Endovascular Coil Embolization of Segmental Arteries Prevents Paraplegia After Subsequent TAAA Repair – An Experimental Model.

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Disclosures

We would like to thank W.L.Gore & Associates, Inc. for the donation of stent grafts.
Background

**TAAA repair:** Staged approach showed dramatic improvement in functional outcome

The **collateral network (CN)** consists of a dense interconnected vasculature with important input from:

- the **intercostal** and **lumbar** arteries
- the **vertebral** arteries and
- branches of the **subclavian** and **hypogastric** arteries

The CN adapts to diminished input by **dilatation** of small and major axial vessels (immediate response) and a combination of **angiogenesis** and **arteriogenesis** (between 48 and 120 hours)\(^1\)

\(\Rightarrow\) find a less invasive 1\(^{st}\) procedure to induce this process

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Surgical ligation of lumbar SAs (T12/13-L5)
Thoracic stenting (T4-T11/12)

Control Group
no coiling

Group 1 – coiling
1.5±0.5 SAs

Group 2 – coiling
4.5±0.5 SAs

Functional Outcome
Histology

Study design
Coiling
Functional Outcome
(Tarlov Score: 10 point scale)

- No functional impairment after coiling
- Paraplegia: 60% in Controls, 20% in Group 1, 0% in Group 2
- Tarlov Scores were significantly better in Group 2 (p=.0002)
- Number of SAs coiled correlated significantly with Tarlov Score (p=<.0001)
Tarlov Scores

Control: 3.4 ± 0.9

Group 1: 5.8 ± 0.8

Group 2: 7.5 ± 0.2

<table>
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<th>p-value</th>
<th>0 vs 1</th>
<th>.06</th>
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<tbody>
<tr>
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<td>.0002</td>
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<td>1 vs 2</td>
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Spinal Cord Injury
(Kleinman Score: 9 point scale)

- Overall histological damage ($p=0.004$) and damage in coiled region ($p=0.001$) was significantly less in Group 2.
- Number of SAs coiled correlated significantly and negatively with histological damage ($p=0.0008$).

<table>
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<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>StdDev</th>
<th>Overall</th>
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<td>25.4</td>
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</table>
Kleinman Score

Avg # of injured levels

Control

7.3±4.4

Group 1

4.3±4.5

Group 2

1.2±1.4

Spinal Cord Segment

Kleinman score

coiled region
Conclusions

The coiling procedure activates mechanisms within the collateral network:

Preliminary endovascular coiling of $\geq 2$ SAs
  -> protects the spinal cord from ischemic injury
  -> prevents paraplegia in an experimental model of extensive TAAA repair

Following coiling, extensive one-stage TAAA repairs in patients who are unable to undergo conventional two-stage procedures could be performed at a much lower risk for spinal cord injury.
Limitations

• Intercostal arteries in patients may already be occluded by mural thrombus -> risk of ischemic damage through coiling

• Complications from atheroembolization & thrombus when performing an endovascular procedure in patients with degenerative AA

• Patients at high risk for rupture are not eligible

Future Perspective

-> Identify a way to clinically monitor vascular remodeling
-> Clinical trial ?!