Hyponatremia Predicts Vasospasm after Subarachnoid Hemorrhage

César E. Escamilla-Ocañas1, Syed Omar Kazmi1, Asim Naveed1, Eric Bershad1, Christos Lazaridis2, Rahul Damani1 and Chethan P. Venkatasubba Rao1

1 Department of Neurology, Section of Vascular Neurology and Neurocritical Care Baylor College of Medicine, Houston, TX
2 Division of Neurocritical Care, Departments of Neurology and Neurosurgery, University of Chicago, Chicago, IL

Objectives
1. To identify an association between hyponatremia and CVS after SAH.
2. To assess the temporal relationship among hyponatremia and CVS.
3. To compare outcome at discharge (Glasgow Outcome Scale: GOS) between hyponatremic and normonatremic subjects.

A relation among hyponatremia and cerebral vasospasm has been previously reported after SAH. The pathophysiology behind this is still unclear. The aim of this study was to identify an association between hyponatremia and vasospasm focusing in the temporal relation of these events in a cohort of SAH patients.

Background
• Hyponatremia is a common complication after subarachnoid hemorrhage (SAH).
• Previous studies have reported an association between hyponatremia and cerebral vasospasm (CVS).
• Whether hyponatremia directly contributes to the pathogenesis of CVS, or is a by-product is still unclear.

Methods
• Retrospective review of patients with SAH admitted to the Baylor-St. Luke’s Medical Center (January 2008 – December 2012) (Figure 1).
• Demographics, occurrence of hyponatremia (serum sodium <135), evidence of CVS (TCD, CTA, MRA, DSA) and Glasgow Outcome Scale (GOS) were collected.
• Patients divided in a hyponatremic and normonatremic group.
• CVS was defined as mean velocity >120 cm/s and Lindergaard Ratio > 3 on TCD and by the attending neuroradiologist interpretation on CTA, MRA, DSA.
• CVS incidence and outcome at discharge (GOS) were compared between the two groups using $\chi^2$.

Table 1. Patient demographics and vasospasm occurrence comparison among hyponatremic and eunatremic patients.

<table>
<thead>
<tr>
<th></th>
<th>Hyponatremic</th>
<th>Normonatremic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>66</td>
<td>98</td>
</tr>
<tr>
<td>Female, %</td>
<td>78.8</td>
<td>77.6</td>
</tr>
<tr>
<td>Age, yr</td>
<td>58.7 ± 1.4</td>
<td>54.5 ± 1.4</td>
</tr>
<tr>
<td>Race, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>59.1</td>
<td>43.9</td>
</tr>
<tr>
<td>African American</td>
<td>16.7</td>
<td>32.7</td>
</tr>
<tr>
<td>Hispanics</td>
<td>18.2</td>
<td>20.4</td>
</tr>
<tr>
<td>Asian</td>
<td>3.0</td>
<td>3.1</td>
</tr>
<tr>
<td>Other</td>
<td>1.5</td>
<td>0.0</td>
</tr>
<tr>
<td>Vasospasm, %</td>
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<td></td>
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</table>

Results
• Our cohort shows a significant association between hyponatremia and CVS.
• We additionally demonstrated that for all of our cases hyponatremia preceded CVS.
• Vasospasm events occurred shortly after the hyponatremia (mean 2.6 days).
• Outcome at discharge was better for normonatremic subjects compared to hyponatremia.
• Further large prospective studies are required.

Conclusions
• Incidence of vasospasm was higher in the hyponatremia group compared to the normonatremic group.
• Outcome at discharge was significantly higher in patients without hyponatremia compared to patients with hyponatremia.
• The normonatremia group included 75 patients with good outcome and 23 patients with poor outcome.

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Our findings imply a possible use of serum sodium as an additional predictor for developing CVS.
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“Incidence of vasospasm was higher in the hyponatremia group compared to eunatremic group.”