Distal Endograft Induced Re-Entry Tears After TEVAR For TBADs: What Factors Cause Them: How Can They Be Prevented And Treated

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• “Nothing to Disclose”

Acute: 18.5%
Mean follow-up: 24.8 ± 4.6 months

Chronic: 35.7%
Mean follow-up: 24.8 ± 3.9 months

P = .121

Late Distal Stent graft Induced New Entry (SINE)

Acute onset
False lumen expansion & rupture
Mal-perfusion
False lumen Expansion
Pseudoaneurysm
True lumen compression

Device Related Complications

Device-related complications
Access site hematoma
Access site lymphocele
Endoleak type
Type I
Type II
Type III
Type V
Device Distal injury
Distal injury required intervention
Follow-up proximal dissection

Acute [n=33] Chronic [n=28] P
Access site hematoma 1 (3.0) 0 >0.000
Access site lymphocele 1 (3.0) 0 >0.000
Endoleak type
Type I 0 0
Type II 3 (9.3) 1 (3.4) 0.618
Type III 0 1 (3.4) 0.207
Type V 0 1 (3.6) 0.419
Device Distal injury 6 (18.9) 10 (35.7) 0.321
Distal injury required intervention 2 (6.1) 1 (3.6) >0.000
Follow-up proximal dissection 0 2 (7.1) 0.459

The re-intervention of device related complications increased gradually along with follow-up time

Q1: Any Impact of Distal SINE on Entire Aortic Remodeling?

The Impact of Distal Stent Graft-induced New Entry on Aortic Remodeling of Chronic Type B Dissection


**Volumetric analysis of true and false lumen over thoracic and abdominal aorta**

- The late distal SINE occurrence could worsen thoracic false lumen regression and counteract abdominal true lumen expansion significantly.
- Early re-intervention for distal SINE might be considered for better abdominal aortic remodeling of chronic aortic dissection.

**Q2: Better aortic remodeling will really improve the Distal SINE Occurrence?**

**Optimal Result of Aortic Remodeling with False Lumen Complete Regression after TEVAR**

**Table 7. Comparison of the preoperative true lumen ratio with that at postoperative follow-up times between the total thrombosis and inadequate regression groups**

**Figure 3 True and false lumen volumetric change ratio / year**

Volumetric change ratio in 1st year, 2nd year and 3rd year

- Black: Non-SINE group
- Gray: SINE group

**Volumetric analysis of true and false lumen over thoracic and abdominal aorta**


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Three Types of False Lumen Remodeling 6 months after TEVAR

Complete regression of entire false lumen: 24.4% (22/90)
Total thrombosis of entire false lumen: 20% (18/90)
Abdominal false lumen patent: 55.6% (50/90)

Factors Affecting Optimal Aortic Remodeling after Thoracic Endovascular Aortic Repair of Type B (III b) Aortic Dissection

<table>
<thead>
<tr>
<th>Stent graft induced new entry</th>
<th>Total (N = 90)</th>
<th>Complete regression (n = 22)</th>
<th>Total thrombosis (n = 18)</th>
<th>Inadequate regression (n = 50)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 (22.2)</td>
<td>0 (0)</td>
<td>15 (13.0)</td>
<td>5 (10.0)</td>
<td>0.004*</td>
<td></td>
</tr>
</tbody>
</table>

Continuous data are presented as mean ± standard deviation, and categorical as * p < 0.05, significant difference among the three groups number (percentage) † p < 0.0167, significant difference as compared with the complete regression group and total thrombosis group


Optimal aortic remodeling would be associated with lower Distal SINE occurrence rate

Statically, complete regression group is significantly different with other two groups...


Q3: Any Predictive Factors of Distal Stent Graft-induced New Entry?

Shih CC et al. JTCVS 2013;146:623-630
Shih CC et al J Vasc Surg 2013;57:64-71

How to measure of distal size of true lumen of aortic dissection?

Longitudinal maximal diameter: $X_a$
Transverse maximal diameter: $X_b$
Average of longitudinal & transverse maximal diameter: \( \frac{X_a + X_b}{2} \)
Area and circumference

Pre-stent Graft Oversizing Ratio = \( \frac{X_a}{X_b} \) - 1

Oversizing Ratio: The ratio between the size of distal end of selected graft and distal landing zone before procedure.
Table 4: Pre-stent Graft Oversizing Ratio

<table>
<thead>
<tr>
<th>Parameter</th>
<th>SINE (mean ± SD)</th>
<th>Non-SINE (mean ± SD)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal maximal</td>
<td>1.05±0.77</td>
<td>0.81±0.41</td>
<td>0.034</td>
</tr>
<tr>
<td>diameter</td>
<td>2.76±1.56</td>
<td>1.71±0.51</td>
<td>0.082</td>
</tr>
<tr>
<td>Mean Diameter</td>
<td>0.94±0.47</td>
<td>0.6±0.18</td>
<td>0.115</td>
</tr>
<tr>
<td>Area</td>
<td>4.06±2.96</td>
<td>1.98±0.86</td>
<td>0.054*</td>
</tr>
<tr>
<td>Circumference</td>
<td>0.75±0.39</td>
<td>0.65±0.19</td>
<td>0.115</td>
</tr>
</tbody>
</table>

* p<0.05, significant difference related with distal SINE

Shih CC et al JTCVS 2013; 146:623-630

During follow up, the ratio between the size of distal end of stent graft and 2 cm distal of non-stented segment of true lumen is called expansion mismatch ratio of true lumen size.

Expansion Mismatch Ratio of True Lumen = X_G'/X_A'_{2cm}

Shih CC et al JTCVS 2013; 146:623-630

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Table 6 Expansion mismatch ratio of true lumen= X_G'/X_A'_{2cm}

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</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal maximal</td>
<td>1.29±0.28</td>
<td>1.13±0.17</td>
<td>0.343</td>
</tr>
<tr>
<td>diameter</td>
<td>1.89±0.54</td>
<td>1.45±0.38</td>
<td>0.115</td>
</tr>
<tr>
<td>Mean Diameter</td>
<td>1.48±0.29</td>
<td>1.22±0.15</td>
<td>0.039*</td>
</tr>
<tr>
<td>Area</td>
<td>2.39±0.85</td>
<td>1.58±0.62</td>
<td>0.031*</td>
</tr>
<tr>
<td>Circumference</td>
<td>1.43±0.27</td>
<td>1.18±0.14</td>
<td>0.016*</td>
</tr>
</tbody>
</table>

Post-stent graft: distal area expansion mismatch over 2.4 times is highly related to distal SINE

The result showed that the parameter of mean diameter, area, and circumference calculation with significant differences between groups.

Shih CC et al JTCVS 2013; 146:623-630

Q4: How to Prevent?

BOTTOM UP TECHNIQUE

Distal small graft first

Implementation sequence modification and distal graft-induced new entry after endovascular repair of Stanford type B aortic dissection.

Chen IM. Shih CC et al. JVS 2016;64:281-288

Chronic Dissection Distal small graft first implantation procedure

Bottom up Technique since June 2010

¢ extreme compressed distal true lumen anatomy

Taper Graft: taper 4.8,10 mm

Conclusions

- DSINE is not rare and is a potentially life-threatening.
- Distal oversizing or mismatch ratio seems predictive of the formation of DSINE.
- Tapered-diameter design, the bottom-up technique, can be used to reduce the risk of DSINE.
- The “Petticoat” procedure may lead to relatively low SINE incidence or extend intervals between SINE occurrence.


Q5: DID “PETTICOAT” REALLY PROTECT DISTAL SINE OCCURRENCE?

Two Stage Secondary “Petticoat” Procedure

Abdominal true lumen expansion after Petticoat Procedure

Figure 1: Freedom from SINE rate between BMS and Non-BMS groups

Conclusions