How to Prevent and Treat Spinal Cord Ischemia (SCI) with Endovascular TAAA Repairs

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INTRODUCTION

- Spinal cord ischemia (SCI) is a devastating complication after branched/fenestrated endovascular aortic repair (B/FEVAR)
  - 5-31% incidence
- Several interventions described to ↓ SCI events
  - E.g. Spinal drains, permissive BP goals, medications
- SCI patients have poor long-term survival [~30-50% 1-year]

SCI IMPACT ON SURVIVAL AFTER TEVAR

N = 9124

<table>
<thead>
<tr>
<th>Predictor</th>
<th>HR</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA Class (per level)</td>
<td>1.8</td>
<td>1.4-2.3</td>
<td>&lt;0.001</td>
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<tr>
<td>Prior aortic/iliac aneurysms</td>
<td>1.8</td>
<td>1.2-2.7</td>
<td>0.008</td>
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<tr>
<td>Non-occlusive case</td>
<td>1.6</td>
<td>1.2-2.1</td>
<td>0.001</td>
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<tr>
<td>Hypertension</td>
<td>1.6</td>
<td>1.1-2.6</td>
<td>0.03</td>
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<tr>
<td>COPD</td>
<td>1.4</td>
<td>1.0-1.8</td>
<td>0.02</td>
</tr>
<tr>
<td>Perioperative creatinine &gt; 1.7mg/dL</td>
<td>1.4</td>
<td>1.2-1.8</td>
<td>0.06</td>
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<tr>
<td>Use of intravascular ultrasound</td>
<td>1.3</td>
<td>1.1-1.7</td>
<td>0.04</td>
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<tr>
<td>Female gender</td>
<td>1.2</td>
<td>1.1-1.7</td>
<td>0.06</td>
</tr>
<tr>
<td>Non-white race</td>
<td>1.2</td>
<td>1.1-1.7</td>
<td>0.06</td>
</tr>
<tr>
<td>Max aneurysys diameter per mm increase</td>
<td>1.0</td>
<td>1.0-1.06</td>
<td>0.09</td>
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<tr>
<td>Age per year increase</td>
<td>1.0</td>
<td>1.0-1.06</td>
<td>0.05</td>
</tr>
</tbody>
</table>

SCI AND COMPLEX TAAA REPAIR

- No Level 1 evidence supporting strategies to ↓ SCI
  - SCI sequelae likely ↓ evidence-based threshold
- Care bundles highly successful in prevention of neonatal sepsis, VAP, CLABSI
- No descriptions of care bundles to prevent SCI after B/FEVAR that encompass all phases of care

DISCLOSURES

- None
PREVENTING SCI AFTER F/BEVAR

• CSF drainage
• Early lower extremity reperfusion
• Staged repairs
• Preservation of collateral networks (subclavian, hypogastric, lumbar vessels)
• Neuromonitoring (intraoperative motor evoked and somatosensory evoked potentials)
• Pharmacologic intervention (e.g. vasopressors, steroids, free radical scavengers, receptor antagonists, etc.)
• Enhancing oxygen delivery (cardiac function, oxygen carrying capacity)
• Mitigation of ischemia-reperfusion (inflammatory modulators, oxidative stress)

SPINAL CORD ISCHEMIA PROTOCOL

PRE-OPERATIVE MANAGEMENT
Clinic
• Patient education about risk
• Continue chronic β-blockers
• Withhold ACEI/ARB
• Statin initiation and/or continuation
Preoperative Holding
• Naloxone Infusion
• Spinal drain

INTRA-OPERATIVE MANAGEMENT
• MAP > 90 mmHg [Aline]
• Hemoglobin > 9 gm/dL
• Steroid bolus (methylprednisolone)
• Passive Hypothermia
• Mannitol PRN
• Judicious morphine/dilaudid use
• Glucose control (insulin gtt)

POST-OPERATIVE MANAGEMENT
• Q2h Neuro-checks in SICU
  - Spinal drain removed after 36-48hr
  - Naloxone drip discontinued at 48hrs
  - Glucose control (insulin gtt; FSBG < 150)
  - MAP goals relaxed ~48hr
  - Oral home BP medications titrated

SPINAL CORD ISCHEMIA PROTOCOL

MANAGEMENT OF SUSPECTED SCI EVENT

Suspected SCI Event
• Spinal drain manipulation
  • Raise MAP goal to >100
  • Raise Hgb/Hct goal to 10/30
  • Steroid Bolus
  • Stroke evaluation

No Improvement
• Attempt to clamp spinal drain 24-48hr after resolution of symptoms
• Hold anti-hypertensives
• Maintain MAP/Hct goals until return to clinic
• Continue protocol for 72 hours
• Spinal cord rehabilitation

All Patients

Incidence of Any F/BEVAR SCI Before and After Implementation of Protocol

Pre Post
13% 3% * p = .007
19% 4% * p = .004

N=223 N=70

CONCLUSIONS

• SCI after F/BEVAR is devastating
• The most vulnerable patients can be identified preoperatively to improve resource utilization
• Multiple interventions can be undertaken to mitigate the risk and/or subsequent development of SCI
• Utilization of a bundled approach that intervenes at all phases of patient vulnerability may offer a way to further reduce the impact of SCI after complex endovascular TAAA repair
THANK YOU