Performance of different models of bridging stents in TAAA endovascular repair

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No disclosures to be reported
Critical issues in visceral stenting in complex aortic endografting

- Stenosis
- Kinking
- Fracture
- Tortuosity

Branch Occlusion

- Visceral ischemia
- Renal insufficiency

Branch Related Complications

- Endograft migration
- Insufficient landing
- Uncorrect sizing

Branch Migration

- Endoleak
- Growth

Branch Related Reintervention
Branch stability is linked to **specific practice in device planning** and advanced imaging techniques.

Technical issues to take in account in endograft planning:

- **Internal lumen diameter** *(branch/fenestration)*
- **Direction of native vessels** *(downward/upward)*
- “**Clock” orientation** *(off-the-shelf/custom made)*
- **Early vessel bifurcation**
- **Types and Length of Bridging Stent** *(balloon or self-expanding)*
Early vessel bifurcation

Extension into hepatic artery with bare stent
Fenestrated vs branched

Coeliac and SMA usually down-facing:
SUITABLE FOR BRANCH SOLUTION

Renal arteries often horizontal:
FENESTRATION PREFERABLE
Hybrid (branched/fenestrated) solution is preferable in device planning in case of horizontal renal arteries.

Fenestrated solution is needed for small internal lumen.
Branch instability
Total relining with bare stent
Improved distal apposition

Patency of splenic artery
SELF EXPANDABLE COVERED STENT

- High conformability
- Ability to follow aneurysm shrinkage
- Ability to follow target vessel movement during respiration

Fluency

- Low range of length available
- Low deployment accuracy
- Poor visibility
- Relining often mandatory
- Precise deployment
- High visibility
- Relining not always required
- Timesaving

- Higher stiffness
- Shortening if overinflated
- Lower compliance to aortic remodelling
**EVOLUTION OF COVERED STENT**

- High flexibility, conformability, and trackability
- High radial strength
- Minimal shortening
- Improved endoprosthesis retention on delivery
- Thromboresistant surface

**VIABAHN BX**

New lengths available

Possible use in conjunction with the new Gore TAMBE Thoracoabdominal Stentgraft

Not commercially available (CE Mark pending)

<table>
<thead>
<tr>
<th>Labeled device diameter (mm)</th>
<th>Max Endoprosthesis expanded diameter (mm)</th>
<th>Crimped stent length (mm)</th>
<th>Introducer sheath size (Fr)</th>
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<tbody>
<tr>
<td>5</td>
<td>8</td>
<td>15, 19, 39, 59</td>
<td>7</td>
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<td>13</td>
<td>39, 59</td>
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Off-the-shelf Branched (T-Branch) for symptomatic Type IV TAAA

Need of long bridging stents

Longer target vessels stentgraft
High conformability of VIABAHN stentgraft due to LOW RADIAL FORCE

NEED OF REINFORCEMENT WITH BARE STENT to improve:

- Patency
- Fixation
Durability of branches in branched and fenestrated endografts

Tara M. Mastracci, MD, Roy K. Greenberg, MD, Matthew J. Eagleton, MD, and Adrian V. Hernandez, PhD, Cleveland, Ohio

650 subjects (branched and fenestrated)

Redefinition of branch endoleak

Freedom from branch reintervention: 98% (30-day), 94% (1-year) and 84% (5-year)
Late vessel related events

The mean length of follow up was 15.0/12.6 months. Patient compliance with follow up CTA imaging was 80% at 12 months (99 of 124), 87% at 24 months (33 of 38), and 68% at 36 months (15 of 22). The mean follow up interval between two CTAs was 6 4 months, and two (1.3%) patients were lost to follow up.

During the follow up period, 19 (4%) BSGs required a re-intervention and there were 13 (2%) occlusions. Thirty one BSGs (n=31 [6%]) reached the composite end point. The 4 year freedom from secondary intervention and composite event was 91% (SE 3%) and 79% (SE 6%), respectively. The 3 year freedom from occlusion was 85% (SE 6%). Univariate analysis to determine factors associated with the secondary intervention, occlusion, or composite event is illustrated in Appendix 2. Cuffs as joint type showed a statistically significant association with secondary intervention (hazard ratio [HR] 3.5, 95% CI 1.3-9.9; p=0.02) and for composite event (HR 2.8, 95% CI 1.2-7.0; p<0.01 [Fig. 1]). But not for occlusion. No statistically significant differences were recorded between the different types of target vessel (Fig. 2).

In nine (1.7%) vessels, a crimping or collapse of the BSG was observed, leading to five type 1b endoleaks, two stenoses and two vessel occlusions. A repeated percutaneous transluminal angioplasty with the addition of a relining stent was required to increase the wall adaptability at the sealing zone (in case of endoleak), or at the level of the BSG to restore the patency of the vessel (in case of stenosis). The two occlusions were asymptomatic and were found during the scheduled follow up CT and were not treated.

In two patients a disconnection of the BSG from the fenestration led to a type 3 endoleak. In both cases, a proximal extension of the BSG was successfully performed.

**Appendix 2**

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR</th>
<th>95% CI</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td>Challenging vessel</td>
<td>0.7</td>
<td>0.1-5.2</td>
<td>0.69</td>
</tr>
<tr>
<td>Cuffs as joint type</td>
<td>0.5</td>
<td>0.1-4.0</td>
<td>0.50</td>
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<tr>
<td>Self expandable BSG</td>
<td>1.0</td>
<td>0.0-1.0</td>
<td>1.00</td>
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<tr>
<td>Relining technique</td>
<td>3.3</td>
<td>0.4-27.1</td>
<td>0.27</td>
</tr>
<tr>
<td>Multiple BSG</td>
<td>1.7</td>
<td>0.3-8.2</td>
<td>0.54</td>
</tr>
<tr>
<td>TAAA Crawford type 2 or 3</td>
<td>1.6</td>
<td>0.3-7.4</td>
<td>0.55</td>
</tr>
<tr>
<td>Renal artery as target vessel</td>
<td>13.2</td>
<td>1.5-118.4</td>
<td>0.02</td>
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</tbody>
</table>

Note. OR = odds ratio; CI = confidence interval; BSG = bridging stent graft; TAAA = thoracoabdominal aortic aneurysms.

**Composite end point** = technical failure, vessel injuries, and early occlusions.

**Figure 1.** Kaplan-Meier curve for composite outcome over the follow up period comparing fenestration with cuff as type of joint for bridging stent graft (BSG).

**Figure 2.** Freedom from BSG related composite events over the follow up period (n=150, 95% BE stents), TAAA 80.3 %, J/R AAA 19.3 %.
Conclusions: High tortuosity was a significant predictor for the occlusion of renal branches, but renal angulation, bridging length, and the extent of renal coverage were not. By avoiding highly tortuous renal branch paths, good outcomes are expected even in upwardly directed renal arteries. Longer paths are acceptable.
2006 – 2015
BRANCHED + FENESTRATED: 179
TAAA: 106

<table>
<thead>
<tr>
<th>Type</th>
<th>数量及百分比</th>
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<tbody>
<tr>
<td>Type I</td>
<td>10 (9.4%)</td>
<td></td>
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<tr>
<td>Type II</td>
<td>27 (25.4%)</td>
<td></td>
</tr>
<tr>
<td>Type III</td>
<td>34 (32.1%)</td>
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<tr>
<td>Type IV</td>
<td>35 (33.0%)</td>
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- 30-day mortality 8.4%
- Spinal Cord Ischemia 7.5%
ROME – PERUGIA EXPERIENCE

2006 – 2015
BRANCHED + FENESTRATED: 179
TAAA: 106
Vessel stented: 377

<table>
<thead>
<tr>
<th>CT</th>
<th>SMA</th>
<th>RRA</th>
<th>LRA</th>
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<tr>
<td>89</td>
<td>96</td>
<td>95</td>
<td>97</td>
</tr>
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</table>

Primary patency 98.2%

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<thead>
<tr>
<th>Stent</th>
<th>n°</th>
<th>Primary patency</th>
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</thead>
<tbody>
<tr>
<td>ADVANTA</td>
<td>185</td>
<td>98.6 %</td>
</tr>
<tr>
<td>FLUENCY</td>
<td>95</td>
<td>96.9 %</td>
</tr>
<tr>
<td>VIABAHN (from Oct 2013)</td>
<td>63</td>
<td>98.2 %</td>
</tr>
</tbody>
</table>
CONCLUSION

• Branch instability: major concern in complex aortic endovascular repair

• Long-term performance: mostly affected by morphological remodeling and dynamic stress

• Most perioperative and late events are related to Renal Arteries, likely due to respiratory movements
CONCLUSION

• Safe proximal overlapping for cuffs and flaring for fenestrations to avoid disconnections

• Relining strategy: safe and effective but efficacy not confirmed and time-consuming

• Dedicated Covered stent that join stability with flexibility are needed