CSF Protein and Initial Blood Burden are Associated with Progression to Permanent Shunt in Patients with Aneurysmal Subarachnoid Hemorrhage: A Case Control Study

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Disclosures

• The author has nothing to disclose
Introduction

- Subarachnoid Hemorrhage (SAH) Management
  - External Ventricular Drain (EVD) placement is standard of care\(^1\)
  - EVD management plays a large role in patient care
    - When to wean/clamp
    - When to progress to a ventriculoperitoneal shunt (VPS)

- Better prognostication of ultimate shunt-dependent hydrocephalus (SDH) could:
  - Spare ICU time
  - Limit complications (e.g. ventriculitis)\(^2\)
  - Reduce hospital expenditures

- Past studies have investigated risk factors for SDH, but much uncertainty remains\(^3,4\)
Methods

Design

• Retrospective case control

• Patients at Emory University Hospital
  • 2015-2019

• Inclusion criteria:
  • Aneurysmal SAH and EVD placement

• Exclusion criteria
  • H&H = 1 or 5, Craniotomy, Angio (-), previous SAH

Measures

• Age/Sex

• Aneurysm location

• H&H

• Modified Graeb Score

• Post-EVD wean day

• Wean failures
  • Clinical, radiographic, ICP

• First CSF protein after placement

• CSF protein prior to wean

• VPS placement
## Results - Demographics

<table>
<thead>
<tr>
<th></th>
<th>No Shunt</th>
<th>Shunt</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N =</strong></td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>52 +/- 13</td>
<td>58 +/- 12</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td>29F / 21M</td>
<td>36F / 14M</td>
</tr>
<tr>
<td><strong>H&amp;H</strong></td>
<td>3.2 +/- 0.46</td>
<td>3.3 +/- 0.49</td>
</tr>
<tr>
<td><strong>Anterior Circulation</strong></td>
<td>54%</td>
<td>48%</td>
</tr>
<tr>
<td><strong>Days Until EVD Wean Attempt #1</strong></td>
<td>8.32 +/- 3.40</td>
<td>7.92 +/- 3.96</td>
</tr>
</tbody>
</table>
## Results – Univariate Analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>No Shunt</th>
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<th>P =</th>
</tr>
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<tbody>
<tr>
<td>Age</td>
<td>52 +/- 13</td>
<td>58 +/- 12</td>
<td>.0351</td>
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<tr>
<td>Sex</td>
<td>29F / 21M</td>
<td>36F / 14M</td>
<td>.2081</td>
</tr>
<tr>
<td>mGraeb 3(^{rd}) Ventricle</td>
<td>2.20 +/- 1.24</td>
<td>2.96 +/- 1.32</td>
<td>.0037</td>
</tr>
<tr>
<td>mGraeb 4(^{th}) Ventricle</td>
<td>2.48 +/- 1.30</td>
<td>3.18 +/- 1.35</td>
<td>.0095</td>
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<tr>
<td>mGraeb Total</td>
<td>11.52 +/- 4.78</td>
<td>14.94 +/- 5.68</td>
<td>.0022</td>
</tr>
<tr>
<td>CSF Protein &gt;110 Before Wean</td>
<td>11/50</td>
<td>25/50</td>
<td>.0064</td>
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</table>
## Results – Significance of Varying CSF Protein Thresholds

**First CSF Protein**

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<th>Cutoff</th>
<th>No Shunt</th>
<th>Shunt</th>
<th>p</th>
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<tbody>
<tr>
<td>&gt;100</td>
<td>24/50</td>
<td>29/50</td>
<td>.423</td>
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<tr>
<td>&gt;110</td>
<td>23/50</td>
<td>28/50</td>
<td>.423</td>
</tr>
<tr>
<td>&gt;120</td>
<td>20/50</td>
<td>26/50</td>
<td>.3158</td>
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</table>

**CSF Protein Before Wean**

<table>
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<th>Cutoff</th>
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<th>Shunt</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td>&gt;100</td>
<td>15/50</td>
<td>25/50</td>
<td>.0656</td>
</tr>
<tr>
<td>&gt;110</td>
<td>11/50</td>
<td>25/50</td>
<td>.0064</td>
</tr>
<tr>
<td>&gt;120</td>
<td>10/50</td>
<td>20/50</td>
<td>.0486</td>
</tr>
</tbody>
</table>
Discussion

• Significant findings
  • Age
  • mGraeb score on initial CT
  • CSF protein prior to first wean attempt

• Non-significant findings
  • Sex
  • Aneurysm location (anterior vs posterior circulation)
  • Initial CSF protein

• Limitations
  • Retrospective
  • Non-numeric CSF protein cutoff reported (e.g. “>200” or “>300”)
    • Cannot perform t-test
Summary

- Age, initial CT blood burden, and CSF Protein may have significant prognostic values for progression to VPS placement
- Better understanding of when to pull EVD vs prolonging wean vs progressing to VPS could limit infection, ICU LOS, and hospital LOS
- One piece of an emerging picture of optimal EVD management after aneurysmal SAH
References


