal false lumen branches, and preoperative false lumen status of thoracic aorta.

Registry Of type B aortic dissection with the Utility of STent graft:

ROBUST study (registration number: ChiCTR-POC-17011726)

- Ambispective, multicenter, open cohort study;
- Patients after TEVAR for TBAD from January 1, 2008 to July 1, 2027;
- Focusing on preop CTA features related to outcomes after TEVAR;
- Until now, 201 patients available for analysis.

Pre- and post-TEVAR CTA DICOM files, analyzed by 3D workstation

Demographic and clinical variables obtained from electronic records

Outpatient/telephone interview
New Evidence: Predictive Role of Preop TFLBs in TAE

- 201 patients with a mean age of 52.7 years, male predominance (88.6%);
- Median follow-up period: 26.4 months (range, 1.4-109.1);
- TAE: >20% increase in TA volume after 6 months post-TEVAR, as compared with preop CTA.

Hazard ratio (HR) and 95% confidence interval (CI) for the association of preop TFLBs with the risk of TAE

<table>
<thead>
<tr>
<th></th>
<th>Crude HR (95% CI)</th>
<th>adjusted HR$^a$ (95% CI)</th>
<th>Adjusted HR$^b$ (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preop TFLBs</td>
<td>1.11 (1.04-1.18) &lt;0.01</td>
<td>1.11 (1.04-1.19) &lt;0.01</td>
<td>1.11 (1.03-1.19) &lt;0.01</td>
</tr>
</tbody>
</table>

$^a$Adjusted for gender, acute dissection, abdominal entries related to visceral arteries, and FL-perfused celiac trunk;

$^b$Adjusted for gender, acute dissection, abdominal entries related to visceral arteries, FL-perfused celiac trunk, preop TA volume, the number of preop FL perfused visceral arteries, and LLR (the ratio of the dissection length and aortic length between LSA and aortic bifurcation).
A Novel Morphological Category for TBAD

Aortic segment of interest:
From lower margins of Th4 to Th 11

Category I n=62
Category II n=115
Category III n=24
New Evidence:
Predictive Role of Novel category in TAE

- 201 patients with a mean age of 52.7 years, male predominance (88.6%);
- Median follow-up period: 26.4 months (range, 1.4-109.1);
- TAE: >20% increase in TA volume after 6 months post-TEVAR, as compared with preop CTA.

Hazard ratio (HR) and 95% confidence interval (CI) for the association of the novel category with the risk of TAE

<table>
<thead>
<tr>
<th>Novel Category</th>
<th>Crude HR (95% CI)</th>
<th>adjusted HR$^a$ (95% CI)</th>
<th>Adjusted HR$^b$ (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Type II</td>
<td>4.25 (0.98-18.38)</td>
<td>4.71 (1.06-20.81)</td>
<td>4.57 (1.03-20.31)</td>
</tr>
<tr>
<td>Type III</td>
<td>10.22 (2.12-49.29)&lt;0.01</td>
<td>14.41 (2.89-71.88)&lt;0.01</td>
<td>13.68 (2.72-68.76)&lt;0.01</td>
</tr>
</tbody>
</table>

$^a$Adjusted for gender, acute dissection, abdominal entries related to visceral arteries, and FL-perfused celiac trunk;

$^b$Adjusted for gender, acute dissection, abdominal entries related to visceral arteries, FL-perfused celiac trunk, and preop TA volume, the number of preop FL perfused visceral arteries.

- QUESTION: Which patient is at a higher/lower risk of TAE after TEVAR?
- ANSWER: Type III → Type II → Type I
Predictive Role of Preop AFLBs in AAE

AFLBs: abdominal false lumen SMALL branches (e.g. lumbar arteries, adrenal arteries)

✓ 184 patients with TBAD extending through the visceral segment;
✓ Mean age of 52.6 years with a male predominance (88.6%);
✓ Median follow-up period: 26.4 months (range, 1.4-109.1);
✓ AAE: >20% increase in AA volume after 6 months post-TEVAR, as compared with preop CTA.

Hazard ratio (HR) and 95% confidence interval (CI) for the association of preop AFLBs with the risk of AAE

<table>
<thead>
<tr>
<th></th>
<th>Crude HR (95% CI)</th>
<th>adjusted HR(^a) (95% CI)</th>
<th>Adjusted HR(^b) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preop AFLBs</td>
<td>1.21 (1.13-1.29)</td>
<td>1.14 (1.05-1.24) &lt;0.01</td>
<td>1.12 (1.03-1.22) 0.01</td>
</tr>
</tbody>
</table>

\(^a\)Adjusted for gender, age, acute dissection, BMI, LLR, and the most distal re-entry tear.

\(^b\)Adjusted for gender, age, acute dissection, BMI, LLR, the most distal re-entry tear, abdominal entries related to visceral arteries, the number of preop FL perfused visceral arteries, postop endoleak, and postop distal SINE.
Novel Morphological category for AA

Aortic segment of interest: from origin of celiac trunk to AA bifurcation

Category I
n=19
Less lumbar A.

Category II
n=102
No more no less

Category III
n=63
More lumbar A.

True lumen
False lumen
Predictive Role of Novel category in AAE

AFLBs: abdominal false lumen SMALL branches
✓ 184 patients with TBAD extending through the visceral segment;
✓ Mean age of 52.6 years with a male predominance (88.6%);
✓ Median follow-up period: 26.4 months (range, 1.4-109.1);
✓ AAE: >20% increase in AA volume after 6 months post-TEVAR, as compared with preop CTA.

Hazard ratio (HR) and 95% confidence interval (CI) for the association of novel category with the risk of AAE

<table>
<thead>
<tr>
<th>Novel category</th>
<th>Crude HR (95% CI)</th>
<th>adjusted HR&lt;sup&gt;a&lt;/sup&gt; (95% CI)</th>
<th>Adjusted HR&lt;sup&gt;b&lt;/sup&gt; (95% CI)</th>
</tr>
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<tbody>
<tr>
<td>Type I</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Type II</td>
<td>4.31 (1.01-18.42) 0.05</td>
<td>4.47 (1.05-19.13) 0.04</td>
<td>5.26 (1.14-24.24) 0.03</td>
</tr>
<tr>
<td>Type III</td>
<td>5.97 (1.39-25.65) 0.02</td>
<td>5.80 (1.35-24.99) 0.02</td>
<td>6.21 (1.35, 28.51) 0.02</td>
</tr>
</tbody>
</table>

<sup>a</sup>Adjusted for gender and age.
<sup>b</sup>Adjusted for gender, age, acute dissection, BMI, the most distal re-entry tear, abdominal entries related to visceral arteries, the number of preop FL perfused visceral arteries, postop endoleak, and postop distal SINE.
Multiple Predictive Roles of the Novel TA Category

Kaplan-Meier curves stratified by the novel TA category
Multiple Predictive Roles of the Novel TA Category

Kaplan-Meier curves stratified by the novel TA category
Predictive Role of Novel TA Category in unfavorable outcomes


Hazard ratio (HR) and 95% confidence interval (CI) for the association of novel category with the risk of composite endpoints

<table>
<thead>
<tr>
<th>Novel category</th>
<th>Crude HR (95% CI) P</th>
<th>adjusted HR\textsuperscript{a} (95% CI) P</th>
<th>Adjusted HR\textsuperscript{b} (95% CI) P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Type II</td>
<td>2.74 (1.13-6.62) 0.03</td>
<td>2.78 (1.15-6.74) 0.02</td>
<td>3.67 (1.34-10.09) 0.01</td>
</tr>
<tr>
<td>Type III</td>
<td>3.54 (1.19-10.54) 0.02</td>
<td>3.43 (1.15-10.22) 0.03</td>
<td>3.67 (1.02-13.12) 0.04</td>
</tr>
</tbody>
</table>

\textsuperscript{a}Adjusted for gender and age.

\textsuperscript{b}Adjusted for gender, age, acute dissection, BMI, the most distal re-entry tear, abdominal entries related to visceral arteries, the number of preop FL perfused visceral arteries, preop TA volume, preop AFLBs, preop abdominal small tears, and LLR.
Conclusion

• We developed a new category based on TBAD morphologic characteristics that small branches arteries arising from FL.

• The new category can predict the TA and AA expansion after TEVAR in TBAD.

• The category seems to predict some unfavorable outcomes, such as distal SINE, persistent endoleaks, rupture/impending rupture, reintervention, and aortic related death, but still need more investigations.
Thanks for your attention
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