Effects of Temperature Correction on Key Arterial Blood Gas Measures in a Combat Relevant Trauma Model Treated with Therapeutic Hypothermia: Implications for Prolonged Field Care

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Introduction
Therapeutic hypothermia may be beneficial in preventing reperfusion related damage after trauma.

Blood gas analysis is crucial for the monitoring of patients after lung injury.

Standard arterial blood gas analysis involves heating of arterial blood to a reference physiological temperature of 37°C.

Algorithms in blood gas analyzers can mathematically calculate the patient's blood gas at actual body temperature from the standard 37°C temperature blood gas value.

Objective
We hypothesized that point-of-care blood gas analysis of hypothermic patients provides a systematic under estimation of values for pO₂ and pCO₂ compared to reference temperature.

Methods
The temperature corrected and the 37°C arterial blood gases were recorded at Baseline, post-Shock, post-Pneumonectomy, post-Transfusion, and every 6 hours after transfusion using i-STAT point of care blood gas analyzers (Abbott, Abbott Park, IL). 8 female swine (sus scrofa domestica), mean body weight 54.7 kg.

Results

<table>
<thead>
<tr>
<th>Patient Temp</th>
<th>Baseline</th>
<th>pShock</th>
<th>pPneumo</th>
<th>pTrans</th>
<th>6</th>
<th>12</th>
<th>18</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>37±0.37</td>
<td>38.4±0.27</td>
<td>37.9±0.47</td>
<td>37.2±0.35</td>
<td>32.0±0.03</td>
<td>31.9±0.09</td>
<td>31.7±0.22</td>
<td>32.1±0.11</td>
<td></td>
</tr>
</tbody>
</table>

*Significant difference (p<0.5) between 37°C and patient-temperature corrected pH values, data presented as means±SEM, statistics by Kruskal-Wallis test with a Dunnett adjustment.

Conclusion
Blood gas analysis during Therapeutic Hypothermia at 32°C showed a systematic underestimation of pO₂ values by about 22-26 mm Hg.

The effects on pH and pCO₂ were significant statistically but clinically of less potential impact.

The patient-temperature corrected blood gas values are crucial for monitoring patients treated with TH suggesting that new nomograms for temperature correction should be developed to include commonly used therapeutic targets recommended for specific Therapeutic Hypothermia protocols.

Acknowledgements
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