Traumatic Events:
Cautions about $ETCO_2$ Analysis in Trauma

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Barney Style

• End-Tidal CO$_2$ Measures:
  – Concentration of CO$_2$
  – In exhaled breath
  – At end of exhalation

• Must Have:
  – Metabolism
  – Perfusion
  – Ventilation
ETCO₂

Perfusion

Ventilation

Metabolism
Metabolism
Ventilation
Ventilation

- Capnography allows visualization of respiratory rate
Perfusion

• Cardiac output must be enough to:
  – Perfuse the tissues
  – Return venous blood to the lungs

• Decreased cardiac output $\rightarrow$ decreased perfusion $\rightarrow$ low ETCO$_2$
Perfusion
<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline</th>
<th>Mild</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{PaO}_2 ) (torr)</td>
<td>85.4 ± 7.5</td>
<td>105.2 ± 9.6*</td>
<td>116.0 ± 6.3*</td>
</tr>
<tr>
<td>( \text{PaCO}_2 ) (torr)</td>
<td>38.0 ± 4.8</td>
<td>28.5 ± 4.8*</td>
<td>17.2 ± 3.0*</td>
</tr>
<tr>
<td>( \text{PeCO}_2 ) (torr)</td>
<td>46.3 ± 6.2</td>
<td>42.8 ± 5.0</td>
<td>36.9 ± 3.0*</td>
</tr>
</tbody>
</table>

*Significant differences compared to baseline.
\( \text{paCO}_2 \approx \text{ETCO}_2 \)
PPV and Hyperventilation is the Devil
1mmHg = 4% CBF
Brain Tissue Oxygenation

P = .0016 vs 12

P = .0046 vs 12

Davis Neurotrauma 2009
Capnography in TBI

- Hyperventilation = assassination

- No herniation
  - no benefit from hyperventilation
  - goal 35-40mmHg

- Herniation
  - ? benefit
  - goal 30-35mmHg
Extreme care must be taken in the polytrauma patient with suspected head injury
Ventilation?
Perfusion?
\[ \text{paCO}_2 \approx \text{ETCO}_2 \]
Concordance of End-Tidal Carbon Dioxide and Arterial Carbon Dioxide in Severe Traumatic Brain injury

Sung-Woo Lee, MD, PhD, Yun-Sik Hong, MD, PhD, Chul Han, MD, Su-Jin Kim, MD, PhD, Sung-Woo Moon, MD, Jung-Ho Shin, MD, and Kwang-Je Baek, MD, PhD
Alterations in Ventilation, Perfusion, and Cellular Metabolism Affect ETCO$_2$
• Isolated Head Injury
  – Use ETCO2 to assure proper ventilation

• Significant Trauma Without Head Injury
  – Hypocapnea is an indicator of shock

• Polytrauma + TBI
  – Just do your best
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