Evaluation of spinal cord blood supply after MISACE and EVAR of TAAA with hyperspectral imaging

Daniela Branzan, MD
Assoc. Prof. of Vascular Surgery
Head of Vascular Surgical Department, University Hospital Leipzig, Germany
Visiting Scientist, Helmholtz Institute for Metabolic Obesity and Vascular Research, Leipzig
Speaker name: Daniela Branzan, MD

I have the following potential conflicts of interest to report:

- Grants and Speaking Fees from:
  - Artivion
  - Bentley Innomed GmbH
  - Cook Medical
  - Cydar Medical
  - Endologix
Minimal Invasive Segmental Artery Coil Embolization (MISACE) in EVAR

- an endovascular first stage of a “staged approach” for TAAA repair to reduce SCI

- based on the collateral network concept of the blood supply for the spinal cord

- aims to occlude the segmental artery main stem, thus possibly stimulating the collateral network to build new arterioles and recruit larger preexisting arteries

MISACE - Procedure

- local anesthesia;
- percutaneous trans-femoral access with a 5Fr Sheath;
- no CSF drainage;
- clinical monitoring of the patients’ neurologic function for at least 48h after the procedure.

MISACE - Occlusion of the Ostial Segment of SA

No particles or fluids (CAVE: distal embolization)

Ischaemic preconditioning of the spinal cord to prevent spinal cord ischaemia during endovascular repair of thoracoabdominal aortic aneurysm: first clinical experience

TAAA
(n=57)

1. MISACE (Stage 1)
(n=22)

Optional 2. MISACE (Stage 2)
(n=24)

Optional >2. MISACE (Stage 3)
(n=11)

Endovascular Repair of TAAA (Stage 4)
(n=55)

30 Days Results
0 SCI
1 Death

The hypothesis of a spinal blood supply depending mainly on one critical arterial input (Adamkievicz Artery) is obsolete.
MISACE - Principle

- Based on the Collateral Network Concept of Spinal Cord Perfusion
- Causes the ischemic Preconditioning of the Spinal Cord

Prof. Griepp and Mount Sinai Group, New York

![Diagram showing Paraspinal and Intraspinal compartments with anterior spinal artery and anterior radiculomedullary artery highlighted.](image-url)
Spinal blood supply

- Anterior spinal artery
- Anterior radiculomedullary artery (ARMA) 1
- Anterior radial artery
- Anterior radiculomedullary artery (ARMA) 2
Visualization of ARMA and ASA

Data under Review
MISACE – When and Where to embolize the SA?

SA should be occluded in their ostial segment

Minor complications after MISACE

<table>
<thead>
<tr>
<th>Minor complication</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backpain</td>
<td>13</td>
<td>22.8</td>
</tr>
<tr>
<td>Loss of Coils</td>
<td>2</td>
<td>3.5</td>
</tr>
<tr>
<td>Unable to occlude one SA</td>
<td>3</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Etz et al. *J Thorac Cardiovasc Surg* 2015
Hyper Spectral Imaging (HSI) during MISACE - TEVAR

- no-touch, non-invasive and non-ionizing technique to monitor the collateral network pre-, during, and after MISACE and EVAR

Data under Review
## Hyper Spectral Imaging (HSI) during MISACE - TEVAR

<table>
<thead>
<tr>
<th></th>
<th>BP (mmHg)</th>
<th>SpO2 (%)</th>
<th>Temp (°C)</th>
<th>Hb (g/dl)</th>
<th>StO2 HSI (%)</th>
<th>NIR HIS (Index)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before MISACE</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>After MISACE</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>24h after MISACE</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5±1 Days after MISACE</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>10±2 Days after MISACE</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Data under Review
Hyper Spectral Imaging (HSI) during MISACE and during TEVAR

StO2

Preconditioning with MISACE VS Preconditioning with TEVAR

\[ p^* < 0.05 \]

Data under Review
Hyper Spectral Imaging (HSI) after MISACE – TEVAR and after staged TEVAR

StO2

TEVAR after Preconditioning with MISACE VS TEVAR after Preconditioning with TEVAR

Data under Review
Hyper Spectral Imaging (HSI) during MISACE and during TEVAR

THI

Preconditioning with MISACE VS Preconditioning with TEVAR

p* < 0.05

Data under Review
Hyper Spectral Imaging (HSI) during MISACE and during TEVAR

TWI

Preconditioning with MISACE VS Preconditioning with TEVAR

Data under Review
Hyper Spectral Imaging (HSI) during MISACE and during TEVAR

NIR

Preconditioning with MISACE VS Preconditioning with TEVAR

![Graph showing box plots for values over time points and region comparison between Staged Stent and Coiled groups.](image-url)
Conclusion

- MISACE to precondition the paraspinous collateral network is clinically feasible and very encouraging regarding safety.

- HSI is sensitive to changes in oxygenation of the paraspinous musculature and the spinal cord.

- The normalization of oxygenation was reached after 10 days, suggesting that the intervals between procedures should be evaluated accordingly.

- Further investigations with larger sample sizes must be acquired to test the clinical use of HSI after TAAA repair.
Thank you!

Daniela.Branzan@medizin.uni-leipzig.de
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