What is the benefit of MEP’s in BEVAR for TAAA in preventing paraplegia?

P M Kasprzak
Department of Vascular Surgery, Endovascular Surgery
University Hospital Regensburg, Germany

Disclosures Dr. Kasprzak (grants, speaker fee, development, Cook, Gore, Vascutek, Bard, Medtronic, Maquet, UCB)
Risk of paraplegie in extensive coverage of the thoracoabdominal aorta

5 - >20%

Spinal cord ischemia during BEVAR for TAAA

- direct occlusion of intercostal + lumbar arteries
- secondary reduction of spinal cord perfusion by aneurysm sac thrombosis / hypotension

decreased perfusion of

- segmental spinal arteries
- anterior spinal artery

spinal collateral network

autoregulation

Branched Stengraft

“The endograft was implanted successfully, imaging documented an excluded aneurysm and excellent flow through the endograft and all prosthetic branches.”

…..but the patient developed Paraplegia on day 2.
Post-Dissection aneurysm
FEVAR in small true lumen

staged procedures

TEVAR first

fenestrated stentgraft
ev. not completed distally

Completion

Arteriosclerotic
Aneurysm-BEVAR

TEVAR + BEVAR with TASP

TASP completion after balloon branch occlusion

1. surgery

2. surgery

3. surgery?
TASP (temporary aneurysm sac perfusion)

**Step 1:**
Branched stent graft with 1 non-completed side branch

Temporary aneurysm sac perfusion

**Step 2:**
Secondary side branch completion

"staged procedure"

**Intention:**
- Maintain perfusion of spinal arteries
- To reduce the risk of SCI
- Completion under stable conditions
- After expansion of the spinal collateral network
Temporary Aneurysm Sack Perfusion (TASP) in BEVAR for TAAA

Group: 83 TAAA patients after bEVAR (first patient 2008)

<table>
<thead>
<tr>
<th>Neurological complications</th>
<th>Non-TASP (n = 43)</th>
<th>TASP (all patients) (n = 40)</th>
<th>p*</th>
<th>TASP (completed) (n = 35)</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute cerebrovascular events</td>
<td>0 (0)</td>
<td>3 (1)</td>
<td>NS</td>
<td>1 (3)</td>
<td>.04</td>
</tr>
<tr>
<td>Paraesthesia</td>
<td>1 (2)</td>
<td>5 (13)</td>
<td>NS</td>
<td>3 (9)</td>
<td>.02</td>
</tr>
<tr>
<td>Temporary paraparesis(^b)</td>
<td>1 (2)</td>
<td>5 (13)</td>
<td>NS</td>
<td>5 (14)</td>
<td>.04</td>
</tr>
<tr>
<td>Paraplegia (day 30 or discharge)(^b)</td>
<td>9 (21)</td>
<td>2 (5)</td>
<td>.03</td>
<td>1 (3)</td>
<td>.02</td>
</tr>
<tr>
<td>Subgroup of aneurysm type I–III</td>
<td>n = 24</td>
<td>n = 29</td>
<td>.01</td>
<td>n = 26</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Paraplegia (d 30 or discharge)</td>
<td>7 (29)</td>
<td>1 (3)</td>
<td></td>
<td>0 (0)</td>
<td></td>
</tr>
</tbody>
</table>

Kasprzak P et al. 2014 Eur J Vasc Endovasc Surg
MEPs in BEVAR

22 F Branched Stent Graft

Bridging Stents or renals and SMA

Balloon Occlusion Hypotension

staged procedure?

Intraoperative online internet based monitoring and analysis in cooperation with WH Mess, Institute of Neurophysiology, University of Maastricht, NL. Guidelines: Clin Neurophysiol 2013.
MEPs during TEVAR and BEVAR

Hypotension → temp. SCI (reversible)
MEPs in BEVAR with / without Temporary Aneurysm Sack Perfusion - TASP

MEPs $n = 47$

SCI

MEPs neg. $n = 34$ 0 % Sensitivity 100 %

MEPs pos. $n = 13$ DD: spinal vs peripheral Ischemia

**Action** $\rightarrow$ CSF↓, MAP↑ $\rightarrow$ Chance for recovery

- MEPs recovered 0 %
- MEPs not recovered $n = 3$ 3 (100 %)

Problem of delayed Paraplegia

Intraoperative *online internet based* monitoring and analysis in cooperation with WH Mess, Institute of Neurophysiology, University of Maastricht, NL. Guidelines: Clin Neurophysiol 2013.
BEVAR for TAAA: the TASP concept

**Step 1**

**BEVAR**  
(n = 111)

SCI risk evaluation low/high  
MEPs (BHT-test)

**TASP**  
TASP interval

**Step 2**

side branch completion  
early (5-14) / late (15-28)

MEPs (BHT-test)

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No recommendation for immediate (day 0) side branch completion

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<table>
<thead>
<tr>
<th></th>
<th>nonTASP</th>
<th>TASP MEPs</th>
<th>nonTASP no MEPS</th>
<th>nonTASP + MEPS</th>
<th>TASP MEPs /LA BHT-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>45</td>
<td>28</td>
<td>8</td>
<td>30 (9 LA)</td>
<td></td>
</tr>
<tr>
<td>SCI</td>
<td>11 (24%)</td>
<td>3 (10.7 %)</td>
<td>1 (12.5 %)</td>
<td>1 (3.3 %)</td>
<td>delayed SCI (&gt; 24h)</td>
</tr>
</tbody>
</table>
Two-stages: time interval mean: 5 months (1-60 months)
2 patients ruptured (7.4%)
open branch/ TASP concept

shorter TASP intervals

- side branch occlusion between 5-14 days

Second effect of MEP’s
Other concept to prevent paraplegia

MISACE

Staged procedure + TASP in BEVAR

1. Preoperative coiling of the intercostal / lumbar arteries
2. FEVAR / BEVAR for TAAA

Pre-Conditioning (Role of Postoperative Hypotension?)

1. Staged procedure with BEVAR + TASP + MEPs
2. Completion in LA

MISACE = minimally invasive, selective segmental artery coil embolization
Perfusion preserved but reduced
+ compensated ischemia
-> spinal preconditioning

J Vasc Surg 2016 (accepted)
Conclusions:

- intraoperative MEPs analysis detects patients at risk for SCI

- uneventful MEPs allow early side branch completion with reduction of TASP interval

- we don’t perform single stage procedures due to the problem of secondary paraplegia (sac thrombosis)

- in staged procedures including TASP concept in BEVAR we have achieved lowering of paraplegia rate (3.3%)

Future opportunities:

→ risk stratification

→ role of embolization of intercostal arteries is to be examined
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