Poster #1047: Changes in mean arterial pressure and end tidal carbon dioxide content affect venous sinus pressures and gradients in patients with idiopathic intracranial hypertension: a randomized study

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Disclosures

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Introduction

• Idiopathic intracranial hypertension (IIH) is characterized by headaches, visual symptoms, and other signs of elevated intracranial pressure (ICP).

• Pathophysiology of the disease and normal intracranial venous physiology is poorly understood.

• Observations have been made of the potential influence of general anesthesia on the measurement of venous sinus pressures and the trans-stenosis pressure gradient, but no causative mechanism identified.

• We aimed to determine how changes in cardiovascular and respiratory parameters affect venous sinus pressure and caliber measurements in patients with IIH undergoing venous sinus stenting.
Methods

• Single center

• Prospective randomized pilot study

• 8 patients undergoing venous sinus stenting for IIH were randomized to one of two groups: a) changes in MAP or b) changes in EtCO₂

• Prior to stenting, under general anesthesia, patients underwent venous manometry and waveform recordings twice in succession based on assigned physiologic group.

<table>
<thead>
<tr>
<th>Group</th>
<th>Initial Recording</th>
<th>Subsequent Recording</th>
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<tbody>
<tr>
<td></td>
<td>MAP (mmHg)</td>
<td>EtCO₂</td>
</tr>
<tr>
<td>A1</td>
<td>60-80</td>
<td>38-40</td>
</tr>
<tr>
<td>A2</td>
<td>100-110</td>
<td>38-40</td>
</tr>
<tr>
<td>B1</td>
<td>100-110</td>
<td>24-26</td>
</tr>
<tr>
<td>B2</td>
<td>100-110</td>
<td>38-40</td>
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</tbody>
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Pressure ranges in mmHg.
Results – Changes in MAP

• Group A: changes in MAP
  • MAP 100-110 mmHg
    • SSS pressures: 8-76 mmHg, mean 39.0 mmHg [SEM 39.0]
    • TSPG: 2-65 mmHg, mean 30.0 mmHg [SEM 6.1]
  • MAP 60-80 mmHg
    • SSS: 4-38 mmHg, mean 24.0 mmHg [SEM 7.4]
    • TSPG: 2-31 mmHg, mean 18.3 mmHg [SEM 14.8]

Absolute change in superior sagittal sinus (SSS) and trans-stenosis gradient (TSPG) from MAP of 60-80 mmHg to 100-110 mmHg of each individual subject.
Results – Changes in $\text{EtCO}_2$

- Group B: changes in $\text{EtCO}_2$
  - $\text{EtCO}_2$ 38-40 mmHg
    - SSS pressures: 15-57 mmHg, mean 36.8 mmHg [SEM 10.0]
    - TSPG: 3-44 mmHg, mean 24.5 mmHg [SEM 7.9]
  - $\text{EtCO}_2$ 24-26 mmHg
    - SSS: 8-26 mmHg, mean 14.3 mmHg [SEM 4.1]
    - TSPG: 1-8 mmHg, mean 3.0 mmHg [SEM 0.8]

Absolute change in SSS and TSPG from $\text{EtCO}_2$ of 24-26 mmHg to 38-40 mmHg of each individual subject.
Results – Waveform Changes

• Regardless of physiologic parameter, 6/8 patients experienced higher waveform amplitudes distal to the stenotic region.

• Higher mean waveform amplitudes at EtCO$_2$ 38-40 mmHg than at 24-26 mmHg
  - SSS: 21.1 mmHg vs 3.2 mmHg
  - Torcula: 20.8 mmHg vs 3.3 mmHg
  - Transverse sinus: 20.9 mmHg vs 3.8 mmHg
Discussion

• Changes in EtCO$_2$ had the most profound effect on venous pressures, trans-stenosis pressure gradients, and waveform morphology.

• Within study groups, there is inter-patient variability in response to changes in MAP and EtCO$_2$ of unclear etiology.
  • Secondary to patient differences?
    • BMI
    • Central venous pressures
    • Intracranial compliance
    • Baseline ICP
    • Type/degree of stenosis
  • Other confounding factors?
    • Type of inhalational agent
    • Use/type of paralytics
    • Procedure length
    • Other physiologic parameters (e.g. tidal volume, pulse pressure, etc.)
Summary

• Changes in EtCO$_2$ and MAP have dramatic effects on venous sinus pressures, trans-stenosis gradients, and venous waveform morphologies.

• It is important to maintain normal physiologic cardiovascular and respiratory parameters during venous sinus manometry.

• Need future studies to focus on the effect of these parameters with sufficient power to evaluate for confounding factors.

• Need future studies to understand “normal” intracranial venous physiology.